THE AMERICAN MIDLAND NATURALIST

DEVOTED TO NATURAL HISTORY, PRIMARILY THAT OF THE PRAIRIE STATES

JULIUS A. NIEUWLAND, C. S. C., PH. D., Sc. D.
EDITOR

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NOTRE DAME, INDIANA
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J. A. NIEUWLAND, C. S. C., Ph. D., Sc. D., Editor

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PLATE VIII.—WEBSTER ON NOTES ON THE GENUS ATRYPA.

BY FRANCIS WENNINGER

The following report was compiled from material collected by the Rev. A. M. Kirsch, C. S. C., Professor of Zoology in the University of Notre Dame. It represents the work of years of collecting, done during such time as could be spared from active duty in the lecture-room or laboratory. The measurements given are from specimens that are believed to be representative, and are all expressed in millimeters. The descriptions are based on the Mollusca of the Chicago Area, by Baker; the Mollusca of Indiana, by Call; and the synonymy is that of Charles Torrey Simpson as given in his Descriptive Catalogue of the Naiades or Pearly Fresh Water Mussels, published by Bryant Walker, Detroit, 1914.

LAMPSILIS VENTRICOSA (Barnes).

*Unio accurdinis* Lea, Tr. Am. Phil. Soc., III, 1829, p. 435, pl. X. fig. 16.
*Unio subovatus* Lea, Tr. Am. Phil. Soc., IV, 1831, p. 118, pl. XVIII, fig. 46.
*Unio cardium* Conrad, New F. W. Shells, 1834, p. 68.
*Unio lenis* Conrad, Monog., XII, 1840, p. 106, pl. LVIII, fig. 2.
*Unio dolabraeformis* Sowerby, Conch. Icon., XVI, 1867, pl. LIX, p. 298.

The species was found in the St. Joseph River near Mishawaka, in 1913. The peculiar slope of the posterior portion of the shell as also the formation of the beak are characteristic of this shell. The shell is inflated, rather thin for its size and heavy. Its shape is elliptical rather than oval. The margin, especially in older specimens, is concentrically sculptured. The epidermis is shining and smooth,—characters that are both lost with age. There are

* January 20, 1921.—Pages 1 to 28.
from twenty to thirty-five or more bright green rays. In some specimens the rays do not persist in the posterior portion; when present in old specimens they become wide,—about eight millimeters; or there will be an alternation of a wide ray with a narrow one. The ligament is rather stout, short and wide and of a dark chestnut color. The cardinal teeth are double in the left valve and single in the right. The posterior muscle scar is rounded, as wide as long and not much impressed. The protractor pedis muscle scar is wider than long, deeply impressed anteriorly and coarsely striated. The pallial line is deeply impressed anteriorly but only slightly impressed posteriorly. The cavity of the beaks is deep. The nacre is silvery white with little or no iridescence: sometimes pink.

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_Lampsilis luteola_ (Lamarck).

*Unio luteola* Lamarck, An. sans Vert., VI, 1819, p. 79


*Unio inflatus* Barnes, Am. Jl. Sci., VI, 1823, p. 266.


*Unio siliquoides* Barnes, Am. Jl. Sci., VI, 1823, p. 269, pl. XIII, fig. 150.

*Unio childreni* Hanley, Biv. Shells. 1843, p. 193, pl. XXIII, fig. 57.


*Unio multiradiatus* Sowerby, Conch. Icon., XVI, 1868, pl. LXI, fig. 306.

*Unio affinis* Sowerby, Conch. Icon., XVI, 1868, pl. LXI, fig. 307.

This form, quite abundant in the St. Joseph River, is variable in outline,—a fact that probably gave rise to the extensive synonymy that has been established on this shell. The shell is large, elongated and rather thin. It is rounded anteriorly and somewhat pointed posteriorly. The epidermis is a light horn color, often shading into brown on the posterior slope. There are many bright green, narrow rays, departing from the beaks and covering nearly three-fourths of the disk. The umbones are prominent, slightly elevated, of a brown or green color, usually eroded, and marked by fine undulating ridges. The ligament is stout, short and wide, and of a dark chestnut color. The cardinal teeth are double in both valves. The anterior adductor muscle scar is excavated, longer than wide, large and coarsely striated. The
posterior adductor muscle scar is as long as it is wide, large, shallow. The cavity of the beaks is quite shallow. The pallial line is uniformly impressed. The nacre is white and somewhat iridescent.

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**Lampsilis Ligamentina** (Lamarck).


*Margarita (Unio) crassus* Lea, Syn. 1836, pl. 24.


*Unio carinatus* Barnes, Am. Jl. Sc. VI, 1823, p. 259, pl. XI, fig. 10.

*Unio elliptarvis* Say, Am. Conch., VI, 1834.

*Unio fasciatus* Say, Am. Conch., VI, 1834.


*Unio luteolus* Sowerby, Conch. Icon., XVI, 1867, pl. LVIII, fig. 239a.

*Unio delodontus* Sowerby, Conch. Icon., XVI, 1867, pl. LVII, fig. 288.

*Unio crassidens* Sowerby, Conch. Icon., XVI, 1868, pl. LXII, fig. 312.

*Unio pectus* Sowerby, Conch. Icon., 1868, pl. LXII, fig. 313.

*Unio venustus* Sowerby, Conch. Icon., 1868, pl. LXIV, fig. 326.

*Unio upsoni* Marsh, Conch. Ex. 1, 1887, p. 57.


*Lampsilis pinguis* Simpson, Syn. 1900, p. 540.

The habitats of this animal are variable. It may be found indifferently in sluggish and muddy bayous, living in sand or mud; or it may live in the gravel of a swiftly moving stream. These differences in environment may account for variableness in form and coloration. The nacre is white, varying to bluish and pinkish iridescence. The shell is large and much thicker anteriorly than posteriorly. The umbones are not prominent. The epidermis is yellowish, straw-colored, or light green with numerous dark green rays extending from the umbones to the central margin. Old specimens are dark reddish brown and show the rays only near the umbones. The cardinal teeth are double in both valves; those in the right valve are unequal, the anterior being very small, the posterior large, triangular and crenulated; in the left valve the teeth are more nearly equal, triangular and crenulated. The lateral teeth are strong, heavy, elevated and curved towards the
ventral margin. The anterior adductor muscle scar is deeply excavated, longer than wide and strongly striated. The posterior adductor muscle scar is but lightly impressed, and in some specimens is highly iridescent. The pallial line is deeply impressed anteriorly but only slightly impressed posteriorly. This shell approaches closely to those of *Unio luteolus* and *Unio ventricosus*. It can be distinguished from *U. ventricosus* by its receding umbones, and it lacks the undulations that are so characteristic on the beaks of *luteolus*.

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**Lampsilis Recta** (Lamarck).


*Unio rectus* Conrad, Monog., III, 1836, p. 33, pl. XV.

*Lampsilis rectus* Smith, Bull. U. S. Fish Com., 1890, p. 290, pl. LXXVIII.


Observations and comparisons made on forty specimens in the museum at Notre Dame warrant the following descriptions and measurements. The shell is large, smooth and elongated; there is lateral compression and the shell is quite thick to very thick anteriorly. The epidermis is thick and blackish and obscurely rayed with numerous bands of green. These bands of color disappear in old specimens and are indistinct in some young ones. The cardinal teeth are double in both valves, those in the left valve are about equal in size. The anterior tooth in the right valve is so small as to be inconspicuous. The teeth generally are recurved posteriorly, stout, triangular and serrated. The lateral teeth are long, straight, lamelliform, elevated and crenulated. The anterior adductor muscle scar is wing shaped, longer than wide and very deeply excavated. The posterior adductor muscle scar is rounded, slightly impressed and concentrically striated. The pallial line is deeply impressed anteriorly, crenulated, but only slightly impressed posteriorly. The cavity of the beaks is very shallow. The nacre is variable showing all shades from pure white to a dark purple.
REPORT ON THE UNIONDAE OF ST. JOSEPH RIVER

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**Lampsilis Iris** (Lea).


*Unio radiatus* DeKay, Zool. N. Y., Pt. 5, 1843, p. 189, pl. XVII, fig. 236.

*Unio subrostratus* Kuster, Conch. Cab. Unio., 1861, p. 203, pl. LXVII, fig. 3.

But two specimens of this shell are available for description, and both are evidently quite young. The shells are characterized by the beautiful silvery white nacre which, posteriorly, becomes iridescent, the short erect teeth, the interrupted bands of green, and the foldings on the beaks. In outline, the shell is elliptically oval, thin, small and transversely compressed. The lines of growth are widely separated but conspicuous. The cardinal teeth are triangular, small and erect. They are double in the left valve and single in the right. The lateral teeth are long, thin straight and not much elevated. The anterior adductor muscle scar is deeply impressed; the posterior is slightly impressed and very iridescent. The pallial line is quite faint. The cavity of the shell is small and narrow; of the beaks, shallow and triangular.

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**Lampsilis Alata** (Say).

*Unio alatus* Say, Nich. Euyc., II, 1817, pl. IV, fig. 2.

*Lampsilis alatus* Baker, Moll. Chi., Pt. I, 1898, p. 97, pl. XVIII.

*Unio alata* Lamarck, An. sans Vert., VI, 1819, p. 76.


*Lymnodia alata* Swainson, Treat. on Mal., 1840, p. 256, fig. 48.

*Mysca alata* Swainson, Exotic Conch., 2nd. ed., 1841, p. 28, pl. VII.


This is a large, oval shell, rather thin for its size and triangular when the alae are present. The umbonal slopes are rounded; the alate postero-dorsal margin is quite compressed. The ventral
margin is slightly rounded. The surface is smooth and shining with coarse lines of growth. The epidermis is yellowish-green and distinctly rayed in young specimens, but this color changes to a dark brown or even black in old specimens,—in these the rays may be, partially or even entirely obliterated. There is a solid ligament of a light brown color. The cardinal teeth are double in both valves, about equal in size in the left valve, and unequal in the right. The lateral teeth are long thin, slightly arcuate and smooth. The pallial line is quite distinct. The anterior adductor muscle scar is deeply impressed and striated; the posterior adductor muscle scar is large, indistinct and confluent. The dorsal muscle scar is in the cavity of the beaks and arranged in nearly a straight row; there are six or seven small rounded pits, followed by a single long and narrow scar, very deeply impressed. The nacre varies from deep purple to salmon pink; iridescent. The species may be recognized by the rich purple interior and the more or less alate postero-dorsal margin.

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**Lampsilis Leptodon** (Rafinesque).


*Unio leptodon* Say, Am. Conch., VI, 1834.

*Symphynota leptodon* Ferrusac, Guer. Mag. 1835, p. 25.

*Lampsilis leptodon* Simpson, Syn., 1900, p. 575.

*Anodonta purpurascens* Swainson, Zool. III., 1st ser., III, pl. CLX, 1823.

*Unio velum* Say, New Harm. Dissem., II, Sept. 23, 1829, p. 293


*Unio tenuissima* Hanley, Biv. Shells, 1843, p. 206, pl. XX, fig. 42.

This is one of the thinnest shells to be found in the St. Joseph River. The only shell that approaches it in appearance is Anodonta, the resemblance being in the poorly developed character of the teeth. The shell is small, smooth and elongately elliptical in outline. The epidermis varies from a light horn color strongly rayed with green in the young specimens, to a dark brown and even black color with no rays, in old specimens. The lines of growth are inconspicuous except along the ventral margin. The dorsal is straight; the anterior margin rounded; the posterior margin pointed. The umbones are small and hardly project above the
dorsal margin. The ligament is small, short, thin and hardly protrudes above the valves. The cardinal teeth are scarcely evident at all. The lateral teeth are single in both valves, long and straight. The pallial line is weakly impressed. The cavity of the shell is shallow; of the beaks, scarcely noticeable. The nacre is bluish to white; some specimens are spotted with yellowish brown.

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Plagiola Donaciformis (Lea).

Unio donaciformis Lea, Tr. Am. Phil. Soc., III, 1828, p. 267, pl. IV, fig. 3.
Unio zigzag Lea, Tr. Am. Phil. Soc., III, 1829, p. 449, pl. XII, fig. 19.
Unio nervosa Conrad, New F. W. Shells, 1834, p. 70.
Unio nervosus Say, Am. Couch., VI, 1834.

Only one specimen of this species is at my disposal. The specimen measures 54mm. in length, 33mm. in height, and 12mm. in diameter. The specific name was evidently given to this shell on account of its resemblance to the marine genus Donax. The species does not seem to be common in this locality as but one specimen was found. It is a small, thick shell that can be recognized by its zigzag epidermis, which, in the specimen before me is greenish and rayed with dark green. All the rays arise from the umbones and cover the entire disk. The shell is elliptically elongated, thick, solid and inflated. The lines of growth are indicated by obtuse ridges. The umbones are slightly elevated, much inflated, light brown in color, and marked by very fine ridges. There is a short ligament, rather wide and of a dark horn color. The cardinal teeth are double in the left and single in the right valve, small, elevated, narrow, somewhat triangular and coarsely serrated. The single tooth in the right valve is acutely triangular. The lateral teeth are long and directed ventrally. The anterior adductor muscle scar is longer than wide and deeply excavated. The posterior adductor muscle scar is barely visible. The pallial line is slightly impressed. The cavity of the beaks is rather deep. The nacre is silvery white and iridescent.

Anodonta Grandis (Say).


The largest specimen of this species in the collection at my disposal was taken from St. Mary's Lake, Notre Dame,—about half a mile from the St. Joseph River. This shell, collected in 1914, measures 153mm. in length, 80mm. in height and has a diameter of 60mm. All the other shells in the collection are from the river. The shell of the young is thin and fragile; in older specimens it becomes more solid. The surface is strongly marked by lines of growth,—the lines becoming ridges in the older shells. The umbones are prominent, but little elevated, of a greenish or bronze color.* In all the specimens of this collection the umbones are eroded and marked by five elevated, wavy wrinkles arranged in two parallel rows. The ligament is quite strong and horn colored. The epidermis varies in color from a greenish yellow in the young to a dark brown in older specimens. The rays mentioned by some writers are wanting in all the specimens before me. The adductor muscle scars and the pallial line are present but not impressed. The nacre is silvery white in the young but changes to cloudy in older specimens. Some of the specimens show a deep purple nacre and copper blotches; all the specimens show iridescence.

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**Symphynota Costata** (Rafinesque).

*Symphynota costata* Simpson, Syn., 1900, p. 665.
*Unio rugosa* Hanley, Biv. Shells, 1843, p. 211, pl. XXI, fig. 8.
*Alasmodonta bians* Ferrusac, Guer. Mag., 1835, p. 25.
The shell of this species is elliptical in outline, rather thick and heavy. It is rounded anteriorly and obtusely angulated posteriorly. The dorsal margin is straight in both sexes; the ventral margin is straight in the male and curved in the female. The lines of growth are quite heavy and form strong wrinkles on the dorsal part of the posterior angle. The umbones are eroded on all specimens in this collection, and all are marked by three almost straight, elevated ridges. The ligament is long, narrow and dark brown horn colored. The epidermis is yellowish-green to dark brown or black. The cardinal teeth are thick and heavy, pyramidal and striated on the upper surfaces. The lateral teeth are undeveloped and appear as a slight thickening of the hinge plate. The anterior adductor muscle scar is very wide, slightly impressed and iridescent. The pallial line is impressed only on the anterior portion of the shell. The cavity of the shell and of the beaks is shallow. The nacre is silvery white, bluish white or salmon colored. Old shells have a dark purple band along the entire margin of the valve.

Alasmidonta Marginata (Say).

Margarita (Margaritana) marginata Lea, Syn., 1836, p. 43.
Alasmodonta marginata Baker, Moll. Chi. Pt. I., 1898, p. 62, pl. IV, fig 4: VII, fig. 7: XXII, fig. 3.
Unio Marginatus Sowerby, Conch. Icon., XVI, 1866, pl. LI, fig. 267
Alasmodonta truncata Simpson, Syn., 1900, p. 671.

This species should be easy to recognize on account of its heavy shell, inflated umbones that are characteristically marked with three very coarse, undulating ridges, and its truncated posterior border. The ligament is wide, not very long and of a very dark horn color. The epidermis is brownish or greenish with wide dark rays extending from the umbones to the ventral border, and dotted with black spots and dashes. The cardinal teeth are thin, elevated and striated; there is one in the right and two in the left valve. The lateral teeth are simply a thickening of the hinge. The anterior muscle scar as also the protractor are marked by lines of growth. The posterior muscle scar is only slightly impressed. The cavity of the shell is deep; that of the beaks is shallow. The pallial line is well impressed. The nacre is a bluish white, pearly and iridescent, especially on the edges of the valves.
Quadrula undulata (Barnes).

Unio undulatus Barnes, Am. Jl. Sci., VI, 1823, p. 120, pl. II.
Quadrula undulata Baker, Moll. Chi., Pt. I, 1898, p. 82, pl. XXII, fig. 1, 2.
Unio costatus Conrad, Monog., II, 1836, p. 17, pl. VII.
Unio plicatus Kuster, Conch. Cab., 1856, p. 137, pl. XL, fig. 3.
Unio atrocosiatus Sowerby, Conch. Icon., XVI, 1868, pl. LXXVII, fig. 404.

This is a very heavy shell, somewhat elongated and irregularly rhomboid in outline. A characteristic feature of this species is the sculpture consisting of five strong ridges that are swollen where they cross the posterior ridge. There are oblique folds on the posterior portion of the disk; they run nearly parallel with the posterior ridge and are sometimes broken into corrugations or pustules. The epidermis is greenish or yellowish green in young specimens; in old specimens the color changes to dark brown or black. The dorsal margin is straight; the ventral margin is slightly rounded. The lines of growth are often raised into thin scales on the ventral border. The cardinal teeth are double in both valves, equal in the left, and the anterior much smaller in the right valve. All the teeth except the anterior in the right valve are heavy thick, triangular, striated and grooved. The lateral teeth are long, thick, curved ventrally and serrated. The pallial line is deeply impressed throughout. The cavity of the beaks is broad and shallow. The nacre is silvery white and iridescent on the posterior portion; some specimens show brown blotches.
**Quadrula Rubiginosa** (Lea).

*Quadrula rubiginosa* Baker, Moll. Chi., Pt., I, 1898, p. 77, pl. XIX, fig. 2;  
XX, 1.

*Fusconaia rubiginosa* Ortmann, Ann. Car. Mus., VIII, 1912, p. 241, figs 4, 4a

*Unio flavus* Conrad, Monog. m. IX, 1837, p. 74, pl. XLI, fig. 2.

*Unio trigonus* Sowerby, Conch. Icon., XVI, 1868, pl. LXIV, p. 322.

There are five specimens of this shell in the collection at my disposal. The measurements vary considerably from those given for the species by Call and Baker, showing that these shells are smaller. The shell is quadrate in outline and of moderate thickness. There is lateral compression and striation. The epidermis is brown or olive green,—some young specimens have rays in the umbonal region. The lines of growth are numerous and raised into ridges. The anterior margin is round; the posterior margin is curved; the ventral margin is emarginate. The umbones are small and slightly raised. The ligament is dark brown in color, thick, and short. The cardinal teeth are double in the left and single in the right valve. The lateral teeth are long, thin and plate-like. The pallial line is well marked; in some specimens, it is nearly obliterated towards the posterior end. The nacre is pure white to salmon colored. There is considerable variation within the species, especially in the shape of the posterior portion, and in its corpulency. This shell may be distinguished from *Quadrula coccinea*, which it resembles most closely, by its more angular posterior slope and its stouter and diverging cardinal teeth.

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*Quadrula Coccinea* (Conrad).

*Unio coccineus* Conrad, Monog., III, 1836, p. 29, pl. XIII, fig. 1.  
*Quadrula coccinea* Baker, Moll. Chi., Pt. 1, 1898, p 79, pl. XIV, fig. 1; pl. XIX, fig. 3.


*Unio catillus* Conrad, Monog., III, 1836, p. 30, pl. XIII, fig. 2.


This is an exceedingly variable species and one of the most difficult to diagnose. Its nearest relative is *Q. solida*. It may be
distinguished from this by a greater compression, lower beaks, no full median radial swelling and an absence of a radial depression in front of the posterior ridge. There are, however, intermediates that can not be satisfactorily named. The shell is roundly quadrate or roundly elliptical, rounded before and squarely truncated behind. The surface is roughened by sharp and elevated lines of growth; older specimens show considerable erosion. The umbones are elevated and bear three large, elevated undulating wrinkles and many fine lines of growth. There is a short, wide and strong ligament, of a dark brown or horn color. The epidermis is brown or reddish brown; in very old specimens it becomes chalky. The cardinal teeth are double in both valves, nearly equal in the left, the anterior tooth only a rudiment in the right valve. The cardinal teeth are depressed, triangular, heavy and strongly serrated. The lateral teeth are long, elevated serrated and directed ventrally. The single lateral in the right valve has a depression into which the ventral tooth in the left valve fits. The anterior adductor muscle scar is deeply excavated and striated, and longer than wide; the posterior adductor muscle scar is slightly impressed, striate and confluent. The cavity of the beaks is shallow. The pallial line is barely visible to quite deeply impressed. The nacre is variable from a cloudy white to rose, pink or salmon color.

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Quadrula Tuberculata (Rafinesque).


Rotundaria tuberculata Agassiz, Arch. fuer Naturg., I, 1852, p. 48.

Unio tuberculatus Conrad, Monog., V. 1836, p. 43, pl. XXII.

Quadrula tuberculata Simpson, Syn., 1900, p. 795.


Margarita (Unio) verrucosus Lea, Syn., 1836, p. 16.


Quadrula verrucosa Baker, Moll. Chi., Pt. I, 1898, p. 85, pl. XXIII.


The shell of this species is quadrate, thick, heavy and pustulate. The dorsal margin is nearly straight while the ventral margin is rounded to straight. The surface of the shell is very rough,—the roughness being caused by coarse lines of growth, tubercles and
pustules. The anterior portion is quite smooth, the pustules occupying the center of the shell from the umbones to the ventral margin. The umbones are small, directed anteriorly and marked by heavy ridges. The ligament is a dark horn color, long and wide. The epidermis varies from a dark yellow to a dark brown. The cardinal teeth are single in the right and double in the left valve, flat, large and deeply grooved. The lateral teeth are very strong, and much striated in older specimens. The anterior adductor muscle scar is oval, deeply excavated and markedly striated. The pallial line is deeply impressed anteriorly but almost not at all posteriorly. The nacre varies between a whitish hue in young specimens to a deep purple in older specimens. There is a satin finish near the beaks. The space between the pallial line and the ventral margin is a dark purple, with a thin white line running along the ventral margin.

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The river area over which collections were made is about six miles in length, extending from a point about two miles south of South Bend to Bertrand, a village just above the Michigan state line.

Notes on the Genus Atrypa, with Description of New Species.

BY CLEMENT L. WEBSTER, M. SC.

INTRODUCTION.

For many years I have been engaged in bringing together from the rocks of all geological ages containing them from various parts of the world, a very large collection of all available species and variations of the Genus Atrypa, for the purpose of a monographic revision of the group, and for the further purpose of, in so far as possible, ascertaining the genesis of species of this group. The amount and nature of the material and evidence secured has been very gratifying; and can not but aid somewhat in the solution of at least some of the important questions involved.
Through these studies and collections it has been clearly shown that the species of this genus represent a most wonderful plasticity, and demonstrates more clearly than ever the great difficulty of determining what really does in nature constitute a good "species." It is shown that with every radical (and sometimes relatively slight) change in the deposition and environment in which the various forms we call species, lived, there followed an equally great modification of the forms, and that under these conditions they were remarkably uniform and persistent in their form and character. There is no other group of ancient life perhaps which shows equally well the great plasticity of species (aside from the Stromatoporae and their allied forms) than do the forms of the genus Atrypa. Specific names are here given to certain forms of the genus more for the sake of convenience in reference and to facilitate the further studies of others, rather than to the belief that they always constitute true natural species—in fact I am convinced that in nature, relatively few natural "species," such as have been generally regarded as such, really exist.

Nearly all the Atrypae described in this paper save A. owenensis, and A. subhannibalensis, have been referred by geologists to Atrypa reticularis.

In the following description of forms it will often prove difficult for the student to fully appreciate the importance of the differences existing between them without good illustrations being shown; this, however, will be overcome in the final Monograph of which this paper is to form a part.

**Description of Species.**

**Atrypa owenensis** N. Sp.

Plate VIII. Figs. 12–14.

Shell small usually not over half inch in width; length equal to or considerably greater than width.

Valves usually greatly convex and often nearly equally so; beak sharply incurved; plications rather coarse and transverse annulations or lines of growth prominent. This species is generally unusually constant in form and size, and has a certain phase suggesting *A. impressa* of Hall. This form is gregarious in its habits, and appears to be restricted in its range to a certain limestone bed of the Upper Hackberry Group (the "Owen substage" of Fenton), Owens Grove (south exposure), Cerro Gordo County, Iowa.
Position and locality: Upper Hackberry Group ("Owen sub-stage of Fenton), Devonian, Owens Grove (south exposure) Cerro Gordo County, Iowa.

Now in the author's collection.

Atrypa independensis N. Sp.

Plate VIII. Figs. 4-6.


This species from Independence, Iowa, is described as follows by Hall: "Shell depressed suborbicular in its young state, becoming gibbous and sinuate in its mature condition; hinge line often nearly straight, and almost equalling the width of the shell; valves nearly equally convex in the young state, the dorsal valve becoming more gibbous as the shell advances in age, and sometimes acquiring an undefined mesial lobe down the centre. The ventral valve, in the young state, has the beak nearly straight and perforated at the apex, becoming incurved and finally closely bent over the beak of the opposite valve: a narrow false area is sometimes observable. Shell broadly and deeply sinuate in front." Striation fine and very numerous.

This species is well marked and quite distinct from other forms in several important respects and constant in form and general expression among themselves.

Position and locality: Hard gray-white limestone of the lower portion of the Middle Devonian, Independence, Iowa, and Solon, Big Bend of Iowa river Johnson County Iowa; as well as the Devonian rocks at "East Point, east side of Lake Manitoba," Canada. All now in the author's collection.

Atrypa expansa N. Sp.

This species possesses the general form and size and very fine striation of A. independensis of this paper and occurs associated with it; but differs conspicuously from it and all other forms of this genus by the great development of a "marginal fringe" or "foliated expansion" of the ventral valve, thus attaining a width of 3 1-2 to 5 inches or more. This certainly is a remarkable form, and one not to be confounded with any other. This form has always been referred to A. reticularis, but it seems to warrant the distinction of a separate species.
This form occurs frequently at Independence, Iowa, and a few other localities in Iowa, as well as at various localities in the Devonian strata of Canada at Lake Manitoba, Dawsons Bay and other localities. This form and its almost invariable associate *A. independensis*, are remarkably constant in their respective characters. This description is made to include this form from Lake Manitoba, Canada, as well as the Iowa form. This species is illustrated in Plate 37, Fig. 8, Vol. I Part IV, of "Contributions to Canadian Paleontology, 1892"; and also illustrated by Thomas in "Plate VC, Fig's. 1 and 2, Vol. XXIII, of Proceedings of the Iowa Academy of Science, 1916."

Position and locality: Lower part of the Middle Devonian at Independence, etc. Iowa, and the Devonian rocks at Lake Manitoba etc., Canada; specimens from most all these localities being in the author's collection.

*Atrypa gigantea* N. Sp.

Shell very large—attaining the largest size of any species of this genus known to me; orbicular to sub-orbicular in marginal outline, but sometimes wider than high; dorsal valve strangely and broadly convex above the centre, ventral valve flat or strongly concave; plications very coarse and often bifurcating. The internal structure of the ventral valve is very coarse, strongly marked and the teeth very prominent and stout. This species is very constant in form and expression, and is greatly restricted in its range vertically and horizontally, being confined to a soft granular limestone bed of a dark yellow-brown color, in Johnson County, Iowa.

Position and locality: Known only from the lower part of the Middle Devonian, at Iowa City, Roberts Ferry, Turkey Creek and Linders quarry, Johnson County, Iowa.

Now in the author's collection.

*Atrypa waterlooensis* N. Sp.

Plate VIII. Figs. 1–2.

Shell orbicular in outline and sometimes a little wider than long; attains a large size; very uniform in size, structure and appearance; hinge line shorter than greatest width of the valves, closed hinge area. Dorsal valve very gibbous at or just above the centre; ventral valve flat, or strongly concave below the umbonal region, but some-
times slightly convex throughout most of its surface. Surface covered by very coarse and distant bifurcating plications and usually crossed throughout by prominent lines of growth.

This species is everywhere restricted to a series of soft granular, yellow calcareous limestone beds which on weathering usually break down into a tenaceous yellow clay. The form, structure and general appearance throughout the life history of this species is remarkably uniform and persistent. At Littleton, Iowa, this form generally does not attain so great a size as elsewhere.

Position and locality: In soft, yellow, granular, calcareous limestone just above the centre portion of the Middle Devonian, at Waterloo, Waverly and Littleton, Iowa.

All now in the author's collection.

*Atrypa waterlooensis* var. *canadensis* N. Var.

Plate VIII. Fig. 3.

This variety differs from the typical form of *A. waterlooensis* mainly in its generally smaller size and less coarse bifurcating plications; and is of special interest as showing its close relationship with *A. waterlooensis* of the Iowa Devonian.

Position and locality: Blue shales of the Upper Devonian age, Hay River, N. W. Territory, Canada, and Blue shale of Upper Devonian age on Hay River, 40 miles south of Great Slave Lake, N. W. Territory, Canada. Now in the author's collection.

*Atrypa lineata* N. Sp.

Plate VIII. Figs. 7-8.

Orbicular in outline to sometimes longer than wide. Dorsal valve moderately to strongly convex at or just above the centre and sometimes developing a strong mesial fold at the front of the valve; Hinge line considerably shorter than the greatest width of the valves; area closed and beaks sharply incurved; ventral valve flattened and often concave while somewhat convex below the beak, and sometimes developing a deep mesial sinus in front.

This species generally attains a large size, and throughout its life history, is very constant and uniform in appearance and form. Surface marked by fine striae which often bifurcate, and crossed by more or less numerous annulations of growth.

Position and locality: This form occurs abundantly in a soft granular, yellow calcareous limestone between the two nodular
Stromatopora reefs just below the iron bridge, at Treats quarry, Kelleys Quarry, at Charles City, Iowa, in the upper part of the Middle Devonian.

Now in the author's collection.

**Atrypa subhannibalensis** N. Sp.

Plate VIII. Figs. 15-16.

Shell of medium size, wider than high, both valves convex; dorsal valve extremely convex with greatest convexity about the centre, prominent elevation in the centre corresponding to a mesial fold and especially strong at the front margin of the valve; cardinal extremities rounded; ventral valve much less convex than the dorsal with a prominent mesial sinus especially well developed on the front margin of the valve; hinge line much shorter than the greatest width of the valves, area closed, beak sharply incurved, perforation of ventral beak not well made out. Surface marked by many strong and prominent imbricating lines of growth, and at times these lines are marked by broad and slight elevations.

In general appearance this form might be considered as occupying a position between the genus Atrypa and the genus Athyris, although I am convinced it really is referable to the former. In general appearance and expression also it has a quite strong resemblance to *Athyris Hannibalensis* of the Carboniferous above.

Position and locality: Upper Hackberry Group, (equivalent of the "Owen Sub-Stage" of Fenton) Devonian, Owens Grove (south exposure), Cerro Gordo County, Iowa.

Now in the author's collection.

**Atrypa aspera** var. *occidentalis*, Hall.

This variety of *A. aspera* occurs abundantly at Independence, Waverly, Janesville, and a few other localities, in Iowa, and is a typical western form. Through the kindness of Professor E. M. Kindle, chief paleontologist of the Canadian Geological Survey, I have received identically the same variety from the upper part of the Manitoba formation (Devonian), Red Deer River, Manitoba, Canada.

This is a fact of much scientific interest. Professor Kindle is now at work on his great collection of Devonian fossils from the Northwest Territory, Canada, and his conclusions on the correlation of fauna—especially as they relate to the fauna of the Canadian
and Iowa Devonian—will be awaited with special interest. The prevailing form of *Atrypa aspera* var. *occidentalis* as it occurs in the Iowa Devonian, is illustrated by Hall in Plate 6, Fig's. 3a,—3b, Vol. I, Part I, Iowa Geological Survey, 1858; and in Plate 53A, Fig's, 19-21 Paleontology of N. Y. Vol. 4.

*Atrypa lineata* var. *inflata* N. Var.

This form differs widely from *A. licata*, but it has seemed best to consider it as a variety of this species. It is a well marked variety, being very uniform in outline and form; is longer than wide, more or less sharply rounded in front; very evenly and strongly inflated especially the dorsal valve, while the ventral valve sometimes has a broad even concave area in front; beaks small and sharply incurved; perforation small; hinge line less than greatest width of the valves, straight or broadly triangular. Surface marked by fine striae, sometimes implanted and bifurcating.

Position and locality: From lower Stromatopora reef, upper part of the Middle Devonian, at Scriptures quarry and Bloody Run, three miles southeast from Charles City, Iowa, and from a few other localities in Iowa.

Now in the author's collection.

*Atrypa devoniana* N. Sp. Plate VIII. Figs. 9-11.

Shell ranging from small to medium size, orbicular to sub-orbicular in marginal outline, and sometimes longer than wide.

Ventral valve flattened or gently concave and much more prominently so in the umbonal region; front part of the valve generally somewhat concave or developing a slight to profound undefined sinus; beak low, sharply incurved, area closed and perforation usually very distinct. Dorsal valve generally very convex especially so just above the centre, and in young and immature forms less prominently so. Surface marked by many fine striae which are increased by bifurcation and implantation, but almost wholly so by the former; and generally crossed by faint or sometimes slightly prominent lines of growth, but sometimes this feature is wanting. This is the most beautiful species of the genus occurring in the Hackberry Group, and is constant in form and expression throughout its life history.

Position and locality: Occurs abundantly throughout the
Hackberry Group in Iowa, especially in the Lower and Middle Hackberry. A closely related variety of this species occurs in the lower and middle Devonian at Independence, and Pine Creek, Iowa.

Now in the author’s collection.

*Atypa spinosa* var. *lindere* N. Var.

This is a relatively small form, and a well marked western variety at least of the New York *A. spinosa* of Hall; it in fact stands midway between certain of the coarse ribbed *Atypa* of the western Devonian which have generally been referred to *A. reticularis*, and the eastern form of *A. spinosa*. It is much smaller and coarser ribbed than the typical forms of this species occurring in the Devonian of the Canadian northwest. It is plano-convex to concavo-convex. It has an extreme width of $\frac{1}{2}$ to 1 inch, is well defined and constant in form and expression.

Position and locality: This form occurs in the lower portion of the middle Devonian at Linders quarry 3 miles north from Iowa City, Iowa, and is sometimes met with at a few other points in Johnson County, Iowa.

Now in the author’s collection.

**Explanation of Plate.**

Figs. 1-2.—*Atypa waterlooensis*. N. Sp.

Ventral and dorsal views of two specimens of this species.

Fig. 3.—*Atypa waterlooensis canadensis*. N. Var.

Dorsal view of one specimen of this variety

Figs. 4-6.—*Atypa independensis*. N. Sp.

Fig. 4. Dorsal view of a specimen of this species in the collection of C. L. Fenton, showing the normal shape of a rather young shell. Fig. 5: Dorsal view of another specimen of this species, showing a less common elongated form. Fig. 6: Cross section of a young shell.

Figs. 7-8.—*Atypa lineata inflata*. N. Var.

Lateral and dorsal views of a very gibbous specimen of this species in the collection of C. L. Fenton. From the parting between the two nodular Stromatoporoid beds at Charles City, Iowa.

Figs. 9-11.—*Atypa devoniana*. N. Sp.

Dorsal, lateral and dorsal views of three specimens of this species. Fig. 11 represents the normal size and shape of an adult specimen.

Figs. 12-14.—*Atypa owensis*. N. Sp.

Lateral, dorsal and ventral views of three type specimens of this species.

Figs. 15-16.—*Atypa subhannibalensis*. N. Sp.

Front and dorsal views of the type specimen.
The Winters of North-Central Iowa.

BY HOWARD CLARK BROWN.

To the Iowan whose loss of perfect reason has driven him to California, the escape from the Iowa winter is accounted his greatest blessing. Few, indeed, of those who have formerly lived in Iowa ever consider a trip back to the prairie state in winter. It is the cold, the below zero weather, the snow drifts which they have desired to get away from. And yet all people are not so anxious. There is a strain of Iowans, often having sturdy Scotch blood in their veins, and almost certainly have they come from Canada in their journey to the States, there is such a strain which delights in the cold weather. The coldness adds vigor to their pursuits of life's varied interests. The thermometer at twenty below is only a sign for more eager greeting when once again the sun shines warm over the rolling plains as the Spring breaks upon the country. Often these persons who delight in the cold winters of Iowa have been pioneers in this Middle Western region. They have watched the stretch of plains change from a great treeless tract of loneliness to a region rich with ripening grains, dotted with human habitations, and interspersed with clustered communities.

Just such a pioneer, is Mrs. Eliza Cairns of Charles City, Iowa. Mrs. Cairns reached the Iowa prairie in December, 1858. Her brother, John Brown reached Bradford, the home of the Little Brown Church, in 1855. Both of these people delighted in recalling the oldtime, pioneer days. And a large number of their recollections clustered about the relentless Iowa winters. I think that we of to-day, often hearing the tales of the cold of other times, do not fully realize the fact of the latter. I was interested in probing the subject of former winters to its depth. I spent many afternoons and many long evenings listening to the tales of the pioneer as either Mrs. Cairns or my grandfather would give them to me. And though often these tales contained much hardship, much struggle, yet seldom was there any bitterness in the telling.

It is idle to try to assert that the weather of old times was more severe than it is to-day. A change of fifty years would make so little difference that human records would not denote it. The difference, after all, is in the conditions of life, and not in the change of the temperature. Life of to-day is fortified against the extreme weather of the winter season. Life of fifty years ago was open to
attack. Men are now amassed in communities. Tree rows temper the stinging gales which formerly swept, unchecked, across the prairie. But it is of interest to go back to those old times, to gather up fragments of the old pioneer life, to piece them together, and to interpret them in the light of the world of to-day. And to do this we must consult the old records of the people who then struggled in bitter opposition, against the elements.

In seeking records of the old times, I came first of all to the diary which Mrs. Cairns has kept. It is a record going back for more than half a century. A record of climate, of fall ploughings, of spring sowings, of summer harvests, in fact, a life record of many seasons, repeating itself again and again as life always does, yet adding, presenting greater possibilities, making the whole richer, more lovely than it was at any preceding year. The exceedingly mild winter of 1918-19, in North-Central Iowa might well be compared with the winter of 1854-55. That winter was so very mild that Mrs. John Kellogg of Charles City, (then St. Charles), hatched and raised chickens in December. A friend of my grandfather's, who had come to this part of the country in that year, wrote to him in Canada that the winters were very mild in Iowa. He said that he had chopped wood in his shirt sleeves all winter. The next spring, Mr. Brown set out for Iowa. And, in accordance with his friend's description of the climate, he thought it unnecessary to bring his overcoat. The first winter he was here, 1855-56, it became so very cold that all of the thermometers of that time failed to register the temperature. All of them froze up. On one particular day no one was found in the cabin at which grandfather was staying, who would volunteer to go out after wood. But he, with true pioneer pluck, went out, alone. He had sent for his overcoat, in the meantime, but it had to come from McGregor by wagon, and on the way it was lost off the load. The owner never received it until sometime in January.

In 1876 Mrs. Cairns recorded that it was cloudy on December 25th, and that 'roads were in a terrible condition of mud.' December 28th of this same year found men ploughing.

Christmas day of 1884 was a splendid day with no snow at all, and roads were dusty in places. On the 27th of that year there was considerable rain. It had been cold before these dates, however, for we find that on December 3rd, the roads were good, and dry. On December 4th, it was quite cold, snowy, and blowing. Then, on
December 15th, it is recorded that some were running sleighs. However, the snow disappeared entirely before Christmas time.

It was at about this same time that a terrible winter struck this middle Western region. I have little left to record that season, save a short sketch which had to do with another Grandfather, Donald George Clark. Mr. Clark had been to Dubuque on the jury and was returning home upon an especially cold winter night. He left Charles City, walking toward his farm, some six miles to the South-west. The thermometer stood at thirty-eight below zero, yet he footed it all the way. He said that he had to run from one grove to the next to keep from freezing. A terrible wind swept across the prairies. And those who awaited him at home said that he looked like a snowman when he arrived.

The deep snow fall of 1877 has been recorded by Mr. Fred Strong of Charles City. There was a sixteen inch snow fall in Floyd County in November of that year. The whole disappeared within a month, however, and no other fell during that winter. It is not hard to believe that fences would easily be buried when such falls appeared. Many children of those days remember walking across the fields, over fences, on their way to school. The only care needed was in not breaking through the crust.

December 23rd, 1886 was stormy and roads were drifting badly according to the record of Mrs. Cairns.

January 15, 1888 was very cold. The thermometer registered forty below. On December 25th of that year, the ground was all bare, and the roads were dusty. The first snow of the season came on December 26th.

On December 25th, 1889 there was no snow and the recorder writes that it is more like April than December.

In 1895 there was sleighing on that same date. 1898 was somewhat similar, and Christmas day was made merry with sleighs.

In 1904 the ground was covered with snow on January first, but not enough was present for sleighing, as there was much dust mixed with the snow. On January 3rd of the same year, it was thirty below.

The years since 1904 have been rather uneven; we have had some which brought considerable snow, and some which brought little. Some were cold and some moderate, but the most moderate of all was that of 1918-19. The year just preceding had been an exceptional one in many parts of the country for heavy snows. Blizzards,
the old-fashioned three day sort which we thought had gone forever visited Iowa again. The weather was not so cold, but the blizzards were blinding. They blocked the way of any sort of traffic. Farmers were shut in for some time. But it was not as in the old days, for there was, with most of the farmers at least, some sort of communication with the outside world. It was not long at a time that the telephones were out of order, and even if they were not usable for short periods, at least, the nearest farm was usually a few rods away. It was far different from the case with my grandparents who found only three houses between their home, more than twelve miles distant from St. Charles, and the little village. But since we are told that exceptions prove the rule, so it is in this case. For the winter of 1918-19 was certainly an exception.

In November, 1918, on the first day of the month, an American bittern was seen by the writer, in Willow Pond Bird Sanctuary, at Charles City, Iowa. On that same day, a Wilson's snipe was also seen there. The snipe was again seen on November 3rd, near the same region. And in some bushes along the creek which goes from this sanctuary to the river, a male indigo bunting was seen. This is a most unusual record for the bunting, and I believe that the snipe and the bittern are quite out of season. Of course, since the creek was not frozen, the bittern and snipe could get their necessary foods. But why the bunting should have been around is another question. The weather had been mild, indeed, yet buntings had never remained in that region in former years at all as late as that date. Had it been the only eccentricity of that season I should have thought that something was the matter with the bird, and that it could not fly. But it was very active, flew well, and seemed thoroughly alert. Besides, the other birds having lingered so long past their usual times for migration made me believe that the season was truly to be one of considerable mildness.

In November, Mahlon Palmer, a member of the Califor Naturalist Club of Charles City, found violets in bloom. On the fourteenth of that month, in Brackett's Woods, a favored wood on an old river flood plain, and only a short distance from the town, I found baby-faces, (Anemonella thalictroides), coming up. However, I did not find any in blossom, as I had once before in the late fall when the frost had come very early, and then warm weather had followed closely upon it. There were other signs of reawakening life, for the buds of the lilacs were greatly swollen at this time, and
were about to burst in some instances. And the gardens bore
unmistakable signs of the retarded frosts.

On November 13th, 1918, Mrs. Fannie Kellogg of Charles City
picked enough strawberries for a good sized dish. On December
24th, Mrs. Dutton picked cress in the garden for Christmas dinner.
Mrs. H. Blunt gathered beets from the garden at this same time,
and she had Johnny-jumpups in bloom. Is this not, verily, a repeti-
tion of that old winter of 1854, when men chopped wood all winter
long in their shirt sleeves? So it seemed indeed. But one of the
greatest notes of mildness was yet due.

On December 17th, in a creek on the Floyd Road, the writer found
a frog which wiggled rather inactively away, when touched. It was
in the bottom of the stream when first seen, and minnows were
swimming around in the water. But when the frog was moved, it
continued its journey, proving that it had not yet reached the
hibernation period.

The final triumph of the season, however, was the glad chirp of
a robin on December 24th. Mr. Clement L. Webster of Charles
City, states that robins have been known to remain throughout the
winter occasionally, when a hollow along the river offered protection
from the winter winds, and when some human hand would offer
them food and a crude sort of shelter. But he had no instances in
late years of any remaining under any conditions. I had never
before seen a robin at this season in this locality. It was a novel
and joyful experience when I was summoned by telephone to the
neighborhood in which the robin had been seen. It was hovering
around the back porches, trying to hop in the gravelly parts under-
neath the porches, where there was none of the snow. When a
person passed too near, however, it took to the top of some of the
tall hard maples along the street. Some attempts were made to
scatter food for it, but whether it ate any of the offered crumbs
I can not say. Just the year before, in a wood North of
town, another bird enthusiast and myself had discovered some red
headed woodpeckers which were wintering with us. That was the
first time during the years which we had tramped that region, at
which we had ever seen the red-heads in winter. They had stored
acorns in holes of their own making, in an old stump. We discovered
them at their lunch counter. But now a robin was found and in
the dead of winter. We began to think that Nature knew no laws
at all. Whether this was a robin which had not yet migrated and
would do so later, or whether it was to remain with us all winter is not known, as I had no record for it since that date. It had been seen quite commonly in that neighborhood until the snow on the twenty-fourth. The fact that it could fly well had been definitely demonstrated again and again.

I am glad that this mild sort of winter arrived at a time when I was about to help record some of the strangenesses of it. The weather bureau took temperatures and some of the street seers noted the late open condition of the river, but the fragments which I gathered were from the fields and woods and would else have remained unnoticed. Of course, I do not think that such notes have great value, but I believe that they are very interesting, and that in such comparisons, and such only, do we come to an appreciation of what early times were like. I am truly very grateful for that record which Mrs. Cairns has kept. It is a life record of changing seasons, of storms and quiet. Through its pages the kettle drums of the prairie blizzards howl, the coyote's lonely cries are echoed in the lonely stillness of the night, the snow cracks as the crust breaks with the fleeing deer, and thus the winter goes on. The winter,—season of hunger and of want, season of cold and much misery, yet the season when men's souls are tried and tempered into the finest steel.

Birds Observed at Rum Village on October 7, 1920

BY BROTHER ALPHONSUS, C. S. C.

The day was fine. We left Notre Dame at 8:45 a. m. and arrived at the large grove that is still called Rum Village, from an old Indian settlement, at 9:30 a. m. This piece of timber is perhaps the largest and finest in the immediate vicinity of South Bend, Indiana. The city has recently purchased a portion of the grove, but the larger part is still in private hands and seemingly will soon he levelled to the ground. Already there are large clearings in it, and here and there wretched hovels have been set up. If the entire wood was bought by the city, it would make one of the finest parks in the country.

Just after we got into the grove, we discovered one pine warbler, two downy woodpeckers, and a white-breasted nuthatch. This was the only pine warbler we found, although myrtle warblers were
the most plentiful species in the wood. This was the first time we had seen the myrtle this autumn. They were most numerous in one place in the grove. With the myrtle warblers, we saw two palm warblers, many bluebirds, serveral chipping sparrows and goldfinches. This was the first time we had observed the palm warblers this month. As we advanced farther into the wood, myrtle warblers were still seen, but another species soon attracted our attention by its great abundance. This was the hermit thrush. Most of them were either on the ground or in low trees and brushes. Their rufus tails could be seen in the sunlight without using our field glasses. This was our first record of the hermit thrush this autumn. We saw no other thrushes, and this surprised us greatly. For this grove is filled with wood thrushes in spring, and we did not expect them to have migrated so early.

With the hermit thrushes we found in great abundance robins and bluebirds, especially the former. There were growing in this part of the grove many elder-berry bushes, which probably had attracted the robins. Nowhere else in the vicinity of South Bend, had we recently found robins in any abundance. At most a few individuals were heard or seen.

Gradually we left the robins and hermit thrushes behind us, and farther on we heard a flock of bronzed grackles clattering in the tree tops. Occasionally, too, we heard the more pleasing note of the cowbird. Here we saw the only sapsucker in our pathway. We had seen one on the first of the month, and these two records were all we made up to date. A single ovenbird was also found in this part of the wood, as usual walking quietly on the ground.

We were now approaching the east side of the grove, where many of the fine trees had been felled, and the branches were piled up. In the brush we found white-throated sparrows, rather abundant, and also began to meet again myrtle warblers, bluebirds and chipping sparrows. An occasional snatch of song was heard from the white-throats; from all the other species naught but call-notes.

We passed out of the grove at 11 a. m. and started up the road to catch a Michigan Street car. To do so we walked more than a mile, part of the way on the Vandalia tracks. The only species we saw here were two vesper sparrows. While walking along we counted the species we had seen, and found the number to be twenty-four. These were: bluebird, crow, goldfinch, bronzed grackle, blue jay, white-breasted nuthatch, robin, downy wood-
pecker, sapsucker, killdeer, chipping sparrow, white-throated sparrow, vesper sparrow, ovenbird, pine warbler, palm warbler, myrtle warbler, hairy woodpecker, hermit thrush, flicker, cowbird, golden-crowned kinglet, prairie horned lark, snowbird.

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The Indiana Audubon Society wishes to call your attention to a few significant signs of the times.

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Never before have people recognized so fully that all the wild things of our state have a right to protection, preservation, recognition, entirely independent of the amount of good or harm in dollars and cents that can be attributed to them. Each has a scientific and an esthetic value which cannot be measured and which should protect them from persecution, and above all form extinction. Much of our happiness depends on the beautiful things in nature.

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Some Species of Podosemum.

BY BENJAMIN FRANKLIN BUSH.

In a paper on the Muhlenbergias of Missouri,¹ I pointed out that the plant long known as Muhlenbergia capillaris had been taken as the type of a new genus by Desvaux,² to which he applied the name Podosemum.

This view of Desvaux's seems to me to be quite reasonable; this species and its allies differing superficially and in all essential characters from the other species of Muhlenbergia, and I shall now take into consideration a few of the species related to the type-species.

1. Podosemum capillare (Lamarck) Desvaux, 1810.

A full and complete account of this species has been given in a preceding paper.³ The next two species are closely related to, and are often confused with this, and sometimes considered as varieties of it.


Muhlenbergia filipes M. A. Curtis, Am. Journ. Sec. Plant. 1:44. 1843
Muhlenbergia capillaris Chapman. Fl. S. U. S. 603, 1857, in part, at least as to description, not of Trinius, 1824.

Specimens Examined:

NORTH CAROLINA:
Without definite locality, Curtis, date not given, M. B. G. Herb. No 79695.

FLORIDA:
Apalachicola, Chapman, date not given, M. B. G. Herb. No. 785596;

3–Bush. l. c. 93, 1919.
Apalachicola, Chapman, date not given. M. B. G. Herb. No. 785597;
Hog Island, Tracy 7380, November 26, 1901. M. B. G. Herb. No. 79792;
Hog Island, Tracy 7380, November 26, 1901, M. B. G. Herb. No. 80092;
St. John's River, Curtiss 3401, October, 1878, M. B. G. Herb. No. 79968;
St. John's River, Curtiss 3401, October, 1878. M. B. G. Herb. No. 79609;
St. Mark's, Harper 2, January 1, 1909. M. B. G. Herb. No. 79797;
Without definite locality, but presumably Apalachicola, Chapman, date not given. M. B. G. Herb. No. 80004.

MISSISSIPPI:
Biloxi, Tracy 1414, October 15, 1893. M. B. G. Herb. No. 80010;
Biloxi, Tracy 4353, October 8-9, 1907, U. S. A. H.;
Deer Island, Tracy, October 12, 1898. M. B. G. Herb. No. 79787;

LOUISIANA:
Evergreen, Joor, September 23, 1884, M. B. G. Herb. No. 82682.

3. PODOSEMUM TRICHOPODES (Elliott) n. comb.
Central Texas to Fla. and Va., according to Dewey in Manual of the Plants of Western Texas.
North Carolina to Florida and Texas, Nash in Flora.
North Carolina to Florida and southeastern Texas.

SPECIMENS EXAMINED:

NORTH CAROLINA:
Bladen City, Ashe, October, 1885.
Princeton, Ashe, October, 1888, Ill. Herb.;
Smith's Island, Ashe, date not given;
Wilmington, Chase 4604, October 19, 1907, U. S. A. Herb.;

**SOUTH CAROLINA:**

**GEORGIA:**

**FLORIDA:**
Apalachicola, *Chapman*, date not given. M. B. G. Herb. No. 785518;
Baldwin, *Nash* 2323, September 11, 1889, U. S. A. Herb.;
Jacksonville, *Curtiss* 3402, September, M. B. G. Herb. No. 79806;
Jacksonville, *Curtiss* 3785, September 28, 1896, U. S. A. Herb.;
Without definite locality, *Chapman*, date not given, M. B. G. Herb. No. 79598;
Without definite locality, *Chapman*, date not given. M. B. G. Herb, No. 79599;
Without definite locality, *Chapman*, date not given. M. B. G. Herb. No. 79999;
Without definite locality, *Chapman*, date not given, M. B. G. Herb. No. 80000;

**MISSISSIPPI:**
Biloxi, *Tracy* 3781, September 27, 1897. M. B. G. Herb. No. 80071;
Biloxi, *Tracy* 3842, October 22, 1897. M. B. G. Herb. No. 79708;

**LOUISIANA:**
Without definite locality, collector and date not given.
M. B. G. Herb. No. 79652.

**TEXAS:**
Southern Texas, probably near Houston, *Lindheimer* 1849-51.


Western Texas to Ariz. and Nebr., according to Dewey in Manual of the Plants of Western Texas.
Nebraska to Utah, south to Texas and Ariz., Nash in Illustrated Flora.
Nebraska to Texas, Colorado, Arizona and California.

**SPECIMENS EXAMINED:**

**NEBRASKA:**
Hooker County, Rydberg 1551, July 19, 1913. U. S. A. Herb.;
Loup Fork of the Platte, Haydén, August 6, 1855, M. B. G. Herb. No. 80019;
Spring Branch, Clements 2818, August, 1893. M. B. G. Herb. No. 80016;

NEW MEXICO:
Dona Ana County, Wooton 392, August 26, 1897. M. B. G. Herb. No. 79902;
White Sands, Wooton 392, August 26, 1897. U. S. A. Herb.;
White Sands, Wooten 392, August 26, 1897. U. S. A. Herb.

COLORADO:
San Juan River, Brandegee 1202, M. B. G. Herb. No. 79993;
Without definite locality, Hall and Harbour 632, 1862, M. B. G. Herb. No. 80014;
Without definite locality, Hall and Harbour 632, 1862, M. B. G. Herb. No. 79668.

ARIZONA:
Adaman's, Griffiths 5083, August 6-7, 1903. U. S. A Herb.;
Navajo to Hawthorn, Griffiths 5796, September 13, 1903, M. B. G. Herb. No. 79819;
Navajo to Hawthorn, Griffiths 5796, September 13, 1903, M. B. G. Herb. No. 79820.

UTAH:
Between Kanah and Carmel, Jones 6046, September 13, 1894. M. B. G. Herb.; No. 80120;
Kanah, Jones 6046, September 13, 1894. M. B. G. Herb. No. 80018;
St. George, Palmer 9275, 1875, M. B. G. Herb. No. 79903.

CALIFORNIA:

5. PODOSEMUM GRACILIMMUM (Torrey). n. comb.

Muhlenbergia gracilima Torrey, Pac. R. R. Rept. 4:155. 1856.

Western Texas to Col. and Arizona, according to Dewey in Manual of the Plants of Western Texas.
Kansas to Col. S. to Texas and Ariz., Nash in Illustrated Flora.
Kansas and Oklahoma to Texas, Colorado and Arizona.

**SPECIMENS EXAMINED:**

**KANSAS:**
- Kearney County, *Hitchcock*, August 29, 1897;

**OKLAHOMA:**
- Mountain Park, *Stevens* 1285, June 23, 1913, U. S. A. Herb.;

**TEXAS:**
- Amarillo, *Reverchon* 4111, August 7, 1903;
- Amarillo, *Reverchon* 4111, August 7, 1903, M. B. G. Herb. No. 79885;
- Tascosa, *Reverchon* 2873, June 24, 1902. M. B. G. Herb. No. 79932;
- Tascosa, *Reverchon* 2873, June 24, 1902, M. B. G. Herb. No. 80068;
- Tascosa, *Reverchon* 2873, June 24, 1902. M. B. G. Herb. No. 80069;
  M. B. G. Herb. No. 80029.

**NEW MEXICO:**
- Cimarron Canyon, *Griffiths* 5590, August 21-24, 1903. U. S. A. Herb.;
- Cimarron Canyon, *Griffiths* 5580, August 21-24, 1903. M. B. G. Herb. No. 80104;
- Cimarron Canyon, *Griffiths* 5571, August 21-24, 1903. M. B. G. Herb. No. 80104;
- Cimarron Canyon, *Griffiths* 5571, August 21-24, 1903. M. B. G. Herb. No. 79816;
Gray, Skehan 47, July 26, 1898. M. B. G. Herb. No. 79938;  
Gray, Skehan 69, August 13, 1898. M. B. G. Herb. No. 79939;  
Pecos, Standley 4902, August 15, 1908. M. B. G. Herb. No. 79822;  
Sandia Mountains, Ellis 25, August 12, 1914. M. B. G. Herb. No. 760279;  
Santa Fe, Heller 3702, June 12, 1897. M. B. G. Herb. No. 79737;  
Silver City, Metcalfe 647, September 5, 1903. M. B. G. Herb. No. 79934;  
Without definite locality, Fendler 968, July 3, 1847. M. B. G. Herb. No. 80026;  
Without definite locality, Fendler 968, July 3, 1847. M. B. G. Herb. No. 79672;  
Without definite locality, Fendler 969, 1847. M. B. G. Herb. No. 79669;  
Without definite locality, Fendler 969, 1847. M. B. G. Herb. No. 80027;  

COLORADO:  
Cañon City, Brandegee 579, September 18, 1873, M. B. G. Herb. No. 79930;  
Colorado Springs, Pammel 6011, July 11, 1895. M. B. G. Herb. No. 80035;  
Denver, Hall, 1862. M. B. G. Herb. No. 80123;  
Georgetown, Lemmon 833, August, 1878. M. B. G. Herb. No. 80024;  
Manitou, Clements 26, August 26, 1901, M. B. G. Herb. No. 79936;  
Military Park, Smith, June 14, 1891. M. B. G. Herb. No. 79535;  
Pike's Peak, Chase 5298, August 28 to September 3, 1908. U. S. A. Herb.;  
Sopris, Chase 5405, September 5-8, 1908. U. S. A. Herb.;  
Without definite locality, Crandall, September 11, 1890. M. B. G. Herb. No. 80024;
Without definite locality, *Hall* and *Marbour* 642, 1862.
M. B. G. Herb. No. 79670;
Without definite locality, *Hall* and *Harbour* 642, 1862,
M. B. G. Herb. No. 80031;
No. 80032;
No. 80036.

**ARIZONA:**

Adaman’s to Lone H Ranch, *Griffiths* 5169, August 8, 1903,
M. B. G. Herb. No. 79817;
Empire Ranch, *Thornber* 26, October 9, 1903. M. B. G.
Herb. No. 80129;
Empire Ranch, *Thornber* 26, October 9, 1903;
80023;
Navajo to Hawthorn, *Griffiths* 5804, September 13, 1903,
M. B. G. Herb. No. 79810;
Navajo to Hawthorn, *Griffiths* 5804, September 13, 1903.
M. B. G. Herb. No. 79811;
Navajo to Hawthorn, *Griffiths* 5804, September 13, 1903,
M. B. G. Herb. No. 79812.

6. **PODOSEMUM PORTERI** (Scribner) n. comb.

*Muhlenbergia Porteri* Scribner; *Beal*, N. Am. Gr. 2:259
1896.

*Muhlenbergia Texana* Thurber, ex Coulter, *Man.* Rocky
Mtn. Bot. 416. 1874, not *Muhlenbergia Texana* Buckley,

Western Texas to Ariz., according to Dewey in Manual of the
Plants of Western Texas.

Central Texas to Ariz., Nash in Flora.

Western Texas to California and Mexico.
SPECIMENS EXAMINED:

TEXAS:
Barstow, *Tracy* 8194, October 9, 1902. M. B. G. Herb. No. 79715;
Langtry, *Nealley* 118, October, 1892. M. B. G. Herb. No. 79603;
Langtry, *Nealley* 118, October, 1892. M. B. G. Herb. No. 796319;
Western Texas, *Wright* 734, October, 1849. M. B. G. Herb. No. 79602;
Western Texas, *Wright* 734, October, 1849. M. B. G. Herb. No. 79658;

NEW MEXICO:
Dona Ana County, *Wooton*, October 17, 1903;
Florida Mountains, *Mulford* 85, August 30, 1904. U. S. A. Herb.;
Las Cruces, *Wooton* 67, July 1, 1897. M. B. G. Herb. No. 79712;

COLORADO:
Fremont County, *Brandegee* 3458, 1878. M. B. G. Herb. No. 79713;
Grand Cañon, Collector not given, September 27, 1878; M. B. G. Herb. No. 79608;
Royal Cañon, Clements 282, 1896. M. B. G. Herb. No. 80022;

UTAH:
Diamond Valley, Jones 6102, October 1, 1894. M. B. G. Herb. No. 80119;
Diamond Valley, Jones 6103, 1894. M. B. G. Herb. No. 79604;
Without definite locality, collector and date not given. U. S. A. Herb.;

ARIZONA:
Cienega, collector and date not given. M. B. G. Herb. No. 79609;
El Paso, Hayes, September 5, 1858. M. B. G. Herb. No. 80130;
Fort Whipple, Cones and Palmer 507, September 4, 1865. M. B. G. Herb. No. 79610;
Montezuma Wells, Purpus 68, May—October, 1902. M. B. G. Herb. No. 79714;
Tucson, Pringle, September 6, 1884. M. B. G. Herb. No. 79710;
Tucson, Pringle, September 6, 1884. N. D. Herb.;
Tucson, Pringle, September 6, 1884. M. B. G. Herb. No. 80130;
Without definite locality, Hayes, date not given. M. B. G. Herb. No. 79606;

CALIFORNIA:

MEXICO:
Ciudad Juarez, Palmer 11233, September 26, 1902. M. B. G. Herb. No. 79717;
No State given, Palmer, date not given. M. B. G. Herb. No. 79716;

7. Podoseum Reverchonii (Vasey and Scribner) n. comb.
Western Texas, according to Dewey in the Manual of the Plants of Western Texas.

Northern and Central Texas.

**SPECIMENS EXAMINED:**

**TEXAS:**

Dallas, *Reverchon* 1832, August 30, 1900. M. B. G. Herb. No. 82667;

Dallas, *Reverchon* 1832, August 30, 1900. M. B. G. Herb. No. 79896;

Dallas County, *Reverchon* 1852, August 26, 1900. M. B. G. Herb. No. 79899;

Dallas County, *Reverchon*, date not given. M. B. G. Herb. No. 79750;

Fort Worth, *Reverchon* 3539, October 3, 1902. M. B. G. Herb. No. 79897;

Fort Worth, *Reverchon* 3539, October 3, 1902. M. B. G. Herb. No. 79900;

Fort Worth, *Reverchon* 3539, October 3, 1902. M. B. G. Herb. No. 80127;

Fort Worth, *Reverchon* 3539, October 3, 1902. M. B. G. Herb. No. 80126;

Fort Worth, *Reverchon* 3539, October 3, 1902.

Hood and Tarrant Counties, *Reverchon* 1051, date not given, M. B. G. Herb. No. 82668;

Lampasus, Joor, October 30, 1884, M. B. G. Herb. No. 79596;

Station Creek, *Reverchon*, September 5, 1903. M. B. G. Herb. No. 80125;

Weatherford, Tracy 8237, October 19, 1902. M. B. G. Herb. No. 79898;

Without definite locality, *Lindheimer* 1262, date not given. M. B. G. Herb. No. 79836;

Without definite locality, *Lindheimer* 1262, date not given, M. B. G. Herb. No. 79837;


Without definite locality, *Reverchon* 1051, date not given. M. B. G. Herb. 84124;


6. 2. 1841.

Western Texas to Ariz., according to Dewey in the Manual of the Plants of Western Texas.

Western Texas to Arizona and Mexico.

I have not been able to see many specimens of this species, and it may be that it is only a form of *Muhlenbergia rigida* (Sc. B. K.) Kunth. Rev. Gram. 63. 1829, and if so, this becomes *Podosemum rigidum* H. P. K. Nov. Gen. & Sp. 129. 1816.

**SPECIMENS EXAMINED:**

**NEW MEXICO:**


**ARIZONA:**

Rozemont, *Thornber* 65, October 10, 1903;


**MEXICO:**


Western Texas to Ariz., according to Dewey in the Manual of the Plants of Western Texas.

Western Texas, Arizona and New Mexico.

**SPECIMENS EXAMINED:**

**TEXAS:**


**ARIZONA:**

Mustang Mountains, *Pringle*, September 12, 1884. N. D. Herb.;
SOMIJ

MONTHENBERGIA or GODSMUM.

10. PODOSEUM TEXANUM (Buckley) n. comb.


Muhlenbergia Buckleyana Scribner, ex Coulter, Contr. U. S. Nat. Herb. No. 156. 1890, a new name thought to be necessary, on account of M. Texana Thurber, but Buckley’s name is the older and has priority over Thurber’s. Dr. Gray and other botanists referred Buckley’s species to Sporobolus confusus, but this last belongs to the genus Sporobolus, and is distinct from Buckley’s M. Texana.

Western Texas to Mexico, according to Dewey in Manual of the Plants of Western Texas.

I have not been able to see any specimens of this species, and Hitchcock writes me that Wright’s No. 736 is the only specimen in the U. S. National Herbarium from the United States.

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**Mondo, Adans.**

BY OLIVER ATKINS FARWELL.

Amongst the many genera that are listed as synonyms of Carex is Mondo, Adans. II 496, 1763. Turning to Adanson, we find that Mondo is based upon Kaempfer, Amoen. Exot. t. 824 and is described as with flowers having 6 perianth segments! Turning now to Kaempfer, we find that Mondo, pp. 823 & 825, plate page 824, is Ophiopogon Japonicus, Ker.—Gawl. and the plate is a very excellent illustration of the species. Since Ker.-Gawler, Thunberg, Kunth, and others quote, Mondo, Kaemp., as a synonym under this species, it seems rather incomprehensible that Mondo (Kaemp.) Adanson is so universally referred as a synonym to Carex. Ophiopogon was established in 1807, as Mondo antedates Ophiopogon by 44 years and since the latter is not a “nomen conservanda” it must be displaced by the earlier name. The known species of Ophiopogon will be known as follows, under Mondo (Kaempf.) Adans.

I *M. Japonicum* (Linn. f.) (Convallaria Japonica, Linn. f., Suppl. 204, 1781).

a var majus (Thunb.) (Convallaria Japonica, var. major. Thunb. Fl. Jap. 139, 1784; *Slateria* Jaburan, Sieb. in Act. Batav. XII, 15, 1830).


f var. *micranthus* (Hk. f.) (*o. micranthus*, Hk. f., l. c.).


II *M. dracaenoides* (Baker) (Fl. dracaenoides, Baker, l. c.).

a var. *Clarkei* (Hk. f.) (*o. Clarkei*, Hk. f. l. c. 268).

b var. *reptans* (Hk. f.) (*O. reptans*, Hk. f. l. c.)


VIII *M. Stolonifer* (Leve. & Vani.) (*O. stolonifer*, Leveille & Vaniot, Liliaceae, etc. Chine, 16, 1905.)

IX *M. Bodonieri* (Leve. & Vani.) (*O. Pocinieri*, Leve. & Vani, I. c. 15)
XII M. Cavaleriei, (Leve. & Vani.) (O. Cavaleriei, Leve. & Vani. l. c. VI 266, 1909).

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DEPARTMENT OF BOTANY
PARKE, DAVIS & COMPANY
DETROIT, MICHIGAN.

A Survey of the Naturalistic Periodical Literature of America.

BY HOWARD CLARK BROWN.

That America has a very definite class of naturalistic periodical literature is very certain. And, that that class of literature is badly in need of reform, the following survey will make clear. The periodical literature of America which has dealt with Nature-study, or with Nature, has been quite extensive but there has been little co-operation between the great naturalists and these periodicals. Perhaps this may be accounted for in the fact that most of these periodicals have a very limited circulation, many are extremely local in their subscription list and content, and they can not afford to pay the naturalists of note for their material. It seems strange to me that these periodicals have not as a whole even attempted to draw upon the store of English poetry for their bits of verse. Most of those which include verse include some little offering from a local person of little merit and well deserved lack of fame.

Alexander Wilson, the Scotch naturalist, was the first American whose name can be related in any extensive way to our ornithology. Crevecoeur, before 1775 had established a definite interest for himself in the woods and fields of the new country. But Crevecoeur did not pretend to make his observations his sole occupation. Wilson
devoted his entire time to the pursuits of his naturalistic tendencies. But like many another naturalist, his retiring disposition, his quiet, inexpressive nature won him a very small audience among the common people. His death in 1813 was recognized by the scientific world, but hardly outside of that. Audubon, with his Spanish ancestry and his French communicativeness, was among the common people throughout his life. He knew and loved them. At his death in 1851 there was much interest aroused in the science of ornithology. Then came the really great things. Darwin's publication of the "Origin of Species," and the work in this country of Louis Agassiz fanned scientific interest into a sturdy flame. This started scientific publication in America. And if we are to understand the nature-study movement and literature, we must recognize this background and forerunner in the scientific journals. In 1867, the "American Naturalist" was issued by "The Science Press" in Salem, Massachusetts. In 1883, "Science" was begun. In 1891, "Nature" put forth its first volume. And from that time on there has been many a scientific periodical launched, carried through for a time and then recalled because its funds would not run it. But these three big periodicals have continued through an unbroken career. The content of these is more or less general, dealing with various phases of biology, and of the physical sciences. But these magazines are for the elected scientist, and not for the naturalist. What then came from the work of Audubon? If Darwin and Agassiz developed science, when and where did nature-study begin? The first naturalistic periodical of this country, which I located in point of time, was the "Oologist."

In 1875, the "Oologist," or "Ornithologist and Oologist" was published by F. B. Webster Co., in Hyde Park, Mass. It is distinctly of interest to note that this magazine contained such subject matter as that which would relate to collecting. It was a collectors' magazine. That is where nature-study began. Before most of our great naturalists became interested in the study of the out-of-doors, they were interested in collecting. And this development of the individual is reflected in the progress of interest in the American people, the American mind, as it were.

In 1884, at Gaines, New York, the first volume of another oological periodical was commenced. The "Young Oologist" stated in its first volume that it was "for the Student of Birds, their nests and eggs." Here was a periodical which was distinctly naturalistic as
contracted with the more scientific "Oöologist" of nine years before, or the trend of scientific literature with which we began. There is an announcement in the first issue of the magazine, as follows: "The Publisher of the Young Oöologist in order to obtain a large circulation for his little journal, offers the following inducements which he believes have never been equalled by any publisher". And then the offer is given. For fifty cents one will receive the year's subscription to the "little journal" and any one of five articles which are listed. These articles are two abalone shells, an egg of a Yucatan Jay, an egg of a Curphorice, an egg of an oriole, and a fossil fern from Mazon Creek. The diversity of these subjects for a magazine in Ornithology was rather amusing to me. The extent of the fame of Mazon Creek at that early period in our biologic history, was also interesting. I think that this "never equaled" offer is rather Barnumesque. And it may well have been so, for that was the time of the triumphs of the "Big Show Man." He had been exhibiting "The old nurse of George Washington" only a few years previously and now he had advanced to Jumbo.

The quick and eager response which such a magazine brought at that time is to be seen in looking over the "Inquires and Answers" for the first volume. There are contributions from Grinnell, Iowa; Clinton, Wisconsin; New York City; Auburn, Maine; Red Bank, N. J., Trumansburg, N. Y., Philadelphia, Huron, Dak., and Thayer, Kans. I think it rather striking that so many and such distant communities should thus be brought into the common interest which the magazine awakened. Rather, I suppose one should consider that the interest had already been aroused, and that people all over the country were waiting for something which would give expression and stimulation to this interest. Of course there is no attempt at adaptation of literary material in this early publication. There is no poem, no reference to any of the great nature writers. At this time, however, there was little to have referred to. Something of the character of this pioneer can be seen in the "Editorial Melange." It includes such notes as a whip-poor-will's egg having been found by a certain person of Flint, Mich. Another person of Hyde Park, Ill., had shot three evening grosbeaks during the past winter. Then there were records of when nests of certain birds were found, and comparisons of the date of finding with that of the previous year. This smacks of the method of Thoreau's journal. Perchance his contribution in "Summer" and the other season books
had its influence here. And then there comes an interesting little note which I think is as true an index to the character of the nature periodical and the attitude of the people toward the naturalist, as can be found. The note is in the first volume of the "Young Oölogist" and reads: "Mr. G. G. Pendall, of Edniboro, Penn., writes us that he has a very curious specimen in the geological line. It bears a striking resemblance to a miniature human skull. The eyes, mouth and nose were formed by the action of water." There are many persons still who are interested in only this resemblance phase of nature-study. It is a good beginning if you do not stop, but it does seem a peculiar thing for a periodical on birds eggs to suddenly include such a note. It shows the nonscientific method of the periodical, and at the same time, the tendency toward interest in all nature, the tendancy which produces naturalists rather than scientists. Darwin's observations produced scientists. This sort of random splattering, uncentered interest, humanized sympathy with nature, produced such men as Muir.

In the same year that the "Young Oölogist" appeared, the first volume of "The Auk" was published in Cambridge, Mass. It was a quarterly and was issued by the "American Ornithologists Union," as a "Journal of Ornithology." It was a period of initial stages of societies. The Agassiz Society had been formed in 1875, just two years after the scientist's death, and in 1895, the Audubon Society was organized. This is of interest, because the scientist was ready at once to take up the work of Agassiz, the master. But the naturalist with the poetic dreaminess of his nature had to have a long time in which to dream of what had really been accomplished by his instructor, Audubon. And not until forty-four years had passed was he ready to launch into his work. This is quite truly indicative of the progress of the naturalistic periodical. It seldom proceeds evenly, uninterruptedly, but follows the fancy of its directors, and often dreams.

There is little comment needed on the "Auk." It is a scientific magazine, but devoted entirely to Ornithology. That is, it has the scientific tendency. It is popular only to the ornithologist, but it would not be considered at all in the strictly scientific class. Of course it contains no literary material at all.

Then a strange thing happens in the progress of the naturalistic periodical. All of these publications have been in the East where one would expect them to develop. The Puritan aversion to the pursuit
of nature-study as such, had been hard to break. But such men as Audubon had great influence, and there were minds which did allow nature-study. Also, some had known Thoreau. It seemed incredible that one of these lovers of nature should develop right in the very midst of the Puritan influence, but such happened, and the community has not yet entirely quieted down from the shock. In Oberlin, Ohio, the “Wilson Bulletin” published its first number in 1895. This is the first publication which had strayed from the Eastern atmosphere which I was able to discover. Were it a scientific publication, one would seek for some definite explanation. But since it tends toward the naturalistic side, we will dismiss it as one other eccentricity of a nature-lover. It is a bird journal and is the official organ of the “Wilson Ornithological Club.”

There are never any poetic contributions to it, and never any great literature, but some of the contributions have literary merit, and on the whole, the magazine has a distinct appeal. The photographs with which it is sometimes illustrated add decidedly to the content value. The magazine is non-technical, and of very great value to the naturalist. It is somewhat local, dealing mostly with the middle western ornithology, but it is a very splendid contribution from Ohio, and especially from its worthy editor, Dr. Lynds Jones.

At about the same time that the “Wilson Bulletin” made its first appearance, another ornithological magazine was started in the far west. “The Osprey,” a monthly was published in the state of Washington, but its life was very short. The last issue of it appeared in June 1902. It is only another bit in our naturalistic periodical history, and would hardly be significant were it not for its sudden appearance in the disjunct region of the western coast. It is the pioneer of the western periodicals.

In 1897 there also appeared the first issue of “Birds and Nature.” This is the outstanding magazine of purely naturalistic character of all our periodical literature. It was destined to play the most important part and to wield the greatest influence of any of the magazines which were devoted to the interests and loves of the naturalist. In the first issue of “Birds and Nature” there is much to consider which is of interest in our evolutionary study. The magazine was published by A. W. Mumford and Co., at Chicago. This publishing company is significant, for the naturalist will at once remember it as the one which published the splendid Mumford
bird plates. They are the plates which John Burroughs hailed with such ardent enthusiasm and which he considered sufficiently good to be of use in papering the interior of his study. The place of publication is certainly of interest, also. It shows that the west was waking up and that the interest was shifting from the conservative East where Science was proper but Nature-Study as such hardly yet heard of, to the Mid-West where the interest in the out-of-doors was fresh, eager, enthusiastic.

The first volume of "Birds," for that is the title under which it first came out, informs us as follows, on the title page: "Birds. Illustrated by Color Photography. A Monthly Serial. Designed to Promote a Knowledge of Bird Life." Then there follows a verse of a few lines and the publisher's name which then was the Nature Study Publishing Company, Chicago, 1896.

The Preface in volume one quotes a suggestion from the "Ladies Home Journal, as follows "An excellent suggestion was recently made by the Dept. of Agriculture at Washington that the public schools of the country shall have a new holiday to be known as Bird Day." This was a new thing at that time. It continues to say, "Of all animated nature, birds are the most beautiful in coloring, most graceful in form and action, swiftest in motion and most perfect emblem of freedom." But the beauty would not alone justify their study. "They are withal, very intelligent and have many remarkable traits, so that their habits and characteristics made a delightful study for all lovers of nature. "Then the statement is made that the work done by this publication is useful "for the young." It was the period when the "elders" did not participate in such enjoyments as watching a bird. That would have been too elementary, and not sufficiently sophisticated for any but children. It was a "pretty and harmless employment of time for the children."

"The Text is prepared with view of giving the children as clear an idea as possible, of haunts, habits, characteristics and such other information as will lead them to love the birds and delight in their study and acquaintance."

Notwithstanding the desire to acquaint the readers with birds, it seems to me that the publishers went rather far afield in the first volume. Out of the ten birds described and figured in the first number of volume one, eight of them are not North American birds, and one of the two which is a native bird has a habitat of very restricted area, being found only in some of the Southern states.
The stories or life histories of the birds are all in a child's language and do not have the enthusiasm and eagerness which one would expect in such an enterprising periodical. The reference to "Mr. Nuttall" which is made, is characteristic of the nice and very restrained manner of expression. But the pictures did much for the periodical, and it became very popular. In the first volume are some poetry selections, but they are all unsigned. In the second and third volumes the outstanding poems selected are from Alice Cary, Lowell, Scott, in "Birds of Killingworth," and, a bit later, J. T. Trowbridge, and Bryant, with his "To a Water Fowl."

There is a naiveté comment in volume three which is worth pausing on. "Some subscribers wonder whether the supply of specimens may not soon be exhausted. Of North American alone there are more than twelve hundred birds." Nature at that period of our interests and history was looked upon as something which was very great, very detailed, very difficult to understand. Man could never fully grasp it all, but he might delve into a little corner of it and secure a little knowledge about it. In 1898 under the title of "Birds and All Nature," a few animals and other out-of-door habitants were introduced. The magazine was doing precisely what the naturalist clubs all over the country were doing. They were broadening their scope and widening their influences. They felt a need to study nature as a whole rather than to look for their study at birds alone. The July number, 1898 makes the statement that each number will present at least two birds, four animals, and an extra in the way of a bat, flower, insect, or geological interest. Here too, the statement is made that "Birds" is one of the most popular magazines ever presented to the American public. It is read and admired by over 100,000." And at that time it was only one and a half years of age. I think that record is decidedly worth pausing over. It certainly shows how eager people were at that time for just such a popular presentation of nature as this magazine gave. With all of its faults, its childish language, its rambling nature, still it was the greatest magazine of its time, and of many years to come, if not at the present time. And the influences which had stirred people's enthusiasms for nature was to be found in such men as Thoreau, John Burroughs, John Muir, and the pioneers, Wilson and Audubon. The following is a list of contents for the new series which began with 1906.
Vol. 4, No. 11—7 poems (none well known); 12 sketches of birds (childish prattle); 6 colored illustrations of birds.

Vol. 4, No. 2.—6 poems; 8 sketches; 7 colored photographs.

Vol. 4, No. 3.—6 poems; 8 sketches; 7 colored photographs.

Vol. 4, No. 4.—9 Poems, 2 birds; 7 sketches, 3 mammals; 8 colored illustratations, 2 plants.

Vol. 4, No. 5. One page of gems from many poets, giving their expression for and appreciation of nature. These quotations included Emerson, Bryant, Chaucer, Milton, Leigh Hunt, Wordsworth, Shakespear, Coleridge, Byron and Lowell. This is the first attempt which I found in the nature-periodicals of this country to bring together any such illustrations of the poet's attitude toward the out-of-doors. And for the small space which was taken up with this, I think that it is quite representative and that it marks a time of distinct progress. Besides these "gems," were four other poems by unknown authors, eight bird, animal, insect and plant sketches, and eight colored plates.

Volume five of the new series, included T. B. Aldrich's, "A Snow Flake," Longfellow's, "Birds of Passage" and Whittier's, "The Lumberman." The next volume contained Emerson's "The Titmouse," and what I think is of far greater importance, Edwin Markham's, "The Brothers of the Ground." This is an indication of an attempt at least, to bring the magazine up to date by using the contemporary writers of our country. The fact that the same volume uses a poem from Tennyson is merely indicative of the holding over of the old English dominance which was so long a detriment to our literature. In the later numbers, the character of the articles or sketches has changed somewhat. Neltje Blanchan who has a delightful style, and who combines the literary, aesthetic and scientific in bird study in quite the nicety of proportion which moderns can best enjoy, has some of her work published in the new series. Dr. Lynds Jones, editor of the "Wilson Bulletin" also has been represented in the later pages of the magazine. Here then was a conservative, nature-study magazine which was launched at a time when such things were hardly known, which was maintained because of the merit of its plates rather than its material as literature, but which is now attempting to become more viril, more closely adapted to the life and times of its own existence.

"Bird-lore," a bi-monthly, was first published in 1898, as the official organ of the Audubon Societies, in Harrisburg, Pa., and New
York City. I suppose that there is no doubt as to its being the most popular bird magazine of to-day. It is illustrated with many photographs and with one colored bird plate per number. Louis Agassiz Fuertes as bird artist has done more to make birds live on canvass than any other painter of birds since the time of Audubon and the Audubon society has long had the efforts of this man enlisted in their cause. Save for the articles contributed by the editor, Dr. Frank Chapman, there is little in the magazine which is really literary. An occasional poem may make such a claim, but the magazine does not often make use of poetry. A review of the contents of the March-April number, 1920, which included pages 77-138 in the volume of which it was a part, is as follows:

Membership list.
Editorial Part.
School Department. "Records of bird work in schools."
Book News and Reviews.
The Season (Bird reports of the previous month).
Notes from Field and Study. (More General Observations)
Articles—Among which was, "Bird Watcher in France."
One colored plate; 18 photographs; 6 black and white drawings or charts.

The contribution from France was especially interesting to me as it is an illustration of how the naturalist is trying to bring his material up to date so that it shall not fail in interesting the public.

"The Condor," a "Magazine of Western Ornithology," was first published in 1899, in Hollywood, California. It is a bi-monthly, and is published by the "Cooper Ornithological Club of California. It is only another of those magazines which is of interest to the ornithologist, but which has no claim to literature, nor indeed to the general naturalistic tendency of the times. Here then, our record of bird magazines pauses, a botanic contribution is introduced, then the interest swings back to general nature study, in 1905.

In 1897, "The Plant World," a monthly journal of popular botany was first published in Washington D. C. Since 1902 this has been the official organ of the Wild Flower Preservation Society of America. We should hardly need mention the publication here save as it records the primitive efforts of botany to gain popular recognition, just as ornithology had some years before. Of nine publications which were launched from 1875 to 1901, seven are preeminent ornithological magazines. Two are strictly botanical. This then is the first of these, and it was quite alone in its fields until 1901 when the American Botanist was issued in New York.
Dr. Asa Grey's work, which was the first preeminently botanical approach in America gave a fresh and added impulse to the sort of study which many earlier naturalists had started. This was the time when the sciences were giving rise to many branches heretofore never separated from biology. Ornithology was the first of these to develop as a separate study. Botany came next, but not until quite a bit later. Botanical literature of a popular nature records this break from biology in the very last years of the nineteenth century. The next study was entomology, but of that there is, so far as I know, no popular literature, as yet, because it is so young, and certainly there is none in this country which has literary value. Fabre did for the insects, in France, what Burroughs has done, in a way, for birds, in our country.

1900 was the time of the organization of many movements but one of the most interesting of these was the tendency which arose for the formation of naturalist organizations. The Wild Flower Preservation Society of America is one of the earliest which devoted itself to plants. From 1900 on there have been hundreds of such societies, many of them of strictly local nature which have sprung up within our country. And it is to these societies and their work that the periodical naturalistic literature is indebted for its support. Any change in attitude of these organizations is reflected in their literature. The change was first economic and everything in the out-of-doors was translated into money value. Now I think that we are less commercial in our dealings with nature, but we are not entirely back to the old aesthetic appreciation. We are trying to strike a median between the two. And of this sort of median literature I shall next speak. The "American Botanist," a monthly, claimed in its first number which was published by W. N. Clute and Co., in 1901 to be "Devoted to economic and ecological botany." Mr. Clute is still the editor of this publication, and has maintained for it, throughout its period of nineteen years, a steady, even, well trained influence. It is not scientific in the sense that it abounds in technical terms or explores scientific problems to their very depths. Neither is it popular to the extent of lacking precise, definite information. It seems to me to have struck the between note which we would wish might be struck by more periodicals. There is an increasing demand for just such leisurely excursions into such fields as this magazine suggests. The nature-study clubs have bred up a large number of individuals who enjoy an excursion
into nature. Mr. Clute has contributed many articles of his own to this magazine, and as a whole I think that it has more literary merit than almost any other periodical yet discussed. It is the Burroughs type of literature, and it lacks the virility of the open air which we enjoy seeing caught within a magazine's pages, yet it is conversational, easy, delightful. It is a tramp without sentimentality, and it has some of the folk-lore ease and grace about it in its dealings with plants. The meaning of their names, the legends about them etc., all belong within the scope of this publication. Let us examine the contents of the first volume. It has no poetry. The articles in it include the following titles: "Some Abnormal flowers," "The Grape Fruit," "Lilies," "Mullein and Poke," "The Indian Pipe," "Waning Year in the South," "Devastation of Nature," "The Opening of a Flower," "Double Flowers," "How the Nasturtium is Pollinated," comes in volume five as a distinct surprise because of its purely scientific character. If we examine these titles we find much of interest in evolutionary values. For instance, the first, discussing abnormal flowers, belongs with the curio stage, the first or initial evidence of interest in things, natural. The next, on the grape fruit represents the interest in foreign fruit and flowers. It corresponds with the interest which led "Birds and Nature" to include so many foreign birds in their first numbers. The Indian pipe article, and "Waning Year in the South," are distinctly Burroughsesque. They are quite the same as a Charles Abbott excursion.

Now let us turn to a recent number. It is published at present in Joliet, Ill., and the February, 1920 number lists the contents as follows:

1. 10 articles of about a page each, on various aspects and interests in plants; 1 article of eight pages on "Plant Names and Their Meanings," by Mr. Clute. Continued from former nos.
2. 1 comment of brief nature; 1 verse from Bryant (Heading the publication as 1st article); Odd and rare plant occurrences. Color variation in flowers; Conservation note in "Perpetuating our Native Flora."
3. Note and Comment (six articles).
4. Editorial (Six short ones).

By 1905 Nature Study had won its way into many schools in some form or other. And in that year M. A. Bigelow began the publication in Geneva N.Y. and N. Y. City, of the "Nature Study Review." This was a magazine devoted "to Nature Study in
Schools." It is the official organ of the American-Nature-Study Society. It is excellent for teachers of Nature Study, and for the parent who wishes to help his children in something which need guidance. It was published as a bi-monthly at first, but has since gone over into monthly publication, save for the three school-less summer months. The first volume contained articles upon the aims and methods of teaching Nature-Study, news notes and notes on recent articles. All of the material was concise, brief, and of course non-literary. There were also a few book reviews included in the early numbers. The first volume contained an article by Dr. J. M. Coulter, Liberty Bailey, of Cornell, C. F. Hodge, then of Clark University, and M. A. Bigelow. This recognition by scientific men of the values of such a society as this, is worth noting. But the magazine has changed its character. Under the leadership of its present editor, Mrs. Anna B. Comstock, it has become more nearly suited to the children's needs. It includes animal outlines to be colored, delightful little articles upon habits of birds, animals, essays of interest upon plants, appreciations of Thoreau, Burroughs, Audubon, Agassiz, and others. It includes bits of poetry, seldom chosen from the great poets, but verse which has rhythmic and imageryc value. Throughout the pages is a contagious enthusiasm which counts for more than any other factor in any such publication.

(CONCLUSION NEXT ISSUE.)

Plants of Fargo, North Dakota, With Dates of Flowering.—I.*

O. A. STEVENS.

This paper is similar to one published in this journal (vol. 5) dealing with those of Blue Rapids and Manhattan, Kansas. Compared with that list, the present one has the advantage of a longer and more recent (yet scarcely intensive) period of study (1910 to 1920 inclusive). It deals, also, with a more restricted and less varied area. The same system of indicating the date of first flowering is used, i. e., of dividing the month into 5-day periods, adding in parenthesis the exact average date where records of three or more years are available and in reasonable agreement.

* Contribution from Dept. Botany, North Dakota Agricultural College and Experiment Station.
The area considered is roughly that of 4 or 5 miles radius about the City of Fargo, one-half of it thus being in Minnesota adjacent to the City of Moorhead. The general topography may be described very briefly. The bed of glacial Lake Agassiz, which is said to be perhaps the most nearly level large area of land in the world, is, at this point, about 40 miles in width, extending 15 miles to the east and 25 to the west. The soil is a black, fine-grained, heavy loam, poorly drained and frequently with slightly, lower areas too wet for regular cultivation.

A belt of timber covers the banks of the Red River of the North. Commonly this is but a few rods in width, but frequent bends result in somewhat larger areas. White elm, green ash, and box elder predominate, with basswood on some of the lower portions and burr oak on the higher. An occasional bit of aspen, cut off as it were from the Minnesota forest some 50 miles eastward furnishes various species not elsewhere found. One such area several miles in length on the east side of the river about 3 miles north, adds a number of plants to this list.

Excepting for some of the lower portions above mentioned, the land is nearly all under cultivation and of the original prairie only scattered fragments and the roadsides remain. Frequency in such habitat will therefore be understood as applying to such portions of prairie as are yet to be found. In the gravel used for ballast on the railroad tracks a number of plants common to the higher prairies have become established to various degrees.

In preparing this list the writer has made use of one compiled several years ago by Mr. C. H. Waldron to whom credit is due for various contributions. The notes on distribution and abundance are based upon personal observations, species upon which such are not available remaining on authority of the collector as shown in the herbarium of the North Dakota Agricultural College. Early in 1920 the writer examined the herbarium carefully for Fargo specimens and found that some sixty species were not represented. The greater part of these were secured during the season and the remainder will be secured the coming season if possible.

The nomenclature and arrangement of Bergman’s Flora of North Dakota (Sixth Bienn. dept., Agric. Coll. Survey) have been followed although not always in accord with the writer’s ideas or latest usage. With regard to common names, some attempt has been made to supply suitable ones where they seemed lacking and
such as the writer is more or less responsible for in this or earlier publications are indicated by an asterisk (*). As he has previously stated (Science, N. S. 45:502), he considers that common names are of necessity more or less local, and that different plants may bear the same name in separated regions. Qualifying adjectives may not be needed where related species are absent.

**Ranunculaceae.** Butter-cup Family.

*Actaea rubra* (Ait.) Willd. **Baneberry.**
Woods. Frequent. May 25. The white and red fruited forms are not regarded as different species.

*Aquilegia canadensis* L. **Columbine.**

*Delphinium penardii* Huth. **Prairie Larkspur.**

*Anemone cylindrica* A. Gray. **Cotton Weed.**

*Anemone virginiana* L. **Tall Anemone.**

*Anemone canadensis* L. **Canada Anemone.**

*Anemone quinquefolia* L. **Wood Anemone.**
Aspen woods on the Minnesota side. May 10 (9).

*Pulsatilla hirsutissima* (Pursh) Britton. **Pasque Flower.**
Reported to have been found, but not seen in recent years and no specimen in the herbarium. Apr. 15. Commonly called "Crocus."

*Clematis virginiana* L. **Virgin’s Bower.**
Woods and thickets. Frequent. Aug. 5.

*Ranunculus delphinifolius* Torr. **Yellow Water Crowfoot.**
In water. Occasional. May 25.

*Ranunculus ovalis* Raf. **Prairie Buttercup.**

*Ranunculus abortivus* L. **Kidney-Leaved Buttercup.**
Woods. Common. May 10 (8); excluding an extremely early date—Apr. 10, 1910.

*Ranunculus sceleratus* L. **Ditch Buttercup.**
Margins of ponds, etc. Common. May 30 (31).

*Ranunculus acris* L. **Tall Buttercup.**
An introduced weed collected in 1892 and 1910, but apparently has not become established.
Ranunculus pennsylvanicus L. f.  
Br!stly buttercup.  
Sloughs. Frequent. Apparently no record of flowering but it is late, perhaps first of Aug.  
Tilia americana L.  

**Malvaceae.** Mallow Family.  
Malva rotundifolia L.  
Near railway tracks (Stevens in 1915.)  
Malva borealis Wallm.  
*Northern mallow.  
Yards, roadsides, etc. Common. June 25 (26).  
Malva sylvestris L.  
Various places. Occasional.  
Hibiscus trionum L.  
Gardens. Occasional.  

**Hypericaceae.** St. John's-wort Family.  
Hypericum perforatum L.  
Common St. John's-wort.  
Collected by C. H. Waldron in 1911.  

**Elatinaceae.** Water-wort Family.  
Elatine triandra Schk.  
Mud in dried up ponds. Occasional.  

**Violaceae.** Violet Family.  
Viola papilionacea Pursh.  
Common blue violet.  
Viola sororia Willd.  
Hairy blue violet.  
Dry open woods and thickets. Frequent.  
Viola pedatifida G. Don.  
Viola pubescens Ait.  
Yellow violet.  
Viola rugulosa Greene.  
Canada violet.  
Viola conspersa Reich.  
Wet places in aspen woods on Minnesota side. May 5.  

**Oxalidaceae.** Wood Sorrel Family.  
Oxalis violacea L.  
Violet wood sorrel.  
Oxalis stricta L.  
YELLOW WOOD SORREL.

Oxalis cymosa Small.  *SMOOTH YELLOW SORREL.
Oxalis cymosa Small.
Fields or along ditches and thickets. I have no careful records to show whether or not this flowers at the same time as the preceding, but believe there is little if any difference.

Linaceae. Flax Family.

Linum usitatissimum L.  COMMON FLAX.

Linum lewisii Pursh.  PERENNIAL FLAX.
Collected by C. B. Waldron in 1890.

Linum sulcatum Riddell.  *SMALL-FLOWERED YELLOW FLAX.
Prairie. Common.

Linum rigidum Pursh.  *LARGE-FLOWERED YELLOW FLAX.
Collected by Lee in 1891. June 15.

Geraniaceae. Geranium Family.

Geranium maculatum L.  WILD CRANE'S BILL.

Geranium carolinianum L.
Roadsides, especially by the aspen woods.

Geranium pusillum L.  SMALL CRANESHILL
Lawns, introduced with white clover. Occasional.

Erodium cicutarium (L.) L’Her.  ALFILARIA
Collected by C. H. Waldron in 1910.


Impatiens pallida Nutt.  PALE TOUCH-ME-NOT
Woods. Occasional.

Rutaceae. Rue Family.

Xanthoxylum americanum Mill.  PRICKLY ASH

Euphorbiaceae. Spurge Family.

Euphorbia glyptosperma Engelm.

Euphorbia serpyllifolia Pers.  T YME-LEAVED SPURGE.
Euphorbia maculata L.

Euphorbia esula L.


Callitrichaceae. Water-star-wort Family.

Callitrichaceae palustris L.
Collected by Wright L in 1891.

Caryophyllaceae. Pink Family.

Agrostemma githago L.

Silene antirrhina L.

Silene noctiflora L.

Vaccaria vaccaria (L.) Britton.

Alsine media L.
Shaded dooryards and woods. Common.

Alsine-longifolia (Muhl.) Britton.
Woods. Frequent.

Alsine longipes (Goldie) Coville.
Collected by Bolley in 1891.

Cerastium vulgatum L.
Lawns. Occasional.

Cerastium arvense L.
Prairie and in gravel along railroad. Frequent. May 15 (14).

Moehringia lateriflora (L.) Fenzl.
Woods and thickets. Frequent. Occasional along railroad May 25 (23).

Spergula arvensis L.
Lee in 1892, L. B. Waldron in 1903.

Portulacaceae. Purslane Family.

Portulaca oleracea L.
Aizoaceae. Carpet Weed Family.

Mollugo verticillata L.  
CARPET WEED.
A single plant collected along the railroad by myself in 1910 but the specimen seems to have been lost.

Chenopodiaceae. Goosefoot Family.

Chenopodium album L.  
LAMBSQUARTERS.
Fields, roadsides etc. Common. June 20 (22).

Chenopodium leptophyllum (Moq.) Nutt.  
NARROW-LEAVED GOOSEFOOT.

Occasional along railroad.

Chenopodium boscianum Moq.
Woods. Frequent.

Chenopodium hybridum L.  
MAPLE-LEAVED GOOSEFOOT.
Woods, thickets, or about buildings. Frequent.

Chenopodium glaucum L.  
PALE GOOSEFOOT.
Low, alkaline spots. Frequent. Aug. 15.

Chenopodium rubrum L.  
RED GOOSEFOOT.
Weedy sloughs or waste places. Frequent. Aug. 25.

Chenopodium botrys. L.  
JERUSALEM OAK.
Along railroad (C. H. Waldron in 1910); also seen by myself in 1918.

Cycloloma atriplicifolium (Spreng.) Coult.  
TUMBLEWEED.
C. H. Waldron, also H. F. Bergman in 1910.

Monolepis nutalliana (R. & S.) Greene.

Atriplex hastata L.  
*SALT BUSH.
Roadsides, fields, etc. in low alkaline places. Common. Aug. 10.

Axyris amaranthoides L.  
RUSSIAN PIGWEED.
Along railroad, Stevens in 1912.

Kochia scoparia Schrad.  
BURNING BUSH.
Frequently escaped along streets.

Corispermum villosum Rydb.  
Hairy Bugseed.
Along railroad, Stevens in 1910.

Dondia depressa (Pursh) Britton.  
SEA BLITE.
Low alkaline places. Occasional.

Salsola kali L.  
RUSSIAN THISTLE.
Railroad embankments, roadsides, near buildings, or other places where the soil is loose and dry. Common.
Amaranthaceae. Pigweed Family.

*Amaranthus retroflexus* L.  
ROUGH PIGWEED.  

*Amaranthus blitoides* S. Wats.  
CREeping PIGWEED.  

*Amaranthus graecizans* L.  
*Tumbling Pigweed.*  
Roadsides and waste places. Frequent.

*Acanthospermum hispidum* Moq.  
Low fields and ditches. Occasional Aug. 5.

Allioniaceae. Four o'clock Family.

*Allionia myctagnea* Michx.  
WILD FOUR O’CLOCK.  

*Allionia hirsuta* Pursh.  
Hairy Four o’clock.  
Along railroad. Frequent.

Salicaceae. Willow Family.

*Salix amygdaloides* Anders.  
Peach-leaved Willow.  

*Salix interior* Rowlee.  
SAND-BAR WILLLOW.  
River bank and low ground in various places. Common. May 25 (23).

*Salix petiolaris* Smith.  
Low roadsides and swampy places. Occasional.

*Salix cordata* Muhl.  
River bank and other low places. Frequent. Apr. 30 (27).

*Salix discolor* Muhl.  
Low places. Occasional. Apr. 25 (23).

*Salix bebbiana* Sarg.  
Low places. Occasional.

*Populus balsamifera* L.  
Balsam Poplar.  
May occur with *tremuloides* but I was unable to verify it the past season. May 5.

*Populus deltoides* Marsh.  
COTTONWOOD.  
Rare except as planted. Apr. 25 (25).

*Populus tremuloides* Michx.  
ASPEN.  
Occasional small patches on this side of river. A strip on Minnesota side extends for several miles northward. Apr. 20 (21), excluding an extremely early date—Mar. 27, 1910.
Urticaceae. Nettle Family.

_Urtica gracilis_ Ait.

_Urticastrum divaricatum_ (L.) Kuntze.

_Pilea pumila_ (L.) A. Gray.
River bank. Occasional.

Cannabinaceae. Hemp Family.

_Humulus lupulus_ L.

_Cannabis sativa_ L.
Occasionally escaped along roadside.

Ulmaceae. Elm Family.

_Ulmus americana_ L.

_Ulmus fulva_ Michx.
Said to occur at least on the Minnesota side but I have been unable to verify it.

_Celtis occidentalis_ L.
Woods. Frequent.

Polygonaceae. Buckwheat Family.

_Rumex acetosella_ L.
Roadsides. Occasional. June 5. We have been using this common name which seems more appropriate than the usual Field or Sheep Sorrel (the latter so commonly applied to _Oxalis violacea_).

_Rumex mexicanus_ Meisn.

_Rumex occidentalis_ S. Wats.
Drainage ditch 2 mi. north (Stevens in 1920).

_Rumex crispus_ L.
Low roadsides. Frequent.

_Rumex persicarioides_ L.

_Polygonum aviculare_ L.

_Polygonum erectum_ L.

_Polygonum ramosissimum_ Michx.
Roadsides, etc. Common.

(to be continued)
# Bird Migration Record

**Made At**

**Notre Dame, Indiana**

**In the Spring of 1920**

**By Brother Alphonsus, C. S. C.**

<table>
<thead>
<tr>
<th>Name of Bird</th>
<th>When First Seen</th>
<th>How Many Were Seen?</th>
<th>When Next Seen</th>
<th>When Did it Become Common</th>
<th>When Last Seen</th>
<th>Is it Common or Rare?</th>
<th>Does it Breed Near Your Sta?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bittern, American</td>
<td>Mar. 21</td>
<td>1</td>
<td>Mar. 23</td>
<td>Mar. 27</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>No records this Spring</td>
</tr>
<tr>
<td>Blackbird, Red-winged</td>
<td>Mar. 12</td>
<td>2</td>
<td>Mar. 14</td>
<td>Mar. 16</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>Late this Spring</td>
</tr>
<tr>
<td>Bluebird</td>
<td>May 6</td>
<td>1</td>
<td>May 15</td>
<td>May 24</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>Very late this Spring</td>
</tr>
<tr>
<td>Bobolink</td>
<td>May 28</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rarer this Spring</td>
</tr>
<tr>
<td>Bob-white</td>
<td>Mar. 20</td>
<td>1</td>
<td>Mar. 31</td>
<td>Apr. 9</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>One record this Spring</td>
</tr>
<tr>
<td>Cardinal</td>
<td>Apr. 24</td>
<td>1</td>
<td>Apr. 25</td>
<td>May 7</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>Plentiful this Spring</td>
</tr>
<tr>
<td>Catbird</td>
<td>May 25</td>
<td>5</td>
<td>May 27</td>
<td>May 27</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>A few days late</td>
</tr>
<tr>
<td>Cedar-bird</td>
<td>Mar. 6</td>
<td>1</td>
<td>Mar. 14</td>
<td></td>
<td></td>
<td>Rare</td>
<td>No</td>
<td>Rare in Spring</td>
</tr>
<tr>
<td>Chickadee</td>
<td>Mar. 23</td>
<td>2</td>
<td>Mar. 27</td>
<td>Mar. 30</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>Ten records this Spring</td>
</tr>
<tr>
<td>Coot, American</td>
<td>Mar. 6</td>
<td>2</td>
<td>Mar. 16</td>
<td>Apr. 17</td>
<td>Apr. 23</td>
<td>No</td>
<td></td>
<td>No records this Spring</td>
</tr>
<tr>
<td>Cowbird</td>
<td>Mar. 21</td>
<td>1</td>
<td>Mar. 23</td>
<td>Mar. 24</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td>Somewhat rare</td>
</tr>
<tr>
<td>Creeper, Brown</td>
<td>Mar. 12</td>
<td>2</td>
<td>Mar. 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAME OF BIRD</td>
<td>WHEN FIRST SEEN</td>
<td>HOW MANY WERE SEEN?</td>
<td>WHEN NEXT SEEN</td>
<td>WHEN BECOME COMMON</td>
<td>WHEN LAST SEEN</td>
<td>IS IT COMMON OR RARE?</td>
<td>REMARKS</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>--------------</td>
<td>-----------------------</td>
<td>----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Crow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter resident</td>
<td></td>
</tr>
<tr>
<td>Cuckoo, Yellow-billed</td>
<td>May 22</td>
<td>1</td>
<td>May 24</td>
<td>May 31</td>
<td></td>
<td>Com.</td>
<td>No records this year</td>
<td></td>
</tr>
<tr>
<td>Cuckoo, Black-billed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Common in July</td>
<td></td>
</tr>
<tr>
<td>Dickcissel</td>
<td>May 30</td>
<td>1</td>
<td>June 17</td>
<td></td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Dove, Mourning</td>
<td>Mar. 27</td>
<td>2</td>
<td>Mar. 31</td>
<td>Apr. 8</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Flicker</td>
<td>Mar. 23</td>
<td>1</td>
<td>Mar. 27</td>
<td>Mar. 29</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Flycatcher, Acadian</td>
<td>May 16</td>
<td>1</td>
<td>May 18</td>
<td>May 23</td>
<td></td>
<td>Rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flycatcher, Alder</td>
<td>May 17</td>
<td>1</td>
<td>May 18</td>
<td>May 24</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Flycatcher, Crested</td>
<td>May 16</td>
<td>1</td>
<td>May 18</td>
<td>May 24</td>
<td></td>
<td>Com.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Flycatcher, Least</td>
<td>May 8</td>
<td>1</td>
<td>May 9</td>
<td>May 14</td>
<td></td>
<td>Rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flycatcher, Yellow-bellied</td>
<td>May 24</td>
<td>1</td>
<td>May 25</td>
<td>May 25</td>
<td>Rare</td>
<td>No</td>
<td>Several seen May 25</td>
<td></td>
</tr>
<tr>
<td>Gnatcatcher, Blue Gray</td>
<td>May 4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>Rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goldfinch</td>
<td>Mar. 27</td>
<td>2</td>
<td>Mar. 31</td>
<td>Apr. 20</td>
<td></td>
<td>Com.</td>
<td>One flock in March</td>
<td></td>
</tr>
<tr>
<td>Goose, Canada</td>
<td>Mar. 14</td>
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Does it breed?  
Yes - Yes, late records this spring  
No - No records this spring  
Winter resident - Winter resident  
Six records this spring - Six records this spring  
Three records this spring - Three records this spring  
Two records this spring - Two records this spring  
One record this spring - One record this spring  
No records this spring - No records this spring  
One record, late - One record, late  
Two records, late - Two records, late  
Three records, late - Three records, late  
Four records, late - Four records, late  
Five records, late - Five records, late  
Six records, late - Six records, late  
Seven records, late - Seven records, late  
Eight records, late - Eight records, late  
Nine records, late - Nine records, late  
Ten records, late - Ten records, late  
Eleven records, late - Eleven records, late  
Twelve records, late - Twelve records, late  
Thirteen records, late - Thirteen records, late  
Fourteen records, late - Fourteen records, late  
Fifteen records, late - Fifteen records, late  
Sixteen records, late - Sixteen records, late  
Seventeen records, late - Seventeen records, late  
Eighteen records, late - Eighteen records, late  
Confirmation of breeding status in the late season.
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<th>WHEN BECAME COMMON</th>
<th>WHEN LAST SEEN?</th>
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<td>WHEN NEXT SEEN</td>
<td>WHEN DID IT BECOME COMMON</td>
<td>WHEN LAST SEEN</td>
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<td>DOES IT BREED NEAR YOUR STATION?</td>
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<td>May 10</td>
<td>4</td>
<td>May 12</td>
<td></td>
<td>May 18</td>
<td>No</td>
<td>Six records in May</td>
</tr>
<tr>
<td>Warbler, Palm</td>
<td>Apr. 22</td>
<td>1</td>
<td>May 5</td>
<td>May 12</td>
<td>May 15</td>
<td>No</td>
<td>Nine records this spring</td>
</tr>
<tr>
<td>Warbler, Pine</td>
<td>May 7</td>
<td>1</td>
<td>May 12</td>
<td></td>
<td>May 12</td>
<td>No</td>
<td>Two records in May</td>
</tr>
<tr>
<td>Warbler, Prairie</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Warbler, Prothonotary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Warbler, Sycamore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Warbler, Tennessee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Warbler, Wilson</td>
<td>May 10</td>
<td>1</td>
<td>May 12</td>
<td>May 22</td>
<td>May 29</td>
<td>No</td>
<td>Seven records in May</td>
</tr>
<tr>
<td>Warbler, Yellow</td>
<td>May 4</td>
<td>1</td>
<td>May 7</td>
<td>May 9</td>
<td>Com.</td>
<td>Yes</td>
<td>Late this Spring</td>
</tr>
<tr>
<td>Whip-poor-will</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Woodpecker, Downy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
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<tr>
<td>Woodpecker, Hairy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Woodpecker, Red-headed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Wren, Carolina</td>
<td>May 4</td>
<td>1</td>
<td>May 4</td>
<td></td>
<td>Rare</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Wren, House</td>
<td>May 1</td>
<td>1</td>
<td>May 2</td>
<td>May 3</td>
<td>Com.</td>
<td>Yes</td>
<td>No records this spring</td>
</tr>
<tr>
<td>Wren, Winter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
</tr>
<tr>
<td>Wren, Long-billed Marsh</td>
<td>May 18</td>
<td>1</td>
<td>May 19</td>
<td></td>
<td>Rare</td>
<td>No</td>
<td>No records this spring</td>
</tr>
<tr>
<td>Yellowlegs, Lesser</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No records this spring</td>
<td></td>
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<td>Yellowlegs, Greater</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No record this spring</td>
<td></td>
</tr>
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</table>
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Fall and Winter Birds of Northfield, Minnesota, 1920 - 1921.

BY J. W. HORNBECK.

Northfield is situated about forty miles south of Minneapolis and St. Paul. It is a most favorable locality for bird study. The Cannon River, which flows through the heart of the city, provides timber, thickets, and weed patches, within short walking distance to the north and south. On the east the cemetery furnishes eighteen acres of pine, spruce, balsam, and other evergreens. Carleton College Campus, with its chain of lakes, attracts water birds as well as land birds; while St. Olaf College Campus, spreading over the hills on the west, harbors species which frequent the open woods. The outlying country is a typical dairy-farming region, spotted here and there with patches of timber land.

This report includes the six-months interval from September 1, 1920 to March 1, 1921. With the two or three exceptions, noted in the column of the Table headed "Remarks," all of the records were made within the city limits of Northfield or, at the fartherest, within a zone a half-mile wide surrounding the city. Observations in town and on Carleton College Campus were recorded daily, and regular trips were made about three times a week.

The third column of the Table gives the date of migration of a number of our summer residents. Since the date, September first, is chosen arbitrarily, it will be in the interest of completeness to list a few additional species which remained late into August, but which migrated before the first of September. The date when last observed will be given for each species.

- Indigo Bunting .................................. last seen on Aug. 20th.
- Cowbird ........................................ last seen on Aug. 25th.
- Cuckoo, Yellow-billed .......................... last seen on Aug. 25th.
- Humming Bird .................................. last seen on Aug. 20th.
Purple Martin ................................... last seen on Aug. 23rd.
Oriole, Baltimore .................................. last seen on Aug. 23rd.
Vireo, Red-eyed ..................................... last seen on Aug. 29th.
Warbler, Yellow ..................................... last seen on Aug. 20th.
Woodcock ............................................ last seen on Aug. 23rd.

Note 1.—(See Table) A small flock, five or six, of Golden-crowned Kinglets were seen regularly among the evergreens in the cemetery until January 9th. They withstood sub-zero weather in December. The week following January 9th brought cold weather again which culminated in a driving snow storm on January 16th, with a temperature about twelve degrees below zero and a forty-mile gale. The Kinglets disappeared. Whether they perished in the storm or were forced to migrate, there is no way to tell. It is significant to note that the Brown Creepers, the Slate-colored Juncoes, and the Tufted Titmouse, survived the storm and spent the rest of the winter here.

Note 2.—The Tufted Titmouse is very rare in this state. So far as the writer has been able to ascertain, this is the fifth published record of the Tufted Titmouse in Minnesota. The four preceding records are found in the "Review of the Ornithology of Minnesota," by T. S. Roberts, Professor of Ornithology and Curator of the Zoological Museum in the University of Minnesota. (Published May, 1919. See. p. 25.) The four are all winter records of single individuals, and in three out of the four cases the bird was seen with Black-capped Chickadees. Strange enough, our visitor this winter brought along none of his relatives and he was invariably found keeping company with the Chickadees. Correspondence with Professor Roberts has brought out his confident opinion that the Tufted Titmouse will soon be found nesting in Southern Minnesota. It is generally resident wherever found.

ABBREVIATIONS IN THE TABLE.—Column 4, reg. for regularly; column 7, S. R. for summer resident; W. V. for winter visitant; Mig. for migrant; H. H. for half hardy, referring to species the bulk of which migrate south in the fall while a few usually spend the winter; column 8, com. for common; T. com. for tolerably common; V. rare for very rare.
<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>When First Seen</th>
<th>When Last Seen</th>
<th>Seen on How Many Different Days</th>
<th>Greatest Number Seen on One Trip</th>
<th>Average Number Seen on One Trip</th>
<th>How Classified</th>
<th>Locally Common or Rare</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackbird, Rusty</td>
<td>Oct. 16</td>
<td>Nov. 10</td>
<td>5 flock</td>
<td>flock</td>
<td>mig. t.com.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catbird</td>
<td>Sept. 5</td>
<td>Sept. 5</td>
<td>1</td>
<td>1</td>
<td>S. R. com.</td>
<td>Common in August.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chickadee</td>
<td>Sept. 5</td>
<td>Feb. 28</td>
<td>reg.</td>
<td>8</td>
<td>P. R. com.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossbill, White-winged</td>
<td>Nov. 14</td>
<td>Nov. 14</td>
<td>1</td>
<td>7</td>
<td>W. V. rare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crow</td>
<td>Sept. 1</td>
<td>Feb. 28</td>
<td>reg.</td>
<td>50</td>
<td>5</td>
<td>P. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dove, Mourning</td>
<td>Sept. 5</td>
<td>Oct. 16</td>
<td>reg.</td>
<td>3</td>
<td>1</td>
<td>S. R. t.com.</td>
<td></td>
<td></td>
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<tr>
<td>Flicker</td>
<td>Sept. 3</td>
<td>Nov. 15</td>
<td>reg.</td>
<td>3</td>
<td>2</td>
<td>S. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goldfinch</td>
<td>Sept. 1</td>
<td>Nov. 10</td>
<td>reg.</td>
<td>8</td>
<td>3</td>
<td>S. R. com.</td>
<td>A flock migrating Nov. 10</td>
<td></td>
</tr>
<tr>
<td>Grosbeak, Rose-breasted</td>
<td>Sept. 1</td>
<td>Sept. 24</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>S. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hawk, Red-tailed</td>
<td>Oct. 3</td>
<td>Oct. 3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>S. R. t.com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hawk, Sparrow</td>
<td>Sept. 7</td>
<td>Sept. 7</td>
<td>1</td>
<td>3</td>
<td>S. R. rare</td>
<td>Seen 5 mi. north of town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heron, Great Blue</td>
<td>Sept. 7</td>
<td>Sept. 7</td>
<td>1</td>
<td>1</td>
<td>S. R. rare</td>
<td>Seen on L. Byllesby, 10 mi.N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heron, Little Green</td>
<td>Sept. 1</td>
<td>Sept. 1</td>
<td>1</td>
<td>1</td>
<td>S. R. rare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jay, Blue</td>
<td>Sept. 1</td>
<td>Feb. 28</td>
<td>reg.</td>
<td>6</td>
<td>3</td>
<td>P. R. com.</td>
<td></td>
<td></td>
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<tr>
<td>COMMON NAME</td>
<td>When First Seen</td>
<td>When Last Seen</td>
<td>Seen on How Many Different Days</td>
<td>Greatest Number Seen on One Trip</td>
<td>Average Number Seen on One Trip</td>
<td>How Classified</td>
<td>Locally Common or Rare</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>---------------------------------</td>
<td>---------------------------------</td>
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<td>----------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Kingfisher</td>
<td>Sept. 3</td>
<td>Oct. 9</td>
<td>reg. 3</td>
<td>2</td>
<td></td>
<td>S. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinglet, Golden-crowned</td>
<td>Oct. 1</td>
<td>Jan. 9</td>
<td>reg. 6</td>
<td>4</td>
<td></td>
<td>Mig. t.com.</td>
<td>See Note 1.</td>
<td></td>
</tr>
<tr>
<td>Kinglet, Ruby-crowned</td>
<td>Oct. 3</td>
<td>Oct. 13</td>
<td>reg. 2</td>
<td>1</td>
<td></td>
<td>Mig. rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighthawk</td>
<td>Sept. 7</td>
<td>Oct. 10</td>
<td>reg. 7</td>
<td>2</td>
<td></td>
<td>S. R. com.</td>
<td>Common throughout</td>
<td></td>
</tr>
<tr>
<td>Nuthatch, White-breasted</td>
<td>Sept. 1</td>
<td>Feb. 28</td>
<td>reg. 12</td>
<td>4</td>
<td></td>
<td>P. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owl, Great Horned</td>
<td>Jan. 28</td>
<td>Feb. 12</td>
<td>2 reg. 1</td>
<td>1</td>
<td></td>
<td>P. R. com.</td>
<td></td>
<td></td>
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<tr>
<td>Owl, Screech</td>
<td>Oct. 10</td>
<td>Feb. 13</td>
<td>reg. 1</td>
<td>1</td>
<td></td>
<td>P. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pewee, Wood</td>
<td>Sept. 1</td>
<td>Oct. 4</td>
<td>reg. 7</td>
<td>4</td>
<td></td>
<td>S. R. com.</td>
<td>Common throughout</td>
<td></td>
</tr>
<tr>
<td>Phoebe</td>
<td>Sept. 8</td>
<td>Oct. 8</td>
<td>reg. 5</td>
<td>2</td>
<td></td>
<td>S. R. rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quail</td>
<td>Oct. 3</td>
<td>Oct. 3</td>
<td>1 reg. 1</td>
<td>1</td>
<td></td>
<td>P. R. rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redstart</td>
<td>Sept. 1</td>
<td>Sept. 1</td>
<td>1 reg. 4</td>
<td>3</td>
<td></td>
<td>S. R. com.</td>
<td>Common in August</td>
<td></td>
</tr>
<tr>
<td>Robin</td>
<td>Sept. 7</td>
<td>Nov. 14</td>
<td>reg. flocks 10</td>
<td></td>
<td></td>
<td>S. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandpiper, Spotted</td>
<td>Sept. 8</td>
<td>Oct. 4</td>
<td>2 reg. 1</td>
<td>1</td>
<td></td>
<td>S. R. com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapsucker</td>
<td>Sept. 10</td>
<td>Oct. 10</td>
<td>4 reg. 3</td>
<td>1</td>
<td></td>
<td>S. R. rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snipe, Wilson's</td>
<td>Sept. 9</td>
<td>Sept. 9</td>
<td>1 reg. 1</td>
<td>1</td>
<td></td>
<td>S. R. rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sparrow, Fox</td>
<td>Oct. 13</td>
<td>Oct. 24</td>
<td>3 reg. 3</td>
<td>1</td>
<td></td>
<td>Mig. t.com.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Name</td>
<td>When First Seen</td>
<td>When Last Seen</td>
<td>Seen on How Many Different Days</td>
<td>Greatest Number Seen on One Trip</td>
<td>Average Number Seen on One Trip</td>
<td>How Classified</td>
<td>Locally Common or Rare</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------</td>
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<td>---------------------------------</td>
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<td>------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Tern, Common</td>
<td>Sept. 7</td>
<td>Sept. 7</td>
<td>1</td>
<td>1</td>
<td>Mig. com.</td>
<td>Seen on Lake Bylesby.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrasher, Brown</td>
<td>Sept. 3</td>
<td>Sept. 3</td>
<td>1</td>
<td>1</td>
<td>S. R. com.</td>
<td>Common in Summer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titmouse, Tufted</td>
<td>Dec. 30</td>
<td>Feb. 28</td>
<td>9</td>
<td>1</td>
<td>W. V. v. rare</td>
<td>See Note 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Towhee</td>
<td>Sept. 3</td>
<td>Sept. 3</td>
<td>1</td>
<td>1</td>
<td>S. R. rare</td>
<td>S. R. com. Common in August.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warbler, Bay-breasted</td>
<td>Sept. 1</td>
<td>Sept. 1</td>
<td>1</td>
<td>1</td>
<td>Mig. t.com.</td>
<td>S. R. com. Common in August.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warbler, Magnolia</td>
<td>Sept. 1</td>
<td>Sept. 9</td>
<td>2</td>
<td>1</td>
<td>Mig. t.com.</td>
<td>S. R. com. Common in August.</td>
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<td>Yellowthroat, Maryland</td>
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A Survey of the Naturalistic Periodical Literature of America

BY HOWARD CLARK BROWN.

(CONTINUED.)

"The Guide to Nature," published by the Agassiz Association, put forth its first volume in Stanford Conn., in 1908: It is a monthly edited by M. Bigelow. The title is alluring, indeed, and it may well be so, for this is one of the most worthy attempts within recent years to make nature-study practical and popular. Of the recent numbers we find book reviews upon Fabre's "Social Life in the Insect World," others by Burroughs, Frank Chapman, etc. There are articles which emphasize the work of Burbank, Thoreau, and other naturalists. In the limited numbers of worth while poems which are chosen, Joyce Kilmer's "Trees" was discovered. Between articles are oftimes short quotations from the great dreamers and thinkers of all time. Among the most valuable which I saw in a casual glance were quotations from Hearn, Roosevelt, Whitman, and W. H. Hudson.

A strict outline of the contents of the April number, 1920, is here given:

3 long articles—A Whittler's Reminiscence (Old Curio stuff); The Heavens in April (Astronomical guide); Review of P. G. Howe's, "Insect Behavior."
11 short articles less than one column)—Various titles, oddities, sights, etc.
5 short book reviews—Shakleton's "South" (Conquest tale); A Botany Textbook; Terhune—"Lad: A Dog." American Annual of Photography 1920; Dickey—"Youth of James Whitcomb Riley."
2 short quotations from W. H. Hudson's—"Book of a Naturalist"; 2 by Emma Pierce—"The Underground Fairies" and a quatrain, unnamed.
3 poems—1 by G. L. Hamlin—"To the Old Tree."
14 illustrations, of which three are diagrams, and eleven are photographs, several full paged.

Of course such a content table can mean but one thing: that is, that the field of the magazine is very wide, the material for the most part quite unliterary, but the whole effort of the magazine being directed toward an appreciation of the out-of-doors; and, consequently, as an aid in developing this appreciation, the great literary contributions upon the out-of-doors are thus brought into play. The magazine is not an epoch marking one in our list, but it is interesting. Its effort is constant, and sincere. It does not introduce our naturalistic literature directly, but rather serves as a guide to it. It stimulates interest and points the way to our nature-study classics.
By 1905 the wave of nature-study had swept far and wide over this country. This time it was not bird study, but nature study which was sweeping through the schools and homes. Then the local naturalist organizations came into being in many places, established their organs in the form of some publication or other, and were soon on their way either toward a general napping period of inactivity, or to an actual decline. The “American Midland Naturalist” is one of the publications which devoted itself to the exploitation of rather local phenomena.

In April, 1909, this magazine was put forth by the University of Notre Dame, at Notre Dame, Indiana. Its purpose was to account for various features and interests of natural history, primarily of the prairie states. It was issued as a bi-monthly, and presents for the most part, nice prose articles, interesting, even, but not literary. Articles upon any phase of natural history. A survey of the January number, 1920, follows.

"Household Insects and their Remedies; Aquatic Life; Our Birds in November; Notes on Variations in Chicory; Our Birds in December." Pages 11-146.

This sort of periodical has been followed up and imitated greatly for the last few years, and it is this sort of thing which we need. If this magazine would adopt literary judgment and standards, mould its material to fit those, and then introduce poetry, it would be of much greater value than at present. Nevertheless, it does present the Middle West in interests and manners, in a manner which no other magazine of to-day does. It will be of interest historically.

In 1914 two valuable publications arose. The Califor Naturalist Club, of Charles City, Iowa, began the publication of its annual reports and bulletins. The war has seriously interfered with this club, and its publications have not yet been resumed, but the contribution which the club made to our periodical literature of naturalistic value is decidedly worth noting. It is of interest again to notice that this comes from a Middle-Western locality. Bird clubs had preceded this organization, but they had published so far as I can find, no programs or literature of any sort. The First Annual Report of the Califor Naturalist Club contains contributions from Clarence Hawkes, the blind poet-naturalist of Massachusetts, from Gene Stratton-Porter, the Indiana Bird Woman,
author of "Freckles," and several articles by local members of the society, upon local phases of interest in the fauna and flora of that club's county. The contributions are small, and the whole report only covers nineteen pages, but there is the nucleus for the type of publication which America needs to-day. The contribution from Clarence Hawkes is a poem, "The Awak'ning." The second annual of this same society contains an autobiographical sketch by this author, with a great deal of local material, and at the top of each article is some little culled quotation from some-one who is well known, or should be because of his interest in the out-of-doors. Quotations from Mrs. Porter, Thoreau, Burroughs, and from well known state authorities in the scientific fields are utilized in this way in both the second and third annuals. This is only a beginning, but I feel that the Califor Naturalist Club is doing the thing which more periodicals should do. That is, I believe that our naturalistic periodicals should not only review the works of our naturalists, but publish the original contributions rather than letting other periodicals of varied interests and contents take what is rightfully in the field of the naturalistic periodical. This sort of thing would create for America a literature in the periodicals which would be of immense value and influence to would-be naturalists of coming time.

In the same year that the Califor Naturalist Club began its publication, the Cleveland Bird Lovers Association began the publication of the "Bluebird." It is a monthly periodical, and I think the most perfect combination of literature and nature-study which has yet been produced in our periodical world. The following contents of the March number, 1920, should be sufficient to convince the doubter that such an ideal periodical does and can exist.

1. Getting Acquainted—A close-up of our Common Birds; "'The Chipping Sparrow"—L. W. Brownell—Article of 3 pages. Followed by several brief comments upon birds, and a bird verse from Emerson and another from Robert Service.

2. The Way of the Protectionist—A serial on Bird Protection by Georgia M. Bowen; 3 pages.

3. Editorial comments. Also, several other verses from Service's "Spell of the Yukon," and Joyce Kilmer's "Trees."

4. Article—"Every Cemetery a Sanctuary"—Contributed by T. Gilbert Pearson—Sec. of Nat'l. Asso'n. of Aud. Soc. One page.

5. Bird Study in Home, School and Club. Daily record from January and February birds given, and the Question Box where answers to questions
are given. Nature Tales Retold in Rhyme, Georgia M. Bowen. Personal Observations Compiled for the Blue Bird. 1 column Quotation of several verses fill out page. Verses from Bryant's, "Forest Hymn" and Whitman's, "Song of Myself."


7. As Poets View the Trees. Four poems given; The Careless Smoker—Harris Reynolds; The Ranger's Life—Aurthur Chapman; Prospectin'—J. R. Simmons; Verse—Edwin Markham.

8. The "Post-Box"—containing a letter from a reader. Following this, and filling in the remaining space are verses from the "Rubaiyat"; Theodosia Garrison's, "Trees"; Whitman's, "I Saw in Louisiana a Live Oak Growing," and a verse from Lela Brechenser-Rostiser.

I know of no happier contribution to our nature periodicals than that made by the "Bluebird." It deserves the interest and support of every naturalist who is interested in the literary-naturalistic motive.

In following our sequence of development of interest in Nature study, we find that birds come first, then plants, then insects, and finally come the water inhabitants in the form of fish, reptiles, etc. And so it happened that in 1915, in Philadelphia, W. A. Poyser edited the first number of "Aquatic Life." It is an "International monthly devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium." The magazine is distinctly popular in character, but has enlisted the interest of one of the best authorities on turtles, which the United States can boast of. Dr. R. W. Shuffeldt, has been publishing a series of articles upon the Chelonians of North America. His handling of this subject is quite as classic in its way, as Thoreau's handling of fungi, was, in his. The March, 1920 number of this magazine included five long articles, of which this part of Dr. Shuffeldt's contribution is one, three short articles, several columns of society notes, and is wonderfully illustrated. It has ten plates within its twelve pages, only one of which is a sketch. The rest are all photographs, several of them half a page or more in size. Again then we have a concise example of the value of good plates.

In 1916 the Illinois Audubon Society began the publication of the "Audubon Bulletin," at Chicago. This began a series of articles upon Illinois conservationists who had become of national repute. Roosevelt, and Robert Ridgeway were included among the numbers
which I glanced through. Much stress was laid, throughout the 
publication, upon conservation. And again, the illustrations which 
were very splendid photographs, played a very large part in exciting 
and stimulating the individual who read to an appreciation of the 
out-of-doors. An active appreciation which should lead to con-
servative efforts. There were also some bits of minor qualified 
poetry. It was quite distinctly local, but emphasized the conserv-
ation side of nature study. Beginning with "Birds and Nature" 
which emphasized the aesthetic side of the subject, going through 
the Califor Naturalist Club and Bluebird for the literary, the Nature 
Study Review for the economic and practical, now we reach the 
conservation period of our story.

In 1917, the Iowa Conservation Association issued the first 
volume of its official organ, "Iowa Conservation." This represents 
another attempt and to me, a very successful one to unite literary, 
historic and naturalistic interests of a given locality. Traditions 
of places and things are preserved in the articles of this publication. 
Traditions such as will be woven in time into the literary values 
of that time and place. There is the potential literature there, just 
waiting to become an expression of reality. I think the magazine 
a very excellent success in its happy combination of interests, and 
in its final effects upon its readers.

With this magazine our study in the evolution of periodical 
naturalistic literature must come to a close. We have followed the 
development of the nature theme from the stage of pure aesthetic 
delight, as an extra thing, a pure beauty phase which could find no 
place in the Puritanic code, down to the time when it was an econo-
ic factor, a vital element in human environment, and finally to the 
place where it has been considered not merely the one nor the other, 
but both. That is, the literature upon nature, the naturalist's 
expressions to-day are a combination of the aesthetic and the 
economic, the artistic and real, the scientific and the poetic.

That our periodicals have not made use of the writings which 
should have got into them is a fact which I think is greatly to be 
deplored. But it does seem to me as though a brighter future in 
this respect lies before us, and has been suggested by such maga-
azines as the Bluebird, Iowa Conservation, and the Midland Na-
turalist. Nature study started as a unit, then it divided into ornith-
ology, entomology, anthropology, etc. Now men are again going 
back and recognizing the unity of all of these. Some periodicals
are emphasizing this unity, and rightly so. If these same periodicals would bring the works of great naturalists more prominently into their fields of work and activity, America would have a naturalistic periodical literature of which she might well, indeed, be proud.

CHRONOLOGY OF APPEARANCE OF PERIODICALS

1884—Young Oologist. Gaines, N. Y.
1895—Wilson Bulletin. Oberlin, Ohio
1897 (?) Osprey. Washington.
1897—Birds and Nature. Chicago, Ill.
1897—Plant World. Washington, D. C.
1899—Bird-Lore. Pens. N. Y.
1914—Califor Naturalist Club Annual. Charles City, IA.
1914—Blue Bird. Cleveland, Ohio
1917—Iowa Conservation. Iowa City, IA.

Plants of Fargo, North Dakota, With Dates of Flowering.

Errata—Omitted between Ranunculus pennsylvanicus and Tilia—March 1921—p. 57.

Sisymbrium officinale (L.) Scop. HEDGE MUSTARD.
Streets. Occasional.
Sisymbrium altissimum L. TUMBLING MUSTARD.
Sophia sophia (L.) Britton. FLIX WEED.
Sophia incisa (Engelm.) Greene. TANSY MUSTARD.
Sophia hartwegiana Fourn. HARTWEG'S TANSY MUSTARD.
Erysimum chieranthoides L. WORM-SEED MUSTARD.
Common in woods and thickets; less so in open places. Apparently only one flowering record (June 20) besides an extremely early one of Apr. 10, 1910.
**Erysimum inconspicuum** (S. Wats.) Mac.M.

*Barbarea barbarea* (L.) Mac.M.  
  Collected by C. H. Waldron in 1910.

*Brassica nigra* (L.) Koch.  
  Roadsides. Rare.

*Brassica juncea* (L.) Cosson.  

*Brassica arvensis* (L.) B. S. P.  
  *Common Mustard.*  

*Brassica campestris* L.  
  Roadsides. Occasional.

*Erucastrum pollichii* Schimp. & Spenn.  
  *Dog Mustard.*  
  Frequent along the railroad tracks and occasional along streets.  
  June 15. This common name which is proposed is a contraction of one used in a European manual. The plants flower vigorously in the fall until after the first frost, frequently into November.

*Eruca eruca* (L.) Britton.  
  Garden Rocket.  
  Collected by L. R. Waldron in 1902, by Bergman in 1912.

*Draba nemorosa* L.  
  Yellow Whitlow Grass  

*Arabis hirsuta* (L.) Scop.  
  *Hairy Rock Cress.*  
  Common in prairie, occasional in fields. June 20.

*Conringia orientalis* (L.) Dumort.  
  *Hare's-Ear Mustard.*  

*Polygonum amphibium* L.  
  In water or on mud. C. H. Waldron in 1910.

*Polygonum emersum* (Michx.) Britton.  
  *Long-Rooted Smartweed.*  

*Polygonum lapathifolium* L.  
  *Dock-Leaved Smartweed.*  

*Polygonum pennsylvanicum* L.  

*Polygonum persicaria* L.  
  *Ladies' Thumb.*  

*Polygonum convolvulus* L.  
  *Wild Buckwheat.*  
PLANTS OF FARGO, ETC. 81

Pyrolaceae. Wintergreen Family.

*Pyrola elliptica* Nutt.  
Frequent in aspen woods on Minnesota side. June 25.

Monotropaceae. Indian-pipe Family.

*Monotropa uniflora* L.  
Occasional in aspen woods on Minnesota side.

Primulaceae. Primrose Family.

*Androsace occidentalis* Pursh.  
Fields and prairie. Frequent. Apr. 30 (29); excluding Apr. 9, 1910.

*Steversonema ciliatum* (L.) Raf.  

*Polanisia trachysperma* T. & G.  
A large colony in some gravel along N. P. Ry. west of town in 1910, but has nearly disappeared. July 20.

Brassicaceae Mustard Family.

*Lepidium densiflorum* Schrad.  

*Lepidium virginicum* L.  
Yards, occasionally introduced but not persisting.

*Thlaspi arvense* L.  
Fields and roadsides. Common. Apr. 20 (22); earliest, March 22, 1910. Many seedlings pass the winter in various stages, often after beginning to flower. So far as I have noticed, the flowers which are just opened when winter begins do not develop in the spring, but well developed flower buds open with the first warm weather.

*Bursa bursa-pastoris* (L.) Britton.  
Fields and roadsides. Frequent. Apr. 10 (9).

*Camelina sativa* Crantz.  
Roadsides. Occasional.

*Camelina dentata* Pers.  
Roadsides. Occasional.

*Neslia paniculata* (L.) Desv.  
Roadsides. Occasional.

*Radicula palustris* (L.) Moench.  
Low places in fields, river-banks, etc. Common. June 20 (19).
Radícula armoracia (L.) Robinson. Horseradish.
Fields and roadsides. Occasionally escaped from cultivation and persisting. May 30 (June 1).

Sisymbrium officinale (L.) Seop. Hedge mustard.
Streets. Occasional.

Sisymbrium altissimum L. Tumbling mustard.

Sophia sophia (L.) Britton. Flix weed.

Sophia incisa (Engelm.) Greene. Tansy mustard.

Sophia hartwegiana Fourn. Hartweg’s tansy mustard

Erysimum chieranthoides L. Worm-seed mustard.
Common in woods and thickets; less so in open places. Apparently only one flowering record (June 20) besides an extremely early one of Apr. 10, 1910.


Barbara barbara (L.) MacM. Winter cress.
Collected by C. H. Waldron in 1910.

Brassica nigra (L.) Koch. Black mustard.
Roadsides. Rare.

Brassica juncea (L.) Cosson. Indian mustard.

Brassica arvensis (L.) B. S. P. Common mustard.

Brassica campestris L. Roadsides. Occasional.

Erucastum pollichii Schimp. & Spenn. Dog mustard.
Frequent along the railroad tracks and occasional along streets. June 15. This common name which is proposed is a contraction of one used in a European manual. The plant sflower vigorously in the fall until after the first frost, frequently into November.

Eruca eruca (L.) Britton. Garden rocket.
Collected by L. R. Waldron in 1902, by Bergman in 1912.

Draba nemorosa L. Yellow whitlow grass.

Arabis hirsuta (L.) Scop. Hairy rock cress.
Common in prairie, occasional in fields. June 20.
Conringia orientalis (L.) Dumort. HARE’S-EAR MUSTARD.
Steironema lanceolatum (Walt.) Gray. LANCE-LEAVED LOOSESTRIFE

Plantaginaceae. Plantain Family.
Plantago major L. COMMON PLANTAIN.
Plantago rugelii Dec. RUGELS’ PLANTAIN.
Plantago lanceolata L. LANCE-LEAVED PLANTAIN.
Streets. Occasionally introduced but not persisting.

Gentianaceae. Gentian Family.
Gentiana puberula Michx. DOWNY GENTIAN.
Prairie (C. B. Waldron in 1891.)
Gentiana andrewsii Griseb. CLOSED GENTIAN.
Low prairie. Frequent.

Oleaceae. Ash Family.
Fraxinus pennsylvanica Marsh. RED ASH.

Apocynaceae. Dogbane Family.
Apocynum androsaemifolium L. SPREADING DOGBANE.
Margin of woods or open places in same. Occasional; common near the aspen woods on Minnesota side. June 20.
Apocynum hypericifolium Ait. INDIAN HEMP.

Asclepiadaceae. Milkweed Family.
Asclepias incarnata L. SWAMP MILKWEED
Asclepias syriaca L. COMMON MILKWEED
Asclepias ovalifolia Dec.
Asclepias verticillata L. WHORLED MILKWEED.
Solanaceae. Nightshade Family.

Physalis virginiana Mill. GROUND CHERRY.
Prairie and along railroad. Frequent. July 5.

Solanum nigrum L. COMMON NIGHTSHADE.
Gardens, riverbank and various places. Frequent.

Solanum triflorum Nutt. CUT-LEAVED NIGHTSHADE.
Along railroad etc. Occasional. June 20.

Solanum rostratum Dunal. BUFFALO BUR.
Occasionally introduced.

Lycopersicon lycopersicon (L.) Karst. TOMATO.
Common every year on the riverbank below the city.

Scrophulariaceae. Figwort Family.

Verbascum thapsus L. MULLEIN.
Lee and Wright in 1891.

Verbascum blattaria L. MOTH MULLEIN.
L. R. Waldron in 1901.

Linaria linaria (L.) Karst. TOAD FLAX.
Occasionally escaped or introduced? Boley in 1891. June 25.

Scrophularia leporella Bickn. FIGWORT.
Roadsides or edges of thickets. Occasional. June 10 (11).

Penstemon gracilis Nutt. SLENDER BEARD TONGUE.

Mimulus ringens L. MONKEY FLOWER.

Bacopa rotundifolia (Michx.) Wettst. WATER HYSSOP.
In water or the mud remaining. Lee in 1892.

Gratiola virginiana L. HEDGE HYSSOP.
Low fields or other wet places. Occasional.

Lysanthes dubia—(L.) Barnhart. FALSE PIMPERNEL.
Low field at Wild Rice (10 mi. south); Stevens in 1914.

Limosella aquatica L. MUDWORT.
Roadside ditch; Stevens in 1917 (seeds only, collected).

Veronica peregrina L. SPEEDWELL.
Low places in fields, etc. Common. May 25 (23).

Gerardia tenuifolia Vahl. SLENDER GERARDIA.
Lee in 1892.
PLANTS OF FARGO, ETC.

Utriculariaceae. Bladderwort Family.
Utricularia vulgaris L. var. americana Gray. BLADDERWORT.
and 12th. Ave. N., now filled up.

Orobanchaceae. Broom-rape Family.
Thalesia uniflora (L.) Britton. CIVCER-ROOT.
Woods and thickets. Occasional (Stevens in 1910 and 1917)
June 10.

Phrymaceae. Lopseed Family.
Phryma leptostachya L. LOPSEED.

Convolvulaceae. Morning Glory Family.
Ipomea purpurea (L.) Roth. MORNING GLORY.
Occasionally escaped along streets.
Convolvulus sepium L. BINDWEED.
Convolvulus repens L. DOWNY BINDWEED.
Convolvulus arvensis L. FIELD BINDWEED.
Well established in several places. June 30.

Cuscutaceae. Dodder Family.
Cuscuta arvensis Beyr. FIELD DODDER.
On weeds along river bank and on clovers in fields. Occasional.
July 30.
Cuscuta coryli Engelm. HAZEL DODDER.
On shrubs and various herbs (but not observed on hazel) along
riverbank or other low places. Common. I have a date of July 9,
1910, and one of 4 days later than arvensis where planted at same
time.
Cuscuta gronovii Willd. GRONOVIUS DODDER.
In about the same places as last. Frequent. Aug. 5. Either of
the last two occasionally appear on various garden or ornamental
plants such as potatoes and various shrubs.. The clover dodder C.
epithymum Murr. was found on white clover in a lawn in 1912,
but no specimens secured.

Polemoniaceae. Phlox Family.
Phlox pilosa L. WILD PHLOX.
Bolley in 1891.
Collomia linearis Nutt.
Lee in 1891. Likely to be found along the railroad. June 15.

**Hydrophyllaceae.** Waterleaf Family.

*Hydrophyllum virginicum* L.

*Macrocalyx nyctelea* (L.) Kuntze.

**Boraginaceae.** Borage Family.

*Boraginaceae.** Borage Family.

*Lappula lappula* (L.) Karst.
Roadsides etc. Common. May 30 (June 2).

*Lappula occidentalis* (Wats.) Greene.

*Lappula americana* (Gray) Rydb.

*Lithospermum canescens* (Michx.) Lehm.

*Lithospermum linearifolium* Goldie.
Along railroad. Occasional (introduced).

*Onosmodium occidentale* Mackenzie.

**Verbenaceae.** Vervain Family.

*Verbena urticaefolia* L.

*Verbena hastata* L.

*Verbena stricta* Vent.
Along railroad; Stevens in 1918.

*Verbena bracteosa* Michx.

**Lamiaceae.** Mint Family.

*Teucrium occidentale* A. Gray

*Scutellaria lateriflora* L.
Riverbank. Frequent.

*Scutellaria parvula* Michx.
Low, open places. Occasional.
Agastache anethiodora (Nutt.). Britton. 

*Nlesea* cataria L. C. H. Waldron in 1910 (Oak Grove).

Prunella vulgaris L. 

*Moldavica parviflorum* (Nutt.) Britton. 

Leonurus cardiaca L. 

*Stachys palustris* L. 
Riverbank, fields, etc. Common. June 30 (29). Bergman has also recorded *S. aspera* Michx. The plant is quite variable and should repay careful study.

*Monarda fistulosa* L. 

*Lycopus americanus* Muhl. 
Frequent. May 30.

*Lycopus asper* Greene. 

*Mentha canadensis* L. 
Riverbank, fields, etc. Common. June 30.

*Ranunculus macounii* Britton. 

*Ranunculus cymbalaria* Pursh. 

*Thalictrum venulosum* Trelease. 
Prairie, especially near woods and thickets. May 25 (23).

*Thalictrum dasycarpum* Fisch. & Lall. 

**Menispermaceae.** Moonseed Family.

*Menispermum canadense* L. 

**Berberidaceae.** Barberry Family.

*Caulophyllum thalictroides* (L.) Michx. 
**Papaveraceae. Poppy Family.**

*Sanguinaria canadensis* L.  
**BLOODROOT.**  

*Papaver somniferum* L.  
**COMMON POPPY.**  
Occasionally escaped in yards or streets.

*Papaver rhoeas* L.  
**CORN POPPY.**  
Occasionally escaped in yards or streets.

**Fumariaceae. Fumitory Family.**

*Capnoideae. Caper Family.*

*Capnoideae. Caper Family.*

*Cleome serrulata* Pursh.  
**ROCKY MOUNTAIN BEE PLANT.**  
Prairie near railroad (introduced?); Stevens in 1920. July 5.

*Polanisia trachysperma* T. & G.  
**CLAMMY WEED.**  
A large colony in some gravel along N. P. Ry. west of town in 1910, but has nearly disappeared. July 20.

**Brassicaceae. Mustard Family.**

*Lepidium densiflorum* Schrad.  
**PEPPER GRASS.**  

*Lepidium virginicum* L.  
**FRENCHWEED. PENNY CRESS.**  
Yards, occasionally introduced but not persisting.

*Thlaspi arvense* L.  
**FRENCHWEED. PENNY CRESS.**  
Fields and roadsides. Common. Apr. 20 (22); earliest, March 22, 1910. Many seedlings pass the winter in various stages, often after beginning to flower. So far as I have noticed, the flowers which are just opened when winter begins do not develop in the spring, but well developed flower buds open with the first warm weather.

*Bursa bursa-pastoris* (L.) Britton.  
**SHEPHERD'S PURSE.**  
Fields and roadsides. Frequent. Apr. 10 (9).

*Camelina sativa* Crantz.  
**FALSE FLAX.**  
Roadsides. Occasional.

*Camelina dentata* Pers.  
**ROUND-SEEDED FALSE FLAX.**  
Roadsides. Occasional.

*Neslia paniculata* (L.) Desv.  
**BALL MUSTARD.**  
Roadsides. Occasional.

*Radicula palustris* (L.) Moench.  
**MARSH YELLOW CRESS.**  
Low places in fields, river-banks, etc. Common. June 20 (19).
Radicula armoracia (L.) Robinson.  
HORSERADISH.  
Fields and roadsides. Occasionally escaped from cultivation and persisting. May 30 (June 1).

Rosaceae, Rose Family.

Spiraea salicifolia L.  
MEADOW-SWEET.  
Low places in prairie, roadside, etc. Common. July 5 (7).

Potentilla paradoxa Nutt.  
BUSHY CINQUEFOIL.  
Lee in 1891.

Potentilla middlegana Engelm.  
Riverbank and low places. Frequent.

Potentilla monspeliensis L.  
ROUGH CINQUEFOIL.  

Potentilla pentandra Engelm.  

Potentilla pennsylvanica L.  
*PRAIRIE CINQUEFOIL.  

Argentina anserina (L.) Rydb.  
SILVER WEED.  
Sloughs. This may not occur in the immediate vicinity, but I have seen it within 10 miles east and north. May 10.

Fragaria virginiana Duchesne.  
WILD STRAWBERRY.  
Woods and prairie. Common. May 10 (9).

Drymocallis arguta (Pursh) Rydb.  
TALL CINQUEFOIL.  

Geum canadense Jacq.  
WHITE AVENS.  

Geum macrophyllum Willd.  
GEUM.  
Woods. Bolley in 1897. I have been uncertain as to the position of this form.

Geum strictum Ait.  
YELLOW AVENS.  

Geum ciliatum Pursh.  
*TORCH FLOWER.  
Prairie. Frequent. May (no accurate dates). I have long sought for a suitable name for this pretty little plant, and this one, suggested by Mr. H. D. Long seems quite acceptable. It refers to freshly matured fruit heads with their graceful, beautifully colored plumes.

Rubus triflorus Rich.  
DWARF RASPBERRY.  
**Rubus strigosus** Michx. RED RASPBERRY.


**Agrimonia striata** Michx. AGRIMONY.

Woods and thickets. Occasional.

**Rosa pratiucola** Greene. PRAIRIE ROSE.


**Rosa alba** Ait. SMOOTH ROSE.


**Malaceae**, Apple Family.

**Amelanchier alnifolia** Nutt. JUNEBERRY.


**Crataegus chrysocarpa** Ashe. RED HAW.


**Crataegus succulenta** Schrad. RED HAW.

Woods and thickets. Occasional.

**Crataegus mollis** T. & G. LARGE RED HAW.

One tree at Potter’s Slough (E. of Fair grounds), many in bend of river 2 miles farther north and on Minnesota side beyond. May 20. This flowers about 5 days earlier than chrysocarpa, but my records are insufficient to show it.

**Prunaceae**, Plum Family.

**Prunus americana** Marsh. WILD PLUM.


**Prunus pensylvanica** L. i. BIRD OR PIN CHERRY.

Woods and thickets. Frequent. May 15 (should be about 14).

**Prunus virginiana** (L.) Mill. CHOKE CHERRY.


Date for Kansas vol. 5, p. 101, should be Ayr. instead of May.

**Fabaceae**, Pea Family.

**Trifolium procumbens** L. LOW HOP CLOVER.

Along railroad; Stevens in 1918.

**Trifolium pratense** L. RED CLOVER.


**Trifolium hybridum** L. ALSIKE CLOVER.


**Trifolium repens** L. WHITE CLOVER.

**Plants of Fargo, etc.**

**Trifolium incarnatum L.**
Collected in a field by C. H. Waldron in 1909.

**Medicago sativa L.**

**Medicago lupulina.**

**Melilotus alba Desv.**

**Melilotus officinalis (L.) Lam.**

**Anthyllis vulneraria L.**
Collected in a field by C. H. Waldron in 1909.

**Hosackia americana (Nutt.) Piper.**
Prairie bird'sfoot trefoil.

**Astragalus carolinianus L.**
LITTLE RATTLE-POD.

**Astragalus hypoglottis L.**

**Glycyrrhiza lepidota Nutt.**

**Amorpha fruticosa L.**
Riverbank or low roadside. Frequent.

**Amorpha nana Nutt.**
Prairie, 3 mi. nw.; Stevens in 1920.

**Amorpha canescens Pursh.**

**Psoralea argophylla Pursh.**
Prairie. Common: June 30 (29).

**Psoralea ésculenta Pursh.**

**Parosela dalea (L.) Britton.**
Along N. P. Ry.; Stevens in 1918 (still persisting).

**Petalostemon candidum Michx.**
WHITE PRAIRIE CLOVER.
Along N. P. Ry.; Stevens in 1920.

**Petalostemon purpureum (Vent.) Rydb.**
PURPLE PRAIRIE CLOVER.

**Meibomia grandiflora (Walt.) Kuntze.**
LARGE-LEAVED TICK TREFOLI.
Woods. Occasional.
Meihomia canadensis (L.) Kuntze.  
SHOWY TICK TREFOIL.  
Edges of woods and thickets. Occasional.

Falcata comosa (L.) Kuntze.  
GROUND BEAN HOG PEANUT.  

Vicia americana Muhl.  
WILD VETCH.  

Vicia angustifolia Roth.  
NARROW-LEAVED VETCH.  

Vicia villosa Roth.  
HAIRY VETCH.  
Fields. Occasional.

Lathyrus venosus Muhl.  
*RUSSIAN VETCH.  

Lathyrus palustris L.  
MARCH VETCHLING.  

Lathyrus ochroleucus Hook.  
YELLOW VETCHLING.  

Penthoraceae, Stonecrop Family.

Penthorum sedoides L.  
DITCH STONECROP.  

Saxifragaceae, Saxifrage Family.

Heuchera hispida Pursh.  
ALUM ROOT.  

Ribes americanum Mill.  
WILD BLACK CurrANT.  

Ribes gracile Michx.  
GOOSEBERRY.  

Onagraceae, Evening-primrose Family.

Epilobium adenocaulon Haussk.  
WILLOW-HERB.  
Riverbank, pond margins, etc. Frequent.

Cenotheca biennis L.  
EVENING PRIMROSE.  

Anogra albicaulis (Pursh) Britton.  
WHITE-STEMMED EVENING PRIMROSE.

For several years at least (1910 and later) a colony grew along the N. P. Ry. at about 11th St.; doubtless introduced in gravel. July 10 (12).
Gaura coccinea Pursh.

Along railroad, Stevens in 1919. June 10 (12). I have found the name "Prairie honeysuckle" used for this plant. The flowers are suggestive of honeysuckle, but I hesitate to borrow a name from a well known plant which is so different in general appearance.

_Circaea lutetiana_ L. ENCHANTER'S NIGHTSHADE.

Woods. Frequent at least on the aspen woods on Minnesota side.

**Haloragidaceae**, Water-milfoil Family.

_Myriophyllum spicatum_ L. WATER MILFOIL.

Collected by Lee in 1891.

**Celastraceae**, Staff tree Family.

_Celastrus scandens_ L. CLIMBING BITTER-SWEET.

Woods. Frequent.

**Vitaceae**, Grape Family.

_Vitis vulpina_ L. WILD GRAPE.


_Pariennocissus quinquefolia_ (L.) Planch. VIRGINIA CREEPER.

Woods and thickets. Frequent.

**Eleagnaceae**, Oleaster Family.

_Lepargyrea argenea_ (Nutt.) Greene. BUFFALO BERRY.

A few bushes near filtration plant. I do not know whether introduced or not. Apr. 20 (20).

**Aceraceae**, Maple Family.

_Acer rubrum_ L. RED MAPLE.

Bolley in 1891.

_Acer negundo_ L. BOX ELDER.


**Anacardiaceae**, Sumac Family.

_Rhus glabra_ L. SMOOTH SUMAC.


_Rhus rydbergii_ (Small.) Greene. POISON IVY.

Woods and thickets. Common.

**Betulaceae**, Birch Family.

_Ostrya virginiana_ (Mill.) Willd. IRONWOOD.

Woods. Occasional (Oak Grove and County Hospital). May 15.
Corylus americana Walt.  
Woods and thickets. Frequent. Apr. 10 (12)
The Fargo specimen reported as Alnus incana is Ostrya.

_Fagaceae_, Beech Family.

Quercus macrocarpa L.  

_Araliaceae_, Ginseng Family.

Aralia nudicaulis L.  

_Apiceae_, Carrot Family.

Sanicula marylandica L.  

Washingtonia longistylistis (Torr.) Britton.  

Zizia aurora (L.) Koch.  

Zizia cordata (Walt.) Koch.  

Cicuta maculata L.  
Low prairie, woods and river bank. Frequent. June 30 (30).

Root very poisonous.

Deringia canadensis (L.) Kuntze.  

Carum carvi L.  
Occasionally escaped.

Sinum cicutaefolium Gmel.  
Edges of ponds, riverbanks, etc. Common.

Pastinaca sativa L.  

Heracleum lanatum Pursh.  

Daucus carota L.  
Fields or roadsides. Occasional.

_Cornaceae_, Dogwood Family.

Cornus femina Mill.  
**Rubiaceae**, Madder Family.

*Galium aparine* L.  
**BEDSTRAW.**  

*Galium boreale* L.  
**NORTHERN BEDSTRAW.**  

*Galium triflorum* Michx.  
**SWEET-SCENTED BEDSTRAW.**  
Woods. Frequent.

**Caprifoliaceae**, Honeysuckle Family.

*Viburnum opulus* L.  
**PEMBINA.**  

*Viburnum pubescens* (Ait.) Pursh.  
**DOWNY ARROW-WOOD.**  
Woods. Occasional.

*Viburnum lentago* L.  
**BLACK HAW. SHEEPBERRY.**  

*Symphoricarpus occidentalis* Hook.  
**WOLFBERY.**  
Woods, thickets, prairie. Common. June 25 (26). In this state mostly known as "Buckbrush," or "Badgerbrush," the former name applied also to *Eleagnus argentea*.

*Lonicera dioica glaucescens* (Ryd.) C. R. B.  
**HONEYSUCKLE.**  

**Cucurbitaceae**, Gourd Family.

*Micrampelis lobata* (Michx.) Greene.  
**WILD CUCUMBER.**  

**Lobeliaceae**, Lobelia Family.

*Lobelia spicata* L.am.  
Low prairie. Common at least in places.

**Ambrosiaceae**, Ragweed Family.

*Iva xanthiiifolia* Nutt.  
**FALSE KINGHEAD. MARSH ELDER.**  
Fields and roadsides. Common. Aug. 20 (19). The name "False Kinghead" is from the similarity of the plant and not the seeds. Marsh elder, although in general use is a poor name for the plant at least under our conditions.

*Ambrosia trifida* L.  
**KINGHEAD. GIANT RAGWEED.**  

*Ambrosia artemisiaefolia* L.  
**RAGWEED.**  
Ambrosia psilostachya DC.  PERENNIAL RAGWEED
Dry prairie or roadside. Frequent.

Xanthium canadense Mill.  COCKLEBUR.

Xanthium echinatum Murr.
Dry soil especially around railroad tracks. Common. Aug. 5.

Asteraceae, Aster Family.

Vernonia fasciculata Michx.  IRONWEED.

Eupatorium ageratoides L.  WHITE SNAKERoot.
Woods. Occasional.

Kuhnia glutinosa Ell.  FALSE BONESET.

Lacinaria punctata (Hook) Kuntze.  *NARROW-LEAVED BLAZING STAR.

Lacinaria scariosa (L.) Hill.  BLAZING STAR.

Grindelia squarrosa (L.) Dunal.  GUMWEED.

Chrysopsis villosa Nutt.  GOLDEN ASTER.

Solidago flexicaulis L.  BROAD-LEAVED GOLDENROD.
Woods near County Hospital. Stevens in 1915.

Solidago canadensis L.  CANADA GOLDENROD.
Prairie and roadsides. Common. Aug. 10 (9).

Solidago missouriensis Nutt.  *EARLY GOLDENROD.
Along N. P. Ry. (introduced in gravel?).

Solidago rigida L.  STIFF GOLDENROD.
Prairie and roadsides. Common. Aug. 10 (9).

Solidago scroina Ait.  *TALL SMOOTH GOLDENROD.

Boltonia asteroides L’Her.  FALSE ASTER.

Aster sagittifolius Willd.  ARROW-LEAVED ASTER.
Woods. Occasional; common in aspen on Minnesota side.
Aster laevis L.  
*Smooth Blue Aster.  

Aster sericeus Vent.  
Silky Aster.  

Aster multiflorus Ait.  
White Prairie Aster.  

Aster commutatus (T. & G.) Gray.  
Prairie. This is listed by Bergman but I am as yet uncertain whether it is common or distinct from the preceding.

Aster paniculatus Lam.  
*Tall White Aster.  

Aster ptarmicoides (Ness.) T. & G.  
Prairie. Lee in 1891.

Brachyactis angusta (Lindl.) Britton.  
Rayless Aster.  
Sloughs and along railroad. Frequent. Sept. 15.

Erigeron philadelphicus L.  
Fleabane.  

Erigeron ramosus (Walt.) B. S. P.  
Daisy Fleabane.  

Leptilon canadense (L.) Britton.  
Horse-Weed.  

Antennaria aprica Greene and A. neglecta Greene.  
Cat's-Foot.  
I do not know the two species. The plants are frequent on the prairie and sometimes in open woods. The record of A. parviflora is an error. May 10.

Silphium perfoliatum L.  
Cup Plant.  
I have seen a colony on the river bank, but failed to find it the past season.

Heliopsis scabra Dunal.  
False Sunflower.  
Prairie. Frequent. June 20 (22).

Rudbeckia laciniata L.  
Tall Coneflower.  

Ratibida columnaris (Sims) D. Don.  
Coneflower.  
Along railroad (introduced?) Occasional. July 5 (7).

Helianthus annuus L.  
Common Sunflower.  

Helianthus petiolaris Nutt.  
Along railroad or other dry soil. Occasional. July 5 (4).
Helianthus scaberrimus Ell. ROUGH SUNFLOWER.

Helianthus maximiliani Schrad. *NARROW-LEAVED SUNFLOWER.

Helianthus tuberosus L. JERUSALEM ARTICHOKE.
Low fields and roadsides; especially near the woods. Common.
Aug. 20 (18). The records of H. giganteus and grosse-serratus are considered as errors, the specimens being maximiliani.

Bidens cernua L. BUR MARIGOLD.
Riverbank or other low places. Occasional. Aug. 20.

Bidens comosa (A. Gray) Wiegand.

Bidens frondosa L. BEGGARTICKS.

Bidens vulgata Greene. *LARGE BEGGARTICKS.

Galinsoga parviflora Cav.
C. H. Waldron in 1911 near Oak Grove.

Gaillardia aristata Pursh. GAILLARDIA.
Lee in 1891. Unknown to me in immediate vicinity. I have seen it on a knoll near the Sheyenne River at Christine. June 20 (17).

Achillea lanulosa Nutt. MILFOIL. YARROW.

Anthemis cotula L. DOG FENNEL.
Along railroad and streets. Frequently introduced but little persisting. June 20.

Chrysanthemum leucanthemum L. OX-EYE DAISY.

Artemisia caudata Michx. PRAIRIE WORMWOOD.
Along railroad, introduced in gravel. Aug. 10.

Artemisia frigida Willd. LITTLE SAGE.
Bergman in 1910.

Artemisia absinthium L. ABSINTH.

Artemisia biennis Willd. WORMWOOD.
Artemisia ludoviciana Nutt.  

*Prairie Ragwort.*

Petasites sagittata (Pursh) Gray.  
Wet place in aspen woods on Minnesota side. May 10.

*Sweet Coltsfoot.*

Senecio plattensis Nutt.  

Golden Ragwort.

Senecio aureus L.  
Woods near County Hospital and on Minnesota side. May 25.

*Prairie Ragwort.*

Arctium minus Schk.  

Burdock.

Carduus lanceolatus L.  

Bull Thistle.

Carduus altissimus L.  
Roadsides near the woods. Occasional.

Tall Thistle.

Carduus undulatus Nutt.  
Prairie, roadsides and fields. Common. July 5 (5). This common name is very appropriate for this region. *C. flodmannii* Rydb. is listed by Bergman but I am as yet in doubt whether or not all should be placed under the preceding.

*Prairie Thistle.*

Carduus arvensis Robs.  

Canada Thistle.

Centaura cyanus L.  
Occasionally escaped from gardens. June 25.

Corn-Flower.

Cichorium intybus L.  
Stevens in 1910.

Chicory.

Lapsana communis L.  
Stevens in 1911. Introduced in lawngrass seed mixtures.

Nipple-Wort.

Tragopogon pratensis L.  

Goat's-Beard.

Taraxacum taraxacum (L.) Karst.  
Prairie to woods, literally everywhere. Apr. 30 (29).

Dandelion.

Taraxacum erythrospermum Andrz.  
Red-Seeded Dandelion.

Woods and nearby roadsides. Frequent. I have not been able secure accurate flowering data.

Red-Seeded Dandelion.

Sonchus arvensis L.  

Permanent Sow-Thistle.
Sonchus oleraceus L.
Streets. Occasional. The name "Common sow-thistle" ordinarily applied would be both inappropriate and misleading for this locality.

Sonchus asper (L.) Hill.

Lactuca scariola L.
SING SOW THISTLE.

Lactuca ludoviciana (Nutt.) D C.
WESTERN WILD LETTUCE.
Prairie and roadsides. Frequent. July 5.

Lactuca canadensis L.
WILD LETTUCE.

Lactuca pulchella (Pursh) DC.
BLUE WILD LETTUCE.

Lactuca spicata (Lam.) Hitch.
TALL BLUE LETTUCE.
Woods. Frequent.

Agoseris glauca (Pursh) Greene.
FALSE DANDELION.

Crepis tectorum L.
HAWK'S BEARD.
C. H. Waldron in 1912.

Crepis capillaris (L.) Wallr.
Stevens in 1918 (lawn).

Hieracium scabriusculum Schwein.
HAWKWEED.
Woods. Occasional.

Nabalus albus (L.) Hook.
WHITE LETTUCE.
Woods. Frequent at least in or near aspen on Minnesota side. Aug. 15.

Nabalus racemosus (Michx) DC.
Prairie. Stevens in 1920; not previously reported but quite common in that particular place. Aug. 25.

Alismaceae, Water Plantain Family.

Alisma plantago-aquatica L.
WATER PLANTAIN.

Sagittaria arifolia Nutt.
ARROW-HEAD.

O. A. Stevens,
North Dakota Agricultural College.
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The Origin and Development of the Earth.

BY CARROLL LANE FENTON

Geology is the science which treats of the materials, the constitution, and the development of the earth. The history of the events which have brought this planet and its inhabitants to their present state of being forms one of the principal divisions of the science. Of necessity such a history had a beginning, and concerning this beginning men have ever been prone to speculate. At first these speculations were the mere superstitions contrived in the minds of untutored savages, and we may find many of them in the mythology of the Indians of our own country. Later, in the beginnings of civilization, the philosophers of their time advanced ideas—less erratic and superstitious, perhaps, but hardly less impossible of truth than those of their savage ancestors. But gradually things changed. The invention of the telescope and the study of physics taught man much. Speculation and guesswork slowly gave way before scientific investigation, and within the last few decades there has been a more or less organized effort on the part of the world's greatest scientists to put to use the combined resources of chemistry, astronomy, physics, and geology in order to find a solution for the problem before them. That their efforts have not been without success may be seen when the various hypotheses in which they have resulted are considered.

Some suggestions as to the birth of our planet may be found in a study of its relations to the other bodies of the solar system, and in its characteristics as a member of that system. We may feel quite certain in saying that no such
complicated organization as that which is displayed by the sun and its attendant bodies ever came into existence by accident. Beyond possibility of question the story of the birth of the system would be revealed in its organization and forces, were man only able to read that record. But in spite of the fact that we can give no positive definite interpretation of the remaining traces of the earth's beginning it is necessary, in order to carry on investigation, to form hypotheses to explain them. It is also important that we study these hypotheses carefully and note the various ways in which they may enter into the doctrines and ideas of modern science. Not a few of the principles of geology, astronomy, and even biology rest upon some hypothesis of the earth's origin, and have no greater strength than that of the hypotheses on which they are founded.

1.—The Laplachian Hypothesis.

It is the almost universal opinion among astronomers that the solar system was evolved from some sort of a nebula. Until comparatively recently most of them accepted a special hypothesis advanced in the latter part of the eighteenth century by the great French mathematician Laplace. So general was the acceptance of Laplace's idea that it came to be known as the "Nebular Hypothesis," without consideration of the fact that there were several other hypotheses which also supposed that the solar system was derived from a nebula. This explanation of Laplace's was supposed to offer a thoroughly satisfactory interpretation of the existing evidence as to the origin of the solar system, and therefore of the earth. But with the advance of geological and astronomical knowledge it became evident that the Laplacian hypothesis did not satisfactorily explain the origin of the earth, and that a new interpretation was necessary.

The Laplacian, or as it is popularly called, the Nebular Hypothesis has, however, gained so firm a foothold in literature and general knowledge that we must give it a careful survey before passing on to newer and more satisfactory ideas. Laplace supposed that the solar system was descended from an immense, rotating ball of gas which extended beyond the orbit of the outermost planet—that is, which had a diameter
of more than 5,600,000,000 miles. This ball of gas, which supposedly contained all of the material in the solar system today, possessed at its beginning a very high temperature which it immediately began to lose, just as any hot object will lose its heat. This loss of heat caused shrinkage of the mass, and therefore increased rapidity of rotation. In the course of this rotation great rings of gas, one ring for each of the planets, were left by the contracting central mass. These rings, it is supposed, resembled those about the planet Saturn—in fact it is quite probable that the Saturnian rings suggested this part of the hypothesis. The rings in turn broke up, formed spheres, and in time gave off smaller rings to become the satellites.

According to this interpretation, the earth was originally a globe of very hot vapor which in the course of time cooled, contracted, and gave off a ring which went through the same process and became the moon. The parent mass continued to cool and shrink until it became liquid, and finally formed a crust over its outer surface, the interior still remaining very hot. At this early stage of the earth's history the atmosphere contained all of the gases which now compose it, great quantities of gases that are now united with other elements as parts of the rocks, and all of the hydrogen and oxygen that are now in the waters of the planet. When the cooling process had gone on for so long that gases formerly in the atmosphere could stay in the earth, and those falling as water could remain upon it instead of passing back as vapor, the ancestors of our present oceans began to form.

The hypothesis is skilfully devised, and carefully worked out in many of its details. But in many respects it contains glaring anomalies, and many of the conditions on which it depends could never have existed. In the first place, let us consider the supposed parent nebula a little more closely. The total amount of matter which it contained is now in the solar system—no more, no less. Its diameter was, of necessity, at least 5,600,000,000 miles, and the original hypothesis calls for an even greater figure. Dr. Moulton, of the University of Chicago, has computed that in such a nebula the density would be only one two-hundred-forty millionth of that of air at sea-level—thousands of times more rarified than the most
perfect vacuum that man has been able to produce. How such a nebula, too thin to be perceived by any of our instruments, could have held itself together, and could have retained its heat for any length of time is impossible to understand. Likewise it is impossible that such a nebula should have given off a single ring, even at its earliest stages, or how such a ring, had it been formed, could have condensed into a sphere that could in time become a planet. As well ask the ring of smoke blown from your cigar or pipe to become a ball.

There are also movements of certain of the planets and their satellites that argue strongly against the Laplacian idea. If satellites evolved from rings that come from rotating planets, they should revolve around those planets in the same direction and with the same speed that the planets themselves turn upon their axes. Now the inner satellite of Mars revolves about the planet three times while Mars turns on its axis once, and the ninth satellite of Saturn has been shown to move in a direction opposite to the one in which the planet itself turns. Under the Laplacian hypothesis these things could not be, yet they unquestionably have been observed.

There is, however, one other line of argument which would dispose of the "nebular" hypothesis even though there were no other points against it. The moment, or amount, of momentum of any freely rotating system such as that to which our earth belongs must forever remain constant; that is a well-established principle of physics. In any ancestor of our solar system the moment of momentum must have equaled that of the present system, for the matter composing the one composes the other. But we find that such a nebula as the one postulated by Laplace could not have thrown off a ring until it had shrunk far within the orbit of the innermost planet. In order for this nebula to have produced the supposed ring from which Neptune was to descend it must have possessed at least 200 times the momentum that is in the solar system today. And yet the moment of momentum of any freely rotating system must forever remain constant.

Or let us consider matters from another angle. If the Laplacian hypothesis were correct, the amount of momentum which a planetary ring could possess should be directly proportional to the amount of material in that ring; the greater
the ring, the greater the moment of momentum. Now the mass of material composing the ring from which Jupiter and his suns supposedly descended was about one one-thousandth part of that of the parent nebula at that particular stage of its development, but these same planet and satellites contain 95 percent of the solar nebula at that stage. Equally striking discrepancies appear when the momentum of the other planets is considered. In other words, the Laplacian hypothesis seems to demand that the solar system be so organized that the planets and satellites, amounting to about one seven-hundredth of the total mass of the system, were able to carry off more than 97 percent of its total momentum. There is no law of physics or astronomy that will allow for such a condition.

So far, the arguments against the nebular hypothesis which we have considered have been principally astronomical, and credit for their discovery and elaboration must be given to Dr. F. R. Moulton, the first astronomer to seriously consider the difficulties in the way of Laplaceism. There are other arguments, perhaps equally strong, coming from the geologists and paleontologists, but these will be left for consideration farther on in the paper. On the whole, the Laplacian hypothesis must be given up. The idea of a molten globe which is gradually cooling and losing its atmosphere; of the moon as a dead body, and the earth and Mars as dying ones is very poetic but it fails to stand the test of modern science. Writers of feature articles for Sunday papers, and of "popular" books on alleged science still favor the old idea, for it works up excellently into sensational treatment. We must, however, as did geologists and astronomers of thirty years ago, look for another solution.

2.—The Meteoritic Hypotheses.

No matter how great the popularity of any hypothesis there are bound to be people who will disagree with it and advance other ideas, and the Laplacian hypothesis was no exception to this rule. Hundreds, even thousands of years before Laplace's time it had been noted that "shooting stars" enter the atmosphere in great numbers, and that occasionally fragments of stony or metallic material fall to the earth. From the ob-
servation of these meteors and meteorites arose the idea that the earth had been built up from them, the rate of infall being more rapid in the early history of the process. The great irregularity in the motions and velocities of the observed meteorites soon shows that this explanation fails to account for the development of any such orderly and harmonious motions as are to be seen in the solar system.

George Darwin, a son of the great Charles Darwin, still thought he saw in the infall of meteors and meteorites a possible solution of the origin of the solar system. He believed that meteorites might be brought together into swarms, thus constituting nebulae. These nebulae would, according to Darwin, behave essentially as though they were composed of gases, and the laws of gases might be used in determining their mechanics. If this were the case, the same objections which have been raised against the Laplacian hypothesis apply to the one sponsored by Darwin and Lockyer, so it need not be given further attention.

3.—The Planetesimal Hypothesis.

When the failings of the Laplacian hypothesis became so evident, and the hypothesis of Lockyer and Darwin showed itself to be unreliable—in fact, less satisfactory than that of Laplace—an alternative more suited to the facts was looked for. Earlier astronomers and astrophysicists had maintained that the matter of a nebula, if composed of particles revolving around their common center of gravity, could not come together into planets without giving them a backward motion. The six inner planets of the solar system have forward rotations, and for the time being all hypothesis of the strictly nebula type seemed to be ruled out. A more careful survey, by Doctors Moulton and Chamberlin, showed that this conclusion was wrong, and that there was no initial barrier in the way of a hypothesis in which the solar system was supposed to be descended from a nebula. It was also shown by astronomic photography that there were many times the number of nebulae that there formerly were thought to be, and it was to these that Dr. Chamberlin turned his attention.

The nebulae known at the present time seem to fall into two classes, when studied with the spectroscope. The first
class is characterized by bright spectral lines which indicate a structure somewhat akin to gaseous, although it is not certain that this is the actual condition. Due to the fact that these nebulae show the presence of some elements not known to exist in any part of the solar system, and since there is absolutely no indication of metals in their constitution, they have been ruled out. It is, of course, conceivable that the elements composing these nebulae might in the course of time become elements such as we know, but is mere supposition, and will not suffice as a ground for basing a hypothesis.

The other class of nebulae give what are called "continuous line" spectra, which is commonly interpreted to mean that the materials composing them are in either liquid or solid state. It is also almost certain that these nebular materials are in very finely divided particles, for in spite of the immense size of the nebulae they are known to intercept very little light and possess but slight gravitative power. Their spectra show, it seems, the presence of the same elements that compose the solar system, and their number is at least ten times as great as that of the nebulae of the "bright line" type.

The dominant type of these nebulae is the spiral, as was determined by the great astronomer Keeler, for years the director of the Lick Observatory. The distinguishing characteristic of the spiral nebulae is a central mass or ball with two arms which arise from opposite sides of the central mass and curve concentrically away from it. In the outer regions of these arms they commonly branch, but throughout all of the spiral nebulae the two dominant arms may be distinguished. In these nebular arms there are also considerable knots between which the nebulous matter is irregularly distributed. It is clear, from oblique views of the nebulae, such as that of Andromeda pictured in the accompanying plate, that the spirals are roughly disk-like, a shape which corresponds with that of the solar system.

The results of their study of the various characteristics of the spiral nebulae convinced Chamberlin and his associates that here, if anywhere among the astronomical bodies, they might successfully look for the traces of the earliest history of the solar system. While nothing is as yet known of the motions of the parts of these spirals, their shape seems to
indicate that they are the products of combined outward and rotatory movement. The former is indicated by the pro-
tuberance of the arms, the latter by their pronounced coiling. Such a supposition calls for the existence of an earlier body that embraced the whole mass, and from which the present nebula is descended. We are forced to look, not only for the ancestor of the solar system, but for the ancestor to that an-
cestor. Such exploration must, of course, possess a good deal of uncertainty, and its results must be taken, as the saying is, with a grain of salt. Nevertheless, where there are thousands of known cases similar to that under consideration—i. e., the spiral nebula—and in all of these cases the same results are evident, it is not out of the way to suppose that the same causes apply throughout. What the scientist must do in such a case is to determine what conditions might produce the re-
results observed, and take the most satisfactory of the hypo-
theses as the one on which to base his further work.

This is precisely what Professor Chamberlin did. The body most apt to produce a nebula of any sort is a sun, and of these there are more than 100,000,000 known, besides an unknown multitude of dark bodies which move through space, and of whose existence we have no definite knowledge. Among such a throng of celestial bodies it is almost inevitable that collisions should have occurred during the billions of years which the universe has been in existence. These collisions would naturally occur in the regions where stars are thickest, and it is worthy of note that in such a region, the Milky Way, the number of new stars—stars which appear where none were before—and also the number of bright line or free-
molecular nebulae, are the greatest. This does not mean that the new stars and the bright line nebulae necessarily arise from the collision of two celestial bodies, but it does give weight to the statement that such collisions occur.

If collisions between stars occur, as it is almost certain they do, there must be much greater probability of close approach of the stars to one another or to dark bodies. There are several astronomical considerations which make it probable that close approach rather than actual collision is responsible for the origin of the spiral nebulae, and it was therefore selected by Chamberlin. It must be remembered, however,
that the planetesimal hypothesis, as the proposed explanation of Chamberlin and Moulton is called, does not rely upon any set origin of the spiral nebulae; it merely proposes an origin for them. Its true basis is the existence of the spirals, which is unquestioned.

Our present sun shoots out great protruberances to the heights of many thousands of miles at velocities which, were it not for the great weight of the sun's atmosphere, would carry them to the outer limits of the solar system, or perhaps even beyond it. Let us now suppose that another sun were to approach ours. The attraction between the two, due to gravity, would greatly increase the tension upon the sun, and would thus cause great tidal protruberances to arise. These protruberances, were the forces causing them great enough, might well leave the sun, never to return. Of such material, arising much as in the manner briefly outlined above, the planets and satellites are supposed to be composed.

We have said that the forms of the spiral nebulae seem to imply that they originated through two types of movement—outward, and rotatory. The outward movement we have just accounted for in the projection of the protruberances from the parent sun through the attraction of another sun passing relatively near it. It now remains for us to account for the rotatory motion.

The protruberances would, according to this hypothesis, be thrust out as the ancestral sun and the passing star were swinging about their common center of gravity. The protruberance shot from the sun in the direction of the star would be drawn into a curved path by the attraction of the star, and the same would be true of the opposite projection, but to a lesser extent. The accompanying diagram, taken from Moulton shows how this would develop a spiral from the partially disrupted sun. Since in the course of rotation the inner parts of the spiral moved more rapidly than the outer, just as the small hand of a clock rotates more rapidly than the large, the arms became more closely coiled, finally developing a closely coiled spiral probably somewhat similar to the accompanying restoration. Since the parent sun was gaseous, as it is today, the particles composing the arms must have originally been in a free molecular state. Their enormous
dispersion, with corresponding opportunity for cooling would soon make of them liquid or solid particles revolving about the sun as their common center of gravity. These particles were the originals of the planetesimals, or as the word means, "little planets."

We now have the spiral nebula, ready for the final development into the solar system. In it are five elements which are to perform the leading parts in the evolution of a planetary system from the spiral. They are:

1. The great central mass (to become the sun.)
2. The main knots in the arms (to become the planets.)
3. Minor arm knots near the large knots, and more or less controlled by them (to become nuclei for the satellites.)
4. Small, scattered knots (to become nuclei of the asteroids.)
5. Scattered nebulous matter (to be added to the nuclei or sun.)

It is assumed that in the early spiral nebula the small particles, or planetesimals, possessed elliptical orbits, as do the bodies of the solar system at the present time. All of these orbits would have as their gravitative center the sun, as would also the orbits of the nuclei. In the course of their passages through space the various bodies, both nuclei and planetesimals, would either pass near to each other or collide and as a result the small particles would be drawn to the larger particles, and these in turn to the nuclei. We thus have the nuclei, or beginnings, of the planets gradually increasing in size by the acquisition of the scattered fine material of the nebula. How long this may have taken—how many thousands of millions of years the growth of a planet occupied—we have no means of telling, but without doubt it was many.

How small the nucleus of the earth was we do not know, just as we do not know how rapidly it was built up. We know that the process has not yet ceased, for every year millions of meteors come within the atmosphere. Most of them become dust before reaching the surface of the earth, but the larger
ones occasionally pass through the atmosphere without being totally destroyed, and reach the earth as meteorites. Obviously the process is now going on much more slowly than it was during the early history of the system, for the larger bodies were undoubtedly acquired early in the growth of the planet.

This conception of the origin of the earth differs, as can be readily seen, from the one proposed by Laplace. According to it the earth, instead of having shrunk from a ball much larger than it now is, has been built up from a mass the smallness of which cannot be determined. The moon, instead of being descended from a ring left behind by the contracting earth, had its origin in much the same manner as did our planet. Since it was never so large as the earth, and is quite near to it, it is controlled by the earth just as the earth is controlled by the sun.

We now come to the question which proved the undoing of the Laplacian hypothesis—that of movement and rotation of the planets and satellites. But according to Chamberlin’s hypothesis there would be no fixed relation between the rotation of a planet and the revolution of its satellites. The rotation of either a planet or satellite may be forward, or it may be retrograde. The former would be the rule and the latter the exception, and this is precisely the case with the solar system. There are many other features of the solar system to be fittingly explained by the planetesimal hypothesis. Certain of them possess added weight because they were not discovered until after the hypothesis had been formulated and published. Any hypothesis, if it is to be considered at all, must explain the facts which are known and considered when it is being formulated. But the hypothesis which merits serious study or even acceptance is the one which explains conditions that were unknown to its authors. This the planetesimal hypothesis of Chamberlin and Moulton to do.
Diagram of the supposed earth-moon stage of the Laplacian hypothesis. 1 is the central mass which is to form the earth, and 2 the ring which supposedly condensed into a ball and became the moon.

The earth on the Laplacian hypothesis. The heavy black portion represents the supposed solid "crust"; the lined disc represents the "molten interior."
A section of the earth on the basis of the Planetesimal Hypothesis (after Chamberlin and Salisbury). The inner division 1, represents original planetesimal matter, with some igneous rocks. The second zone 2, represents the times of earliest sedimentation. Planetesimal matter still dominates, but there is much igneous rock, and some sedimentary rocks, now changed by pressure and other agencies. 3 is a zone rocks, now much changed by pressure and other agencies. 3 is a zone of lavas and other igneous rocks, largely volcanic, with some sedimentary rocks. It represents the deposits of the time when planetesimals became few and small, but the pressure of the growing earth caused much vulcanism. 4 is the newer rocks, mostly sedimentary, representing deposits made from the times of the earliest known abundant fossils to the present.
Figure 3.

The ring nebula in the constellation Lyra. This nebula seems to be a great vortex of the smoke-ring type, and may be due to the center-to-center collision of two large suns. From Chamberlin. Photographed at the Lick Observatory.
The great nebula in Orion, and the Fish-Mouth Nebula. There are several great nebulae of this type known, but these are the most notable examples. They seem to have been co-partners in a mutual collision at rates of many thousands of miles per second. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
The remarkable spiral nebula, M 51, in the constellation Canum Venaticorum, or the Hunting Dogs. This nebula shows with remarkable clearness the great central mass from which extend two partly coiled arms. In these arms can be seen large knots, which play so important a part in the conception of the Planetesimal Hypothesis. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
An eruptive prominence of the sun, photographed at Yerkes Observatory on March 25, 1910. This prominence is but one of the many that are constantly being shot forth from the surface of the sun, rising many thousands of miles above its surface, and traveling at a speed of hundreds of miles per second in some cases.

The same prominence shown in Figure 6, photographed 43.2 minutes later. The immense size of the prominence, and the great speed which it possesses may be judged by comparison with the previous figure, and with the curvature of the visible portion of the sun's outline. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
Figure 8.

Eruptive prominences of the sun. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
Diagram by F. R. Moulton showing the supposed manner in which orbits and the spiral form of the nebula were formed. S is the ancestral sun of the solar system; the approaching sun passes along the path of the larger curve. When it is at the position $S_1$ it draws a body at $P'$ toward it in the direction of $C'$. As it passes on to $S_2$ it acts similarly on the particles coming out towards $P$. The result is a loosely coiled spiral, with the particles composing it revolving around the central mass or sun. From Chamberlin.
A spiral nebula in the constellation Pegasi, in which the arms are remarkably distinct and very slightly coiled. This nebula is very much like the supposed solar system nebula would have been in its early stages, before the arms coiled closely. Compare this nebula with the one shown in Figure 5. From Chamberlin, University of Chicago Press.
Figure 11.

An eruptive prominence of the sun in which there is a series of smaller knots projected with the main knot. Under the gravitative pull of a passing sun, such as postulated in the Planetesimal Hypothesis, there would be many such knots as these, but of even greater dimensions. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
An edge view of the spiral nebula HV 24, Comae Berenices, showing that it has a highly discoidal form. The dark band that shows across the central ball is probably caused by light-absorbing matter. The fact that spiral nebula are discoidal in form supports the hypothesis that the solar system, also discoidal, is descended from one of them. Photographed at the Lick Observatory. From Chamberlin, University of Chicago Press.
The spiral nebula M 74, in the constellation Piscium. This nebula contains a large central body and two well-defined and closely coiled arms. The arms bear a large series of knots that seem to be highly suited to serve as collecting centers for the nearby, scattered nebulous matter. Photographed at the Lick Observatory. From Chamberlin, University of Chicago Press.
Figure 14.
The gigantic nebula M 33, in Triangulum. Even this immense nebula is not too large to have originated in the manner which Dr. Chamberlin assigns for the formation of the spiral nebulae. Photographed at the Yerkes Observatory. From Chamberlin, University of Chicago Press.
4.—Effects of the Planetary Hypothesis on Scientific Ideas.

Such a radical change of thought as that involved in the giving up of the Laplacian hypothesis and the acceptance, either provisionally or otherwise, of the newer ideas of Chamberlin and his co-workers could hardly fail to affect scientific thought. We used to be taught that the earth was originally intensely hot; that its atmosphere was at the same time very heavy. We were told that the oceans were once composed of hot water, and that life could not exist until they had had time to cool. The atmosphere was said to be steadily decreasing in amount, and the atmosphere moon was held up to us as a horrible example of what the earth would some day come to.

Under the new hypothesis, conditions were very different, and these conditions coincide with the evidences of geology and biology. The earth was at one time, during the stage when it was just developing as a planet, too small to hold an atmosphere, just as is the case with the moon at the present time. Gradually the planet increased in size until it became large enough to hold an atmosphere—that is, about as large as the planet Mars. From that time on the earth has been growing, and its atmosphere increasing. When the oceans first formed they were probably no warmer than those of today, and the first life began in conditions essentially the same as those which now exist. Hundreds of millions of years ago there were great glaciers that reached far down into the torrid belt—to within 18 degrees of the equator, and hundreds of millions of years ago there were deserts, just as there are today. The interior of the earth is not inherited from a molten mass, nor is the center of the earth molten at the present time. Volcanoes, instead of springing from a great internal reservoir of molten material are comparatively superficial in their origin. These facts we know from geology and physics. They exist, yet they fit no known hypothesis but the Planetesimal. In closing, however, it will be well to bear in mind that the planetesimal hypothesis is not proved. The difference between a hypothesis and a theory is essentially the difference between perhaps and probably. A hypothesis
that is well enough substantiated may become a theory. To
many it seems that the planetesimal hypothesis is receiving
this support, but the authors do not yet assign to it the ele-
ment of certainty that is implied in the use of the word
"theory."

There are some statements, however, that may be made with
certainty. One of these is that neither the Laplacian hypo-
thesis nor any modification of it, nor any of the hypothesis of
the meteoritic group offer anything whatever of a satisfactor-
interpretation of the origin of the solar system. They have
been definitely proved to possess no foundation, and to
attempt to use them further, whether in geology or in any
other science is futile. On the other hand, the planetesimal
hypothesis stands out as the one existing explanation of the
earth's origin which has not shown flaws. It is in accord with
all known facts, and as said before, explains some that were
unknown at the time it was originally proposed. It affords
a reasonable and satisfactory basis for scientific and popular
thought, and as such a basis it is of almost inestimable value.

Nomenclatorial Notes on Certain American Plants.—I.
HOMER D. HOUSE.

BOTRYCHIUM ONEIDENSE (Gilbert) House, comb. nov.
This was originally described from Oneida county, New
York, as a variety of Botrychium ternatum (Fern Bul. (9) 27.
1901), and later (Walters, Ferns p. 334. 1903), transferred to
Botrychium obliquum as a variety. Additional collections
from Albany and Greene counties indicate that it is more
properly to be regarded as a distant species.

AGROSTIS PECKII House, nom. nov.
Agrostis montana R. Br.
A. torreyi Kunth, Enum. (1): 226. 1833.—Tuckerman in Hovey's
A. laxiflora var. caespitosa Torrey, Fl. N. Y. (2): 442. 1843.
A. oreophila (Trinius, misapplied by) Nash, in Britton & Brown,
NOMENCLATORIAL NOTES ON CERTAIN AM. PLANTS

A rather anomalous species, closely related to *Agrostis hyemalis*, possessing awned spikelets, and at higher altitudes with a tendency to form tufts with numerous slender radical leaves. The species as here considered may be regarded as based upon *Agrostis caespitosus* Torrey (1824), who first described it fully. The awn, when present, varies in length and springs from the back of the flowering glume. In recent floras this has been designated as *A. oreophila* Trinius, but that according to Hitchcock is, as to type specimen, a small erect form of *Agrostis perennans*.

_Torianthus_ type was collected on Mt. Beacon, near Fishkill, and it also occurs on Bald mountain, Herkimer county, _Plaine_, Haberer; Essex county, _Peck_, and Hamilton county, _Peck_.

TRIANTHELLA House, Gen. nom. nov.


TRIANTHELLA GLUTINOSA (Michx.) House, comb. nov.


_Triantha glutinosa_ Baker; i. e.

TRIANTHELLA RACEMOSA (Walt.) House, comb. nov.


_Tofieldia racemosa_ B. S. P. Prel. Cat. N. Y. 55. 1888.

_Triantha racemosa_ Small, Fl. SE. U. S. 249. 1903.

In this connection it is necessary to consider the generic name _Conradia_ or (*Leptilix*) Raf. Neogent. 3. 1825, which reads as follows:

"Diff. Tofieldia; cal. tridentate, cor. six parted, stam. six, base broad, pistil triangular, three short styles and capitate stigmas; one capsule, three angular, three locular, three valve, six seeded. Type all the American species of Tofieldia; the European have three capsules, six petals, etc."

_Tofieldia palustris_ Huds., with a deeply 3-lobed capsule, occurs in Europe and across the subarctic portions of America, a fact probably unknown to Rafinesque, which may ex-
plain his statement that *Conradia* includes all of the American species of *Tofieldia*. No definite type species is indicated, and the statement regarding the stamens having “base broad” applies better to *Tofieldia glabra* Nutt., than to the species of *Triantha* (Nutt.) Baker, and hence the name *Conradia*, doubtless meant by its author to cover this group, must be discarded, or at best considered as a synonym of *Tofieldia*.

**Polygonella serotina** (Raf.) House, comb. nov.


*Polygonella meissneriana* Shuttl. ex Meissn. in DC. Prodr. (14): 81. 1856.


The description of this species by Rafinesque is clear and sufficiently accurate to quite positively identify it with *P. americanum* (F. & M.) Small. The type locality is given as near Lexington, Kentucky. Rafinesque states that the species will probably belong to the genus *Polygonella* of Michaux, which he has called *Lyonella*. (In this connection it is to be noted that *Lyonia* Raf. Med. Repos. II. (5): 353. 1808, is a mere renaming of *Polygonella* Michaux, and hence rests upon the same type species. *Lyonella* Raf. Am. Mo. Mag. (2): 266. 1818, is also a renaming of Michaux’s genus *Polygonella*.

In the second edition of the Flora of the Southeastern United States, Small places *P. articulata* and *P. americana*, in the genus *Gonopyrum* Fisch. & Mey. 1840; and if this segregation of *Polygonella* be maintained, the plant under consideration will be called *Gonopyrum serotinum* (Raf.) House, comb. nov.

**Vitis lecontiana**, House, nom. nov.


From the manner in which “*Vitis bicolor*” is cited in the Index Kewensis, the authors of that index must have assumed that Rafinesque’s species was the same in character as well as in name, as that well known species first described by LeConte. An examination of Rafinesque’s description, however,
shows that his *V. bicolor* applies to some cultivated variety of *Vitis vinifera* with "berries round, soft, black and white on the same branch," and further, the description is placed in Section II, "Exotic Grape Vines."

Section I of Rafinesque's "monograph," treats of the "North American Grape Vines," and among the many species so inadequately defined, the real *Vitis bicolor* of LeConte, may exist under the names: *V. callosa, V. hyemalis, V. labruscoides* or *V. dimidata*, but it is quite impossible to find anything in the description of these four, which might positively indentify them with *Vitis bicolor* LeConte, here renamed in his honor.

In this connection it should be noted that while most of Rafinesque's names in the genus *Vitis* are impossible of recognition, they nevertheless render several later names invalid, viz:

- *Vitis obovata* Baker, Not Raf.

**Vitis Shuttleworthii**, House, nom. nov.


Native of peninsular Florida, in sandy soil.

**Pluchea Viscida** (Raf.) House, comb. nov.

*P. foetida* DC., l. c.

The description by Rafinesque reads as follows:

"Partly pubescent and clammy; leaves petiolate, elliptical, lanceolate, acuminate at both ends, mucronate, serrate, base entire, flowers corymbose, terminal and axillary, glomerulate; foliages of the perianthe ovate-lanceolate, acute, rufous, ciliolate.—A fine species not uncommon in Kentucky in fields and woods. It belongs to the genus Gynema of my Flora Ludoviciana. Stem two to three feet high. The whole plant has a very strong balsamic smell. It blossoms in August and
September; flowers pale red. I had formerly called it G. dentata. Biennial."

I am unable to find that Rafinesque had made an earlier publication of the name "G. dentata," and I assume that it was a manuscript name, and one evidently transmitted to his European correspondents, as the name seems to make its first appearance in DeCandolle's Prodromus in 1830.

**Clinopodium arkansanum** (Nutt.) House, comb. nov.

_Calamintha nuttallii_ Benth. in DC. Prodr. (12): 230. 1848.

_S. glabra_ Fernald, Rhodora (10): 85. 1908.

The range of this little member of the Mint family reaches eastward to New York state, at Niagara Falls.

**Viburnum eradiatum** (Oakes) House, comb. nov.


A subalpine species extending into the high mountains of northern New England and New York, and to northern Michigan and Minnesota.

**Agaloma Elliottii** House, nom. nov.

_Tithymalopsis gracilis_ Small, Fl. SE. U. S. 716. 1903.

Dr. Nieuwland (Am. Mid. Nat. 2: 299) has pointed out the fact that Agaloma Raf. is the correct generic name for the Euphorbiaceous genus heretofore called _Tithymalopsis_. The specific name, however, for this species is invalidated by the publication of two other species both called _Euphorbia gracilis_.

**Agaloma Marylandica** (Greene) House, comb. nov.

_Euphorbia marylandica_ Greene, Pittonia (3): 345. 1898.

An anamolous species of very limited range, known only from a few localities in the sandy region between Baltimore
and Washington. It is not improbable that this is the *Euphorbia uniflora*, so inadequately described by Rafinesque (Med. Repos. II (5) : 360. 1808), from the same region.

**SOLIDAGO ALLEO HANIENSIS** House, nom. nov.


In deep mountain woods from southern Pennsylvania and Maryland to West Virginia and Georgia and Alabama.

**SOLIDAGO SALARIA** House, nom. nov.


In marshes along the coast of the southeastern United States. Apparently also described by Pursh (Fl. 541. 1814) as *Solidago mexicana*, but not the *S. mexicana* of Linnaeus.

**FRAGARIA MICHGAUXIANA** House, nom. nov.


A common species of the northeastern United States. It is possible that the imperfect description of *Fragaria serotina* Rafinesque (Atl. Jour. 152. 1832) applies to this species, but positive identification of his description with this species appears to be impossible.

**SPONDOGONA** Raf. Sylva Tellur. 35. 1838.

*Dipholis* A. DC. in DC. Prodr. (8) : 188. 1844.

The generic name *Dipholis* A. DC., of the Sapotaceae is antedated by *Spondogona* Raf., the type of which is *S. nitida*, based upon the *Bumelia salicifolia* of Swartz. The only species of the United States, found on the Florida Keys and also in the West Indies is:

**SPONDOGONA SALICIFOLIA** (L.) House, comb. nov.

*Achras salicifolia* L. Sp. Pl. Ed. 2, 469. 1762


*Bumelia salicifolia* Sw. Prodr. Veg. Ind. Occ. 50. 1788.

*Spondogona nitida* Raf., l. c.

*Dipholis salicifolia* A. DC., l. c.

Several additional species of this genus are found throughout the West Indies.
MINUARTIA L. Sp. Pl. '89. 1753.

The generic name *Minuartia* appears to be the earliest available name for the group of species commonly referred to *Alsinia* Wahl. (Not L.), and more recently to *Alsinopsis* Small (Fl. SE. U. S. 419. 1903).

*Arenaria verna* L. has already been transferred to *Minuartia* by Hiern in 1899, who appears to have made the correct delimitation of this group of species.

**MINUARTIA MICHUAUXII** (Fenzl.) House, comb. nov.


Other species of this genus in North America are:

M. ARTICA (Stev.) *Arenaria arctica* Stev.
M. BIFLORA (L.) *Stellaria biflora* L.
M. BREVIFOLIA (Nutt.) *Arenaria brevifolia* Nutt.
M. CALIFONICA (Brewer) *Arenaria californica* Brewer
M. CAROLINIANA (Walt.) *Arenaria caroliniana* Walt.
M. DAWSONENSIS (Britton) *Arenaria dawsonensis* Britton
M. DOUGLASII (Fenzl.) *Arenaria douglasii* Fenzl.
M. GLABRA (Michx.) *Arenaria glabra* Michx. *A. groenlandica* var. *glabra* Fernald. *Alsinopsis glabra* Small

M. GROENLANDICA (Retz) *Stellaria groenlandica* Retz
M. HOWELLI (S. Wats.) *Arenaria howelli* S. Wats.
M. LARCIFOLIA (L.) *Arenaria larcifolia* L.
M. LITOREA (Fernald) *Arenaria litorea* Fernald

M. MACRANTHA (Rydb.) *Alsinopsis macrantha* Rydb.
M. MACROCARPA (Pursh.) *Arenaria macrocarpa* Pursh
M. MARCESCENS (Fernald) *Arenaria marcescens* Fernald
M. NUTTALLII (T. & G.) *Arenaria nuttallii* T. & G.
M. OBTUSILOBA (Rydb.) *Alsinopsis obtusiloba* Rydb.
M. OCCIDENTALIS (Heller) *Arenaria nuttallii* Pax. *Alsinopsis occidentalis* Heller
M. PALUDICOLA (Robinson) *Arenaria paludicola* Robinson
M. PATULA (Michx.) *Arenaria patula* Michx.
M. PROPINQUA (Richards) *Arenaria verna* var. *propinqua* Richards
M. PUSILLA (S. Wats.) *Arenaria pusilla* S. Wats.
NOMENCLATORIAL NOTES ON CERTAIN AM. PLANTS 133

M. QUADRIVALVIS (R. Br.)  Arenaria quadrivalvis R. Br.
M. ROSSII (Richards)  Arenaria rossii Richards
M. SAJANENSIS (Willd.)  Arenaria sajanensis Willd.
M. TENELLA (Nutt.)  Arenaria tenella Nutt.
M. TEXANA (Robinson)  Arenaria stricta var. texana Robinson
M. UNIFLORA (Walt.)  Stellaria uniflora Walt.

ALSINE L.

The type of the genus Alsine L., is Alsine segetalis L., a species congeneric with the several species heretofore placed in Tissa, Buda, Spergularia or Lepigonium. The species of the Eastern United States are:

ALSINE MARITIMA Pall. Reise Russ. (3) : 603. 1776 (Arenaria rubra marina L.; Spergularia salina J. & C. Presl.; Alsine media Crantz, not L.; Tissa marina Britton.)


ALSINE CANADENSIS (Pers.) House, comb. nov.


Buda borealis S. Wats. in Gray, Man. Ed. 6, 90. 1890.
Spergularia borealis Robinson, in Gray, Syn. Fl. (1) : 252. 1897.

A species of the northern shores of eastern America, which appears to reach its southern limit of distribution on the shore of Shelter Island, opposite Greenport, N. Y., where collected by Peck in 1871.

The following species of this group have been described from or reported from western America.

ALSINE CLEVELANDI (Greene)  Tissa clevelandi Greene
ALSINE DIANDRA (Guss.)  Arenaria diandra Guss. Arenaria salsuginea Bunge: Tissa diandra Britton
ALSINE TENUIS (Greene)  Lepigonium tenuis Greene; Tissa tenuis Greene; Spergularia tenuis Robinson
Alsine macrotheca (Hornem.) Arenaria macrotheca Hornem.; Tissa macrotheca Britton
Alsine leucantha (Greene) Tissa leucantha Greene
Alsine valida (Greene) Tissa valida Greene
Alsine luteola (Greene) Tissa luteola Greene
Alsine mexicana (Hemsl.) Spergularia mexicana Hemsl.; Tissa mexicana Britton

Alsine platensis (Cambess) Balardia platensis Cambess; Lepigonium gracile S. Wats.; Spergularia platensis Fenzl.; Tissa gracilis Britton; Spergularia gracilis Robinson.

Alsine bracteata (Robinson) Spergularia salsuginea var. bracteata Robinson; S. diandra Robinson; Tissa bracteata Small.

Alsine sparsiflora (Greene) Tissa sparsiflora Greene


Ramischia Opiz, Seznam 82. 1852.

Orthilia secunda (L.) House, comb. nov.

R. secundiflora Opiz, l. c.
Actinocyclus secundus Klotzsch, l. c.
R. secunda Garcke, Fl. Deuts. Ed. 4, 222. 1858.
O. parvifolia Raf., l. c.

In our northern swamps, merging into the var. obtusata (Turcz.) House, comb. nov. (Pyrola secunda var. obtusata Turcz.), originally described from northern Asia and Europe, but which appears to be practically the same as described by Paine (Cat. Pl. Oneida County 135. 1865), as var. pumila. All intermediate forms between the typical species and the var. obtusata, occur in a swamp near Newcomb, New York.

An additional species of this genus occurs in Mexico.

Orthilia elatior (Lang) House, comb. nov. (Actinocyclus secundus elatiór Lange; Ramischia elatior Rydberg).


Erxlebenia Opiz, Seznam 41. 1852.
Amelia Alef. Linnaea (28): 25. 1856,
Braxilia minor (L.) House, comb. nov.

Erzlebenia rosea (Smith) Opiz, l. c.
Amelia minor Alef., l. c.
Braxilia parvifolia Raf., l. c.

Common to the subarctic and northern boreal regions of Europe, Asia and America, reaching the eastern United States only in the northern portions of New England and Minnesota and extending southward into the high mountains of Colorado and California.

Plants of Fargo, North Dakota, With Dates of Flowering.

O. A. Stevens

(Continued from the last issue.)

Typhaceae. Cattail Family.

Typha latifolia L.

Sparganiaceae. Bur-reed Family.

Sparganium eurycarpum Engelm.

Potamogetonaceae. Pond-weed Family.

Potamogeton americanus Cham. & Schlect.
* In water. Bergman and Stevens, 1910.

Potamogeton perfoliatus L.
In water. Bolley in 1891; L. R. Waldron in 1902.

Potamogeton pectinatus L.
In water of river. Common. Name from the tubers which are eaten by the wild ducks.

Naiadaceae. Naias Family.

Naias flexilis (Willd.) R. & S.
Ponds. Collected by Lee, but specimen bears no date (No. 1338)

Cammelinaeae. Spiderwood Family.

Tradescantia bracteata Small.

Prairie, fields, and especially in gravel along railroad. Common. May 30 (27). The record of T. occidentalis is evidently an error, the specimen being T. bracteata.
Melanthaceae. Bunch-flower Family.

Zygadenus chloranthus Richards.

Liliaceae. Lily Family.

Allium stellatum Ker. *Pink wild onion.
Allium reticulatum Don. *White wild onion.
   Prairie. Frequent. May 20 (22).
Allium tricoccum Ait.
Lilium umbrellatum Pursh.*Wild lily.

Convallariaceae. Lily-of-the-valley Family.

Asparagus officinalis L. Asparagus.
   Frequently escaped from cultivation. May 30 (29).
Vagnera racemosa (L.) Morong. False spikenard.
Vagnera stellata (L.) Morong. Star-flowered Solomon’s seal.
Unifolium canadense (Desf.) Greene. False lily-of-the-valley.
   Frequent in aspen woods on Minnesota side. May 30.
Uvularia grandiflora J. E. Smith. Large-flowered bellwort.
   Woods. Occasional, common in aspen woods. May 10 (8).
Uvularia sessilifolia L.*Small bellwort.
   Common in aspen woods on Minnesota side, rare on Fargo side.
May 15 (13).


Trilliaceae. Trillium Family.

Trillium cernuum L. Nodding wake robin.

Smilacaceae. Smilax Family.

Smilax herbacea L. Carrion flower.

Juncaceae. Rush Family.

Juncus balticus Willd.
Plants of Fargo, Etc.

Juncus interior Wiegand.
  Prairie. Frequent.
Juncus torreyi Coville.
  Bolley in 1891.

Araceae. Arum Family.

Arisaema triphyllum (L.) Torr. JACK-IN-THE-PULPIT.

Lemnaceae. Duskweed Family.

Lemma trisulca L. IVY-LEAVED DUCKWEED.
  Ponds and ditches. Common.
Lemma minor L.
  On ponds and river. Common.

Spirodela polyrhiza (L.) Schleid. LARGE DUCKWEED.
  On river with the preceding. Stevens in 1919.

Amaryllidaceae. Amaryllis Family.

Hypoxis hirsuta (L.) Coville. STAR GRASS.
  Low prairie. Lee in 1891.

Iridaceae. Iris Family.

Sisyrinchium angustifolium Mill. BLUE-EYED GRASS.

Orchidaceae. Orchid Family.

Cypripedium candidum Willd. SMALL WHITE LADY'S SLIPPER.
  Lee in 1891; L. R. Waldron in 1899.
Coeloglossum bracteatum (Willd.) Parl. LONG-BRACTED ORCHIS.

Cyperaceae. Sedge Family.

Cyperus erythrorhizos Muhl.
  Riverbank. Frequent. Aug. 5.
Cyperus esculentus L.
  Riverbank (Oak Grove). A considerable colony, first collected
  by Stevens in 1918.
Scirpus validus Vahl. GREAT BULRUSH.
Scirpus heterochaetus Chase.
Scirpus paludosus A. Nels. PRAIRIE BULRUSH.
  More in low flat areas than the last or next. Common.
The American Midland Naturalist.

Scirpus fluviatilis (Torr.) Gray.  
River bulrush.  

Scirpus atrovirens Muhl.  
Lee in 1891. June 30.

Heleocharis engelmannii Steud.  
Low, wet places. Occasional.

Heleocharis palustris (L.) R. & S.  

Heleocharis acicularis (L.) R. & S.  
Pond margins and ditches, especially on mud left by retreating water. Common.

Heleocharis wollii Gray.  
Low prairie. Occasional.

Heleocharis acuminata (Michx.) Nees.  

Carex rosea Schk  

Carex deweyana Schwein.  
Dewey's sedge.  

Carex vulpinoidea Michx.  
Fox sedge.  

Carex gravida Bailey.  
Low prairie or near thickets and woods. Common.

Carex stipata Muhl.  

Carex marcida Boott.  

Carex sychnocephala Carey.  
Riverbank. Occasional.

Carex straminea Willd.  
Three specimens referred here by Bergman.

Carex festucacea Schk.  
Fescue sedge.  

Carex bicknelli Britton.  
One specimen referred here by Bergman.

Carex aquatilis Vahl.  
Riverbank. Frequent.
Plants of Fargo, Etc. 139

Carex laxiflora Lam.

Carex tetanica Schk.
   Prairie. Stevens in 1920.

Carex polygama Schk.
   Woods on Minnesota side.

Carex gracillima Schwein.
   Woods on Minnesota side.

Carex obtusata LIL.
   Low prairie. Stevens in 1920. Quite abundant at least in this particular place (3 mi. NW.)

Carex penna.sylvanica Lam.
   Woods. Frequent. May 5 (6); woodland form, excluding Apr. 4, 1910. Bergman includes in this a form common on the prairie (C. heliophila Mackenzie).

Carex lanuginosa Michx.
   Low prairie or ditches. Common. May 20 (21).

Carex trichocarpa Muhl.
   Sloughs and other low ground. Common. The var. aristata (R.Br.) Bailey perhaps also common.

Carex assiniboensis W. Boott.
   Woods on Minnesota side. Frequent.

Poaceae. Grass Family.

Andropogon furcatus Muhl.

Sorghastrum nutans (L.) Nash.
   Prairie. Bolley in 1890.

Syntherisma sanguinalis (L.) Dulac.
   Lawn. Stevens in 1920.

Syntherisma humifusum (Pers.) Rydb.
   Lawns or waste ground. Occasional.

Panicum capillare L.

Panicum miliaceum L.
   Occasionally escaped from cultivation.

Panicum virgatum L.

Panicum perlongum Nash.
   Low prairie. Stevens in 1920; very abundant in this particular place (3 miles N. W.) June 20.
Panicum leibergii (Vasey) Scribn.

Echinochloa crusgalli (L.) Beaur.

Chaetochloa glauca (L.) Scribn.

Chaetochloa viridis (L.) Scribn.

Chaetochloa italic a (L.) Scribn.
  Frequently escaped from cultivation.

Cenchrus carolinianus Walt.
  Along N. P. Ry. Stevens in 1918.

Zizania aquatica L.
  Edge of river. Abundant in some years (1910, 1918, 1919),
  none or rare in others (1920). Aug. 10.

Homalocenchrus oryzoides (L.) Poll.

Phalaris arundinacea L.
  Ditches or low prairie. Frequent. June 20.

Phalaris canariensis L.
  L. R. Waldron in 1895.

Hierochloa adorata (L.) Wahl.
  Low prairie or roadsides. Common. May 15 (14).

Stipa viridula Trin.

Stipa comata Trin. & Rupr.
  Along railroad (introduced in gravel?) Occasional.

Stipa spartea Trin.
  Prairie. Frequent. June 25 (one year only; viridula on same
date).

Oryzopsis asperifolia Michx.

Oryzopsis racemosa (Sm.) Ricker.
  Woods. Occasional.

Muhlenbergia mexicana (L.) Trin.

Muhlenbergia racemosa (Michx) B. S. P.
  Woods and roadsides. Common.

Muhlenbergia foliosa Trin.
A specimen from the aspen woods on the Minnesota side seems to belong here (Stevens in 1918).

*Muhlenbergia cuspida* (Torr.) Nash.


*Phleum pratense* L.  
MARSH FOXTAIL.

*Allopecurus geniculatus* L.  
MEADOW FOXTAIL.

*Allopecurus pratensis* L.  
Field (planted?) near Sacred Heart Academy. Plowed up in 1920. May 30.

*Sporobolus neglectus* Nash.  
SMALL RUSH GRASS.

*Sporobolus asper* (Michx.) Kunth.  
Prairie. Frequent. (Seen both south and north of town in 1920 but not previously recorded.)

*Sporobolus cryptandrus* (Torr.) Gray.  
Along railroad track (introduced?); Bergman in 1910.  
DROPSEED GRASS.

*Sporobolus heterolepis* Gray.  
NORTHERN DROPSEED.

*Agrostis alba* L.  
Ditches or other wet ground. Frequent. June 25.  
REDTOP.

*Agrostis hyemalis* (Walt.) B. S. P.  
HAIRGRASS.

*Calamagrostis hyperborea* Lange.  
Low prairie, sloughs etc. Frequent. June 30.  
REED GRASS.

*Avena fatua* L.  
WILD OATS.

*Avena torreyi* Nash.  
CORD GRASS.

*Spartina michauxiana* Hitch.  
Low prairie, roadsides, ditches, etc. Common.  
SLough GRASS.

*Beckmannia erucaefor mis* (L.) Host.  
BLUE GRAMA.

Prairie. Occasional. Also introduced in gravel along the railroad tracks.

*Atheropogon curtipendulus* (Michx.) Fourn.  
Prairie. Frequent.
Phragmites phragmites (L.) Karst.  
Sloughs. Frequent.

Eragrostis purshii Schrad.  
Along railroad. Stevens in 1910.

Eragrostis major Host.  

Eragrostis hypnoides (Lam.) B. S. P.  
On mud along river bank. Common.

Sphenopholis obtusata (Michx.) Scribn.  
Low prairie. Stevens in 1920.

Koeleria crisata (L.) Pers.  

Distichlis spicata (L.) Greene.  

Dactylis glomerata L.  
Roadsides. Occasional.

Poa pratensis L.  
Prairie, roadsides and various places. Common. June 10 (9).

Poa compressa L.  
Occasional in various places. June 20 (20).

Poa triflora Gilib.  
Low prairie, sloughs, etc. Common. June 20.

Poa nemoralis L.  
One specimen referred here by Bergman.

Scolochloa festucacea (Willd.) Link.  
*D*Hollow Stem.*  
Ditches, edges of ponds etc; in water at least during the wetter portions of the year. June 15. This name I found in use near Rugby, N. D.

Panicularia grandis (S. Wats.) Nash.  
*D*Tall Manna Grass.*  
Ditches, sloughs, pond margins, etc. Common. June 20 (19).

Panicularia borealis Nash.  
Pond margins. Occasional.

Festuca elatior L.  
*Mealow Fescue.*  

Festuca nutans Willd.  
Woods. Occasional.

Bromus polyanthus Scribn.  
Lee in 1892. Cultivated or escaped.

Bromus japonicus Thunb.  
*Chess.*

Bromus pungens L.       

*Bromus inermis* Leyss.       
Roadsides. Common. June 20 (18). As this is the common bromegrass of cultivation the name may be used without qualifying adjectives. It is quite commonly spoken of as "Bromus inermis" or simply "Bromus."

*Lolium perenne* L.       

Brome grass.

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*Lolium perenne* L.       

Brome grass.
Ophioglossaceae. Adder's-tongue Family.

Botrychium virginianum (L.) Sw. MOON WORT.
Woods. Occasional.

Polypodiaceae. Fern Family.

Dryopteris cristata (L.) A. Gray. SHIELD FERN.
Woods. Occasional.
Matteuccia struthiopteris (L.) Tod. OSTRICH FERN.
Woods of Red and Sheyenne rivers. Occasional.

Equisetaceae. Horse-tail Family.

Equisetum arvense L. HORSETAIL.
Bolley in 1892.
Equisetum pratense Ehrh. RIVERBANK. FREQUENT.
Equisetum hyemale L. SCOURING RUSH.
Low places and in gravel along roadsides. FREQUENT.

Lycopodiaceae. Club Moss Family.

Lycopodium complanatum L. CLUB MOSS
A specimen said to have been collected in woods along the Sheyenne river, but I think there must be some error in the record.

A few records of cultivated plants have been kept, and some of native species not found in the Fargo region. The latter are often of only a single season and were taken at various places in the state. In a few cases such data have been used in the preceding list. In the following list where the locality is not given, the east central part of the state is the source of the record.

CULTIVATED PLANTS

Acer saccharinum L. SILVER MAPLE. APR. 10 (10).
Betula papyrifera Marsh. PAPER BIRCH. MAY 10.
Caragana arborescens Lam. SIBERIAN PEA-TREE. MAY 20 (21).
Crocus vernus All. CROCUS. MAY 10 (8); excluding the extremely early record of March 21, 1910.
Eleagnus argentea Pursh. SILVERBERRY. Wild Olive. MAY 30.
Hippophae rhamnoides L. SEA THORN. MAY 15.
Juniperus virginiana L. RED CEDAR. MAY 5.
Lipidium draba L. HOARY CRESS. PERENNIAL PEPPERGRASS.
June 10 (11).
Native Plants Not Occurring at Fargo

Loonicera tatarica L. Tartarian Honeysuckle. May 20 (20).
Medicago falcata L. Sickle Lucern. June 10 (8).
Populus balsamifera L. Balsam Poplar. Apr. 30.
Syringa vulgaris L. Lilac. May 20 (19).

NATIVE PLANTS NOT OCCURING AT FARGO.
Androsace puberulenta Rydb. Apr. 12, 1910 at Minot.
Astragalus crassicarpus Nutt. Ground Plum. April 12, 1910 at Minot.
Astragalus flexuosus Dougl. June 5.
Astragalus missouriensis Nutt. April 12, 1910 at Minot.
Astragalus pectinatus Dougl. Full flower at Williston, June 4, 1918.
Astragalus platensis Nutt. May 5; Apr. 12, 1910 at Minot.
Braunelia angustifolia (D C.) Heller. Purple Cone Flower.
June 25 (27).
Campanula rotundifolia L. Blue Bells. June 20.
Castilleja sessiliflora Pursh. June 5.
Chamaerhodos erecta (L.) Bunge. June 4, 1918 at Williston.
Chamaenerion angustifolium (L.) Scop. Fireweed. June 20; first flowers at Bottineau, June 9, 1917.
Coryphantha vivipara (Nutt.) Britton & Rose. Purple Cactus.
June 13, 1918 at Hettinger.
Crepis runcinata (James) T. & G. June 10.
Cryptantha calycosa (Torr.) Rydb. June 23, 1918 at Bowman.
Delphinium bicolor Nutt. In flower a few days at Williston, June 4, 1918.
Erigeron asper Nutt. June 5.
Erysimum asperum D C. Western Wallflower. June 5.
Hymenopappus filifolius Hook. First flowers at Hettinger, June 13, 1918.
Lesquerella arenosa (Rich.) Rydb. May 5; Apr. 12, 1920 at Minot.

Lupinus argenteus Pursh. In flower a few days at Hettinger, June 13, 1918.

Lupinus pusillus Pursh. In flower a few days at Hettinger, June 13, 1918.


MerioUx semdata (Nutt.) Walp. June 15.

Mertensia lanceolata (Pursh.) DC. May 5; Apr. 12, 1910 at Minot.


Oreocarya glomerata (Pursh.) Greene. In flower for some days at Williston. June 4, 1918.

Orophaca caespitosa (Nutt.) Britton. Minot, Apr. 12, 1910.


Oxytropis splendens Doug. Showy Loco. June 30, Northern parts of the State.

Parnassia palustris L. July 5.


Pentstemon angustifolus Pursh. In flower for some days at Williston, June 4, 1918.

Phacelia leucocarpa Torr. In flower some days at Bowman, June 20, 1918.


Picradeniopsis oppositifolia (Nutt.) Rydb. First flowers at Bowman, June 25, 1918.


Potentilla concinna Rich. May 10; Minot and vicinity.

Ranunculus aquatilis L. June 10.

Ranunculus glaberrimus Hook. Apr. 19, 1913 at Marmarth.

*The word “moss” appears so frequently in popular names for this plant that this name is suggested.
Ranunculus septantrionalis Poir. June 5.
Senecio integrerrimus Nutt. June 5.
Sideranthus spinulosus (Nutt.) Sweet. July 15.
Sideranthus grindelioides (Nutt.) Britton. In flower for some days at Bowman, June 20, 1918.
Thelypodium integrifolium (Nutt.) Endl. In flower for some days at Tappen, July 11, 1919.
Viola nuttallii Pursh. Nuttall's Violet. May 5; Apr. 12, 1910 at Minot.

The name of Thomas Nuttall, one of the early American naturalists, is well commemorated in this pretty little violet which is one of the characteristic spring flowers of the western part of the state. He described many of our plants for the first time from specimens collected along the Missouri River in 1810. (Note how often his name occurs in the above list.)
The following arrangement of the Fargo plants according to time of flowering may be useful:

<table>
<thead>
<tr>
<th>TREES, FLOWERS, ETC.</th>
<th>WEEDS</th>
<th>GRASSES, SEDGES, ETC.</th>
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<td>Apr. 10, Hazelnut</td>
<td>Shepherd’s Purse</td>
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<td>15, Pasque Flower</td>
<td>Frenchweed</td>
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<td>20, Buffalo Berry</td>
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<td>White Elm</td>
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<td>Prairie Buttercup</td>
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<td>Aspen</td>
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Carex pennsylvanica

The American Midland Naturalist.
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Albino Robins at Notre Dame.

BY BROTHER ALPHONSUS, C. S. C.

The robin seems to be a species in which albinos are not uncommon. Within the past six years there have appeared in the South Bend area two complete albino robins, and two that were partial albinos. These birds naturally attracted the attention of every one who visited the regions where they were staying.

The first white robin to be seen at Notre Dame was in the month of July, 1915. This bird, which made its home in the vicinity of the Grotto, was probably an old one, for no person had observed the parents feeding it at any time. In fact, this albino seemed to be looked upon by the other birds as an intruder, and was persecuted by them. It remained near the Grotto about a month, and then disappeared.

The color of this albino was not snow-white, but was of a less intense quality. It was, however, entirely white, and made a pretty picture when seen on the lawn or in the mulberry trees near the Grotto. These trees, no doubt, were what attracted the bird to the spot during the time the berries were ripe.

In the spring of 1920 a partial albino robin was observed on the grounds at Notre Dame near the Community House. A similar specimen was seen in the same place in the spring of 1921. This circumstance would seem to point to the fact that the identical bird of 1920 returned again in 1921. My observations of this robin were not extensive enough to ascertain whether or not it bred here either year. Whenever I saw the bird it was alone.

On July 5, 1921, Mr. W. H. Woollums of South Bend, Indiana, came to Notre Dame to acquaint the writer of the presence of a white robin, which, he said, had been hatched in a tree near his home in River Side Park. Mr. Woollums invited me to go with him to see this albino robin, and I did so the following day.
We arrived in the park at 9:45 a. m., and found the white robin just at the edge of the grass taking a bath in a pool of water made by a leaking hose. Mr. Woolums went into his house and got some bread crumbs. He approached the bird within ten feet and threw the crumbs to it; but the robin was enjoying its bath too much to heed anything else. Presently it felt satisfied and flew to a swing, which was nearer to us both. Here it remained a few minutes, giving us an excellent view. From the swing the albino went up into an elm tree just overhead, where it rested and preened its feathers.

Three days later I made another trip to River Side Park in company with Dr. J. W. Hornbeck, an ornithologist from Northfield, Minn. We arrived at the park at 10:15 a. m., but could not locate the bird for ten minutes. At length a lady who feeds the robin daily, decried it in a tree near her house. Here we observed the bird with our field glasses for five minutes, hoping it would descend to the lawn where we could see it better. It soon began to flutter in the trees, and then flew across the street and alighted in another tree. We followed it, but not too closely. In another minute it descended to the ground, and suddenly the male bird and another young robin came up to the albino. The old bird had a worm in its bill, which was intended for the white fledgling, but was grabbed by its greedy brother. The albino then flew towards the river, but we did not follow it any further. Our view of these robins had been quite satisfactory, and was, perhaps, an experience that few other bird lovers had ever enjoyed.

Dr. Hornbeck, with his powerful field glasses, found the eyes of the albino to be yellowish-pink. Various opinions about the color of the bird's eyes had been expressed by different observers, the more general one being that it was some shade of pink. The bill was a lighter yellow than in the ordinary robin. These variations from the normal robin's eyes and bill seemed to harmonize with the albino's plumage. On the head and throat the color was a dusky white.

Mr. Woolums told me he first discovered this albino on May 23, soon after it had left the nest. At the present writing (July 10) the bird would be about seven weeks old. I was surprised to learn that the parents feed their young so long
after they have been fledged. The lady's custom of feeding this albino has made it extremely confiding, for it will approach a person within two or three feet. Many kodak pictures of this white robin have been taken, and I give here four of them grouped together.

**BOOK REVIEWS**

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. *All other books for review* should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.


This is a book designed primarily for use in schools, but it will be of value to anyone who wants to find out the more essential facts about the things which Mr. Mosely discusses. The style is interesting, and the facts, while not new, are exactly those which most people do not know. The numerous quotations from poets serve to link the natural science of the book with the literature of the world, and they do it far better than could any long formal essay on the relation of poets and nature.

The section of the book devoted to trees is almost a complete popular manual for their study. There is an excellent discussion of the structure of the limbs, trunk, and roots, of various typical tree groups, and of the proper ways in which to care for trees, both old and young. The second part of the book, headed "Stars," not only treats of stars, but the planets, satellites, and nebulae. It, like the rest of the book, is non-technical, but is at the same time accurate and specific.

It is the third section, however—that on birds,—which most arouses my enthusiasm. That section should be enlarged a little by discussions of some of the general facts and problems of ornithology, and then
published as a separate book. I believe it would be accepted with enthusiasm by people all over the country who find the ordinary beginner's bird manual too conventional and stereotyped to arouse either their own enthusiasm or that of their children. The interesting discussions of the various families, the excellent half-tones, and the sixteen pages of colored plates by Louis Agassiz Fuertes make this section one of the finest popular treatments of the birds of North America that has appeared in some years.

C. L. F.

**The Burgess Bird Book for Children.** By Thornton W. Burgess. Little, Brown, and Co. $3.00.

**The Burgess Animal Book for Children.** By Thornton W. Burgess. Little, Brown, and Co. $3.00.

The problem of writing a book on birds that interests small children, and at the same time give them sound, reliable information has been well handled by Mr. Burgess in his "Bird Book for Children." Because there is no method of approach to the child mind that equals the story, this method has been adopted, but with considerably more success than in the "Bed-time Story Books" by the same author. The effort to keep the stories within the realm of childhood probability has succeeded, and the result is Mr. Burgess at his best.

The book is a series of stories, told by Peter Rabbit, Johnny Chuck, Striped Chipmunk, and the birds themselves. Every page is crowded with interesting facts of bird lore, so cleverly inserted into the conversations of the woodland people that there are no formal description, no fine text, and no footnotes. Fifty-eight species of birds are treated in detail, and many others are mentioned briefly. The whole work is so lively, so real that few children of the ages for which it is designed can resist its appeal.

The workmanship of the book deserves as much credit as the text. There are colored plates, from paintings by Louis Agassiz Fuertes, of each of the fifty-eight species that appear most prominently in the book. The paper, printing, and binding are excellent, and the child who takes pride in a good-looking book will be satisfied by this one.

The "Animal Book for Children" is a fit companion for the "Bird Book." The same method of story-telling is employed, with quite as much success. The word 'animal' is used instead of 'mammal,' which has little meaning to the child. There are no technical terms, no descriptions of subspecies, and no classifications. The sole purpose of the book is to help children to gain an intimate acquaintance with the field and wood, mountain, and plain—the animals which are "in the truest sense the first citizens of America."

The illustrations, again by Fuertes, are both in color and in black-and-white. In some cases the coloring and printing of the plates are faulty, and the black-and-white pictures are much the better of the two. The book is, unfortunately, a trifle smaller than its companion volume, but the general workmanship is quite as good, and the binding even more attractive—not a small consideration in the likes and dis-
likes of children. Both books are distinct accomplishments, and are just what nature-loving parents and teachers, and children who like the animal people of their world, have been wanting for years.

C. L. F.

THE METHOD OF SEARCH


How scale this barrier of rocks and overhanging boulders? Silently humble.

Without conceit in the past, without fancy of the future.

For to assume is to presume.

A healthy dissatisfaction is not the same as discontent.

Accept not for true on the bare assertion. Verify.

For it is usually ignorance which keeps people content with the worse; or, in the pithy word of Shakespeare, "There is no darkness but ignorance."

The summary of the section says that it deals with such subjects as: The Spirit of Search, The Need for Inquiry, Difference, and Continuous Oneness of Man. I shall take the summary at its word, being unable to find that it actually deals with anything whatever. The third section deals largely with disease, such as cancer, and has numerous pictures that are quite intelligible.

How are books like this allowed to come into existence? What sort of person, possessing any education whatever, will perpetrate such tommy-rot? Here are 324 pages of letter-press, printed on first-class paper, and bound as well as the average book of today. There are 322 line drawings and half tones, and several plates in color. And the total value of the book is less than nothing by the value of the materials used and the work consumed in its production. Science is neither mysticism nor scissors-work. Popular science, of course, must be dependent upon research work, and in that sense be parasitic, but it does not consist of making dozens upon dozens of clippings and tying them together by a few ill-phrased sentences.

I have just received a book by an Englishman, prominent among the anti-vivisectionists, who maintains that science is responsible for the woes of the world. This creation of Mr. Trumbull's makes me believe the anti-vivisectionist, at least to the point where I wish science had never invented the printing press, or for that matter even a language and alphabet.

CARROLL LANE FENTON.

A CENTURY OF SCIENCE IN AMERICA. Edited by Edward Salisbury Dana. Yale University Press. $4.00.

In 1918 occurred the centennial of a remarkable journal—the American Journal of Science, published at New Haven, Connecticut. In commemoration of the event there has been published a large volume, composed of several chapters by various specialists, these chapters portraying the development of science in this continent, with particular reference to the Journal.
The opening chapter, by the present editor of the Journal, Dr. Edward S. Dana, traces in detail the early history of the magazine and gives a sketch of its subsequent history. There is a table of scientific periodicals from 1771 to 1832, and a review of the various early scientific societies in Europe and America. The American Journal of Science was founded in 1818 by Benjamin Silliman, then "professor of chemistry, mineralogy, etc. at Yale College." Silliman had doubts as to the quantity of good material that he could get for his publication, and the support it would receive, so he widened its field as much as possible. The title-page of the first number states that the journal will deal with "Minerology, Geology, and the other branches of Natural History; including also Agriculture and the Ornamental as well as Useful Arts." It is interesting to contrast that with the present-day Journal, which is almost entirely restricted to mineralogy and geology, and finds difficulty in publishing the manuscripts that come in to it.

Dr. Dana tells of the completion of the first series of the Journal, of the changes in scope and staff, and of the addition of James Dwight Dana as associate editor. The history of the Journal up to its present issues is treated more briefly than is the early history, but is detailed enough to give the facts desired.

The remaining chapters of the book deal with various subjects of science. Of the twelve, five are concerned with geology, and one each with petrology, mineralogy, geophysics, chemistry, physics, zoology, and botany. The authors include such authorities as Charles Schuchert, Richard Swann Lull, William E. Ford, and Leslie R. Coe. They give excellent summaries of the subjects assigned them, and make the book an excellent one for reference. A feature of interest are the 22 portraits of scientific men of America and Great Britain.

C. L. F.


The first part of this new text on botany is intended to present the biological aspects of plant life from the standpoints of structure and function and is based upon studies of the higher and more familiar seed-bearing plants. Three main themes are considered: the relations and adaptations of the higher plants to other organisms and to the inanimate portions of their environments; the cellular structure of plants in relation to their growth, reproduction and anatomy; and the phenomena of reproduction with relation to crossing, hybridization, and plant breeding.

Part II deals with the morphology, life histories, and the evolution of the main plant groups. In the chapter devoted to the fungi, emphasis is placed on the nature of enzymes and fermentation, and on the relations of these processes to parasitism, disease, and decay. In the treatment of the higher spore-bearing plants, and seed plants much attention is given to the evolution of structure and reproduction, instead of placing the emphasis upon the mere reproductive features, as
is done in a great many of the older elementary text-books. In parts relating to structure, the newer conceptions of anatomy are followed.

Part III is designed to serve as an introduction to field work, and to a knowledge of the more interesting and important biological and economic aspects of a few important families and species among the spring plants. There is a considerable discussion of trees and their importance to man, and the main problems of forestry are emphasized by examples of the life of a few selected species of forest trees. The herbaceous monocotyledons, and the dicotyledons are studied from their biological and economic aspects, and their treatment is designed to serve as a guide for studies in other species.

Throughout the text the plants are presented as living organisms, comparable to animals, and with similar physiological life functions. The purely technical portions are linked up with the theoretical and economic aspects of the subject in a manner that brings the information home clearly and definitely. The treatment of hybridization and kindred subjects is as good as it is uncommon. The chapters on plant physiology are summarized and closely correlated with the seasonal life of such common plants as the bean, clover, and locust. Physiological processes are thus made directly applicable to seasoned life of species that every one knows, and can study.

Mechanically the book leaves little to be desired. The paper, presswork, and binding are excellent, and the book will not come to pieces at once when placed in the student's hands. The illustrations, both from photographs and drawings, are numerous, good, and excellently chosen.

M. J. A.


Henry Fairfield Osborn produced a book on the men the Old Stone Age; Dr. Tyler has done the same for those of the New. He begins at the point where Osborn left off, and carries man on to the dawn of history, taking up in detail the migrations, cultures, daily activities, and existing relics of these ancient ancestors of ours.

Where and how man originated is still pretty much of question. We know that the earliest remains of man-like animals are found in southern and southeastern Asia. In those same regions today are the great apes that are probably descended from the same ancestors that gave rise to man. From the first ape-man to the high types of the Old Stone Age is a long step, but as Dr. Tyler is concerned mainly with the descendants of the Old Stone people, he covers it rather briefly.

The change from the age of the chipped stone implements to that of polished ones took place in northern Europe about fifteen to twenty thousand years ago. Researches in Asia indicate that there the transition was considerably earlier, and that the New Stone men migrated westward from the region of the Iranian plateau. However that may be, the relics of the shell heaps of Denmark and Scandinavia show that some thousands of years after the Cro-Magnon people made their
beautifully colored pictures in the caves of France, men in northwestern Europe were just beginning to polish stone instead of chipping it.

Dr. Tyler shows that the earlier New Stone Age men were possessed of quite high civilization. They buried their dead, built temples, farmed, had numerous domesticated animals, made excellent pottery, plaited nets, and did rude weaving. Some of them built elaborate dwellings on the borders of lakes, while others lived exclusively on land. They seemingly had few wars, for their implements are all designed primarily for hunting or industry of other sorts.

The further evolution of man was largely one of ethics and invasions. Dr. Tyler shows how the continued influx of more highly cultured peoples from the east, bringing with them different ideas and customs from those of the European New Stone peoples forced many changes in life. The continent became crowded, and war was the result. Along with war came the necessity for social life, pooling of interests, and steady progress. Thought, both philosophical and practical, was stimulated. Metals superceded stone, and the New Stone Age was past. Remnants of it lingered on to the time of the Romans, but only in the secluded mountainous or heavily forested districts.

C. L. F.


Mr. Davies has designed his book for purposes of teaching, particularly of elementary teaching. For this reason he begins with the animals that are most common as fossils, and which can most easily be studied by the beginner—the Brachiopoda. The method of treatment is to first describe some common species, from which the student can get an idea of the general characters and variations of the group studied, and then give a brief systematic account of the entire group. References to living forms are rather few, and the illustrations are almost all of fossil species.

Beginning with the Brachiopoda, the text goes on up through the vertebrae. It then returns, begins anew with the Echinodermata, and progresses downward, ending with the protozoa. There are certain features in the classification of the vertebrae that occasion surprise, as the reduction of the birds to the position of an order among the Reptilia, below the Ornithosaurus, or Pterodactyls. Another feature is the absence of the Pythonomorpha; one wonders what is to be done with the saurians that have been referred to that order.

But in spite of one or two innovations of questionable value, the book seems practical and attractive. Its style is sufficiently untechnical so as not to repel either the beginning student or the general reader. The tables of formations are of value to the person who does not wish to continually consult reference volumes. Unfortunately they apply to Europe alone, and are a trifle old-fashioned. One regrets that there is not such a book designed to fit the most modern developments of geology and paleontology in America.

C. L. F.
NOTE

Contributions on general and midland natural history will be gladly received. Papers on botany and allied subjects, zoology, geology and physical geography, should be addressed to the editor.

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Recent Botanical Publications from the United States National Museum

BY THEO. HOLM

We are so accustomed to receive voluminous reports "for the increase and diffusion of knowledge among men" that we have almost ceased to ask ourselves what is meant by knowledge. What is knowledge or not knowledge depends of course on the point of view. Some are still holding the view that knowledge constitutes something more than what is being brought forth by recent discoveries; that it embodies also a thorough, faithful appreciation of the work of our old masters; others are so easily contented that anything "in print" bearing a title of something new and scientific strikes them as knowledge. Still a third class of knowledge seems to exist, one which pretends to be so, but which actually contributes nothing either old or new, and goes even so far as to belittle the labors of honest investigators.

As far as botany is concerned, botanical knowledge rests, and will always rest upon a structure of the past, and surely the floral kingdom has in itself a claim to be our safest guide to serious work. It would, so to speak, be almost beyond our ken to imagine that botanical science should ever suffer abuse in the hands of the vulgar.—And he is not a botanist, who does not honor the science as a precious gift, rendered accessible to us by such brilliant men as Linné, Lamarck, De Candolle, Elias Fries, Lindley, Robert Brown, Kunth and many others. In the writings of these men we have an absolute proof of the conscientious way, in which they worked; they worked for the science itself, by a method purely scientific. Small as were the means with which they worked, simple and modest their aspirations, but grand their results. For sincerity was at the bottom of it all.

Scientific discoveries carry great weight as a contribution
to knowledge, but equally as great is the accomplishment of such labor, which simply emphasizes the aim of making knowledge accessible to others, to lay-men; to pave the way for the young student, the beginning botanist, calls for exact truthful knowledge acquired by a study of the living plants, and literary research.

Some four hundred years ago botany was taught by means of illustrating and describing the plants. Classification was not attempted beyond “herbs, shrubs and trees,” and sometimes the plants were enumerated simply alphabetically. But the illustrations, wood-cuts, were remarkably true; they were drawn by artists from nature, and skilled botanists may readily recognize the species, which they represent. For instance, the wood-cuts in Fuchs’ Historia stirpium 1542 give a very characteristic figure of the respective plant; see for instance the drawings of Paris, Ranunculus, Colchicum, Fragaria, Orchis, Listera, Botrychium, Scolopendrium and numerous others. At that time the diagnoses were but imperfect, the illustrations were the principal means of recognizing the plant. It became the merit of an Italian, Luca Ghini, to make the first herbarium, and his pupils, Aldrovandi and Caesalpino followed his example. In other words botany of the sixteenth century was taught through illustrations, herbarium-specimens and diagnoses. Two hundred years afterwards, Linne wrote his Philosophia Botanica (1751), in which he introduced the botanical terminology; the construction of the diagnoses thus became facilitated, or let us say simplified. He went still further, for he elaborated also an artificial system, by which the student might readily determine the genera. We all know, however, that Linne did believe in the possibility of establishing a natural system, and he actually proposed 67 groups or orders; these he enumerated in Philosophia Botanica “Methodi naturalis fragmenta studiose inquirenda sunt. Plantae omnes utrinque affinitatem monstrant, uti Territorium in Mappa geographic’a.”

The first attempt to describe the natural families we owe to Anfoine Laurent de Jussieu, the author of Genera plantarum secundum ordines naturales disposita (Paris 1789); since then several other natural systems have been proposed, notably by Endlicher, Brongniart, Lindley, De Candolle, and Engler and Prantl.
In the nineteenth century systematic Botany became well established; preference was given to the natural system; the diagnostic part became extended by numerous morphological investigations, clearing up the formerly difficult problem of distinguishing between roots and subterranean stems, beside explaining the ramification of the shoot, and the floral structure.

Thus botanical activity has during the last two hundred years shown steady progress, and systematic botany especially was well founded before the close of the nineteenth century. Furthermore, in the nineteenth century botanical manuals were published all over the world; the vegetation of the various countries became known through the “Floras;” the geographical distribution and the descriptions of the plants received much attention. But of course it did take some time before the systematists became able to grasp the morphological improvements, so as to construe the diagnoses in perfect harmony with the results contributed by the morphologists. Nevertheless long before the close of the nineteenth century most of the Floras and manuals were elaborated in conformity with scientific Botany. Through all these years the aim of botanical teaching has been identically the same; to distribute knowledge of the past and of the present; to encourage botanical research, and to guide the student in a progressive way. Any effort in the opposite direction would be unscientific; it would be so completely adverse to the spirit and labors of our predecessors, that such effort could not possibly be effectual nor accounted for except by inexcusable ignorance. Nevertheless, we have some volumes before us of a very recent date: 1919 and 1921, published under the auspices of Smithsonian Institution, Washington, D. C., and these volumes tend to make the public believe that “our books on botany, instead of opening the path to knowledge, close it with a barrier of technical language.” It would be interesting to know what books are meant by “our books on botany;” presumably those published in this country, by Torrey and Gray for instance. Furthermore the statement is made that “Botanical science is beginning to recognize the prohibitive effect of this barrier and to take steps to open the path to the public,” by using
"common words as substitutes for technical and unusual words." *

It seems difficult to appreciate that such introductory remarks could possibly be endorsed by the highly esteemed Smithsonian Institution, and especially when applied to a work dealing with the flora of the District of Columbia. Are we really compelled to believe that Farlow's words: "There is something in the air of Washington which seems to make it inevitable that those in the government employ should believe that it is the business of the government to undertake or control all scientific work" † are still applicable to the scientific departments in Washington. So far as concerns the so-called "botanical" work conducted by the Smithsonian Institution it is so, and even to a more lamentable extent than expressed by Farlow.

In presenting to the readers of the AMERICAN MIDLAND NATURALIST a brief analysis of some of these works, we freely admit that the American scientists are not in need of being told about the status of Botany four hundred years ago, nor of elementary Botany at present; we have ventured, however, to insert the preceding brief, much too incomplete, sketch of previous botanical activity in order to render the contrast more clear, when comparing the recent botanical publications, which will be discussed in the subsequent pages.

Let us begin with the Flora of the District of Columbia (l. c.) 329 pages and 57 photographs. Some sort of botanical legislation is introduced in the first pages: I. Keys with common words as substitutes for technical and unusual words. II. All the species admitted to the formal list are based upon specimens in the National Herbarium. III. The nomenclature is in accord with the American Code of Botanical Nomenclature, except that so-called duplicate binomials are not used.

When complying with, or let us say if we are in the position to fully appreciate these principles of Smithsonian Botany, we are told, that "a person with almost no knowledge of botany can trace a strange plant to its proper family."


† The popular conception of the scientific man at the present day. Science January 5, 1906,
As if it ever were within the scope of the publications from the Smithsonian Institution to include elementary works, written for "persons with almost no knowledge?" It would perhaps have been better to say "with no knowledge at all," or to omit the notorious word knowledge altogether; "knowledge" is a word much too technical and unusual to be used in this connection.

Now with regard to the contents of this volume, there is a so-called "systematic treatment of the vascular plants" in the manner of keys to the families (in some cases to the genera) based mainly on "vegetative characters," and "on floral characters." Then follows an annotated list of species, accompanied by keys to the species in each family, as well as a brief description of the families; a glossary is appended. The photographs show several landscapes from the region, and about 30 species of the commoner plants.

A systematic treatment of the vascular plants must naturally call for some "system;" the system adopted is: I. Trees and shrubs. II. Herbaceous plants. In other words we are brought back to some four hundred years ago. The "trees and shrubs" commence with Cactaceae, followed by Pinaceae, Ranunculaceae, Staphyleaceae, Fraxinus, Sambucus, Robinia, etc. The "herbs" commence with Juncaceae, followed by Poaceae, Cyperaceae, Lemnaceae, Hydrocotyle, Nymphaeaceae, Callitrichaceae, Potamogetonaceae, etc. This chapter, which occupies 30 pages, contains the two keys, mentioned above; one based on vegetative characters, another on floral characters. The first to be treated according to "floral characters" are the Pteridophyta, ferns and fern-allies. Then follow the Gymnospermae. The Monocotyledoneae begin with Lemnaceae, and end with Iridaceae. In the Dicotyledoneae two divisions are adopted: Choripetalae and Gamopetalae. Of these the former commences with Salicaceae, ending with Lythraceae; the Gamopetalae commence with Monotropsis, followed by Vacciniaceae, Ericaceae, Diospyraceae, etc., ending with Solanaceae. Immediately following this systematic treatment of the vascular plants, we have the "annotated list of species," said to include "all indigenous plants and all introduced ones that have become established" (l. c. p. 15). "All the species admitted to the formal list are based upon specimens in the
National Herbarium,” while “species reported but not supported by specimens have been mentioned in notes.” And these “notes” refer to some foot-notes, where titles and authors are given of papers previously published on the Flora in question. Thus the fate of most of the interesting species which have been collected in the District, but which “have not been presented to the National Herbarium,” is unequivocal—they have been wilfully ignored. And this is not the first time that such procedure has been adopted and approved by the Smithsonian Institution; in these same Contributions from the National Museum, Vol. 15, 1910, we have a monograph of Panicum, where a similar discourtesy has been awarded for failing to supply the National Herbarium with specimens.

Let us now examine the merits of the keys, which according to Mr. Coville, (l. c.), enable persons with almost no knowledge of botany to trace a strange plant to its proper family. These keys, we are told, are based mainly on vegetative characters, but these characters do not include the numerous and very important structures of the subterranean organs, nor of the inflorescences; the foliage is the only one, which has been considered. Although the description of the leaves would have been a very simple matter to handle, it is readily to be seen that it must have been more than troublesome to the authors. For by looking through the keys we notice at a first glance that the authors were unable to distinguish between leaf and leaflet, and between leaflet and segment; even the outline of simple leaves has been misunderstood. The reader will see, for instance, on page 22, how the Fabaceae and Parthenocissus are distinguished: “Leaves of 3 or 5 digitate leaflets,” “leaflets 3 entire” (Fab.), and “leaflets 5, toothed” (Parthenoc). What is really meant by a leaflet being digitate and at the same time entire seems conjectural. We observe the same misinterpretation on page 30, where the leaf of Cannabis is called “leaf of 5-7 digitate leaflets,” and “leaves with 5-7 palmate equal leaflets” are credited to the Capparidaceae. When Linné, some two hundred years ago, described Cannabis and Cleome, he wrote: “foliis digitatis,” and so they have been called ever since until the publication of the present Flora. Then with respect to leaf-
lets and segments, no distinction seems possible according to the key. Because as we see from page 30 Erodium is said to have a leaf with numerous leaflets, the Caesalpiniaceae, on the other hand, ten or more leaflets; on page 29 we see a group of plants distinguished by having the leaves compound, of 2 or more leaflets; in this assemblage we meet with: Leaflets 3, entire in Ionoxalis; leaflets more than 3, much divided in Bikukulla; leaflets 3 in Prenanthes; leaflets more than 3 in Ambrosia, etc., in other words segments have been mistaken for leaflets. The chapter on "folium" in Linné's Philosophia botanica shows how to distinguish between "folium simplex" and "folium compositum." And when an outline so simple as that of the leaf of Hydrocotyle Americana cannot be described in any other way than "peltate," it seems just to conclude that no attention has been given to the terminology.

Furthermore regarding Hydrocotyle (page 28), it would be absolutely impossible to distinguish this plant (H. Americana) with the leaf said to be peltate and the "Corolla of united petals." "Foliis reniformibus" is the character given by Linné (Species plant). Under the Araceae Acorus is described as follows: "Flower-spike naked, borne on a long stalk, the stalk prolonged above the spike!" The inflorescence is a spadix, not a spike, and Torrey (Flora of New York 1843) described the spathe correctly "leaflike, continuous with the scape." The very few instances where the authors have mentioned the subterranean organs, do also illustrate a remarkable ignorance. The Fumariaceae (page 163) are said to have "tuberous or bulblike roots," and Bikukulla canadensis is distinguished from B. cucullaria by the "roots with tubers," while "bulblike roots" are credited to the latter. This seems the more remarkable inasmuch as already Torrey (l. c. 1843) gave an excellent description: Rhizoma not creeping, bulbiferous; the bulbs formed of fleshy triangular scales (the thickened and persistent bases of petioles, filled with starch), mostly acuminate, reddish externally where exposed to the air, white when subterranean (Dicentra Cucullaria); a correspondingly exact description is also given of D. Canadensis. Torrey's descriptions were republished by Gray in his Manual of Botany, 1857.

Our interesting little Orchid Corallorhiza is also one of the
few plants, of which the subterranean organs have been mentioned; very unfortunately, however, for the description reads "roots coral-like" (page 127). Irmisch in his classic work on the biology and morphology of the Orchids (1853) described the European species demonstrating that the subterranean coral-like organ is a rhizome, and not a root, as described by Clusius "radix ramosa corallii instar" (1601). And considering Cirsium arvense (page 292), one of our most troublesome weeds, this does not multiply by rootstocks, but by the roots producing shoots in abundance, a matter that has been described repeatedly in this country and abroad.

The structure of the inflorescence, the flowers and the fruits are so vaguely touched upon or misunderstood that no definite conclusion may be drawn from the descriptions. We shall confine ourselves to mention a few cases. In Betulaceae (page 136) the fruit and seed are described as: "seeds winged, fruit ovoid or oblong!" But Lamarck and De Candolle have many years ago given the correct description namely: "l’enveloppe de la graine est membraneuse sur les bords, comme celle de l’orme" (Flore Française 1807); moreover Elias Fries (Flora Scanica 1835) writes "fructu alato"; Kunth (Flora Berolinensis 1838) in the same manner "fructus utrinque alati!" and finally Torrey (i.e. 1843) writes: "fruit a little one-celled nut, which is often winged."

The fruits of Magnolia and Liriodendron are called "cones" (page 161); the fruit is a syncarp, with the carpels more or less united in Magnolia, but free in Liriodendron; the last genus has winged achenes. The grass-flower has also received a remarkable description, which may neither be considered popular nor in any way correct. It is said (page 66) to "consist normally of a pistil and 3 stamens contained between 2 small bracts, these being aggregated in spikelets. The lowermost pair of bracts (glumes) are without flowers. The succeeding bracts (lemmas) have flowers, and an inner bract (palea) next the rachilla." In order to readily distinguish the Grasses from the Sedges, the key (page 28) renders great assistance viz., "stems round," "flowers with two bracts, one below and one above—Poaceae."

In comparing these few examples we naturally feel inclined to believe, that the reason why common words have been used
as substitutes for technical and unusual words in the "keys" was not because technical terms would be a barrier to the student, but because they would have been a barrier to the authors themselves.

It seems therefore natural to expect that this same kind of so-called "terminology" will be adopted in future works to be published by the Smithsonian Institution. As a matter of fact one has already been published, namely Flora of Glacier National Park, Montana, by Mr. Paul C. Standley.* The scope and style of this paper corresponds exactly with the preceding; the key is constructed in the same manner, and contains similar erroneous statements. Some few of these may be mentioned. "Fruit conelike, seeds not hairy, Betulaceae;" "Leaflets more than 3, some attached along the sides of the petiole, Brassicaceae," "Leaves with 3 or more digitate or pinnate leaflets, Potentilla;" "petals 2 or 5, Onagraceae;" "fruit composed of several cells, these falling apart like the sections of an orange, Sphaeralcea;" "the roots bear cylindric watery tubers, Circaea;" "roots coral-like, Carallorrhiza;" "root-stocks creeping, Rumex Acetosella;" "root-stocks long, Cirsium arvense;" "sepal s 5 spurred at the top, Myosurus."

Returning to the Flora of the District of Columbia, it is said in the introduction that "All the species admitted to the formal list are based upon specimens in the District Flora Herbarium." "Species reported but which are not supported by specimens have been mentioned in notes." Nevertheless Arethusa is not represented except by two specimens from Pennsylvania and New Jersey! There are no specimens of Kyllinga, and many of the plants stated as being common or frequent are only represented by a few specimens. On the other hand several species, which have been reported by me as new to the District have been ignored completely, not speaking of the numerous new localities recorded for some of the rare species. For instance in my third list of additions to the Flora of Washington, D. C. (1892), I have reported Ilex glabra Gray from near Silver Hill, and in the fourth list (1896) this species was reported also from the woods between Camp Spring and Surattsville. From Scott's Run, Va., I have reported such interesting and rare plants as Aralia quinque-

folia, Jeffersonia, Caulophyllum, Papaver dubium, etc., none of which have been mentioned; from High Island Carex Careyana; form the woods and swamps near Suratteville a number of rare species viz. Glyceria obtusa, Rhyncospora gracilenta, Utricularia subulata, etc.; and from Marshall Hall Kyllinga, Trifolium minus, Gnaphalium uliginosum, Quercus heterophylla and many others.

It is really strange to see that Gnaphalium uliginosum in the new Flora of D. C. is credited to Professor Ward with the remark “not collected since 1884,” nevertheless I have reported it from Marshall Hall and Hyattsville, in the fifth list of additions (1901).

Danthonia sericea I have reported from near Highland, Fimbristylis laxa from Hyattsville, etc., but neither the specimens collected nor the lists published in the Proceedings of the Biological society of Washington (1892, 1896 and 1901), have been of any interest to the authors of the new Flora. It would, however, have been of interest to the student to get as complete a list as possible, not only for the sake of collecting the plants, but also in order to become acquainted with their distribution within the District. In this respect the student learns very little, for the authors too frequently use the word “common” for species which are actually rare; moreover the localities are not given for quite a number of the species said to be rare. In the genus Polygala for instance several species are said to be frequent, although they are relatively rare; no localities are given for several of these, and they are represented by specimens from localities very scattered, and by relatively few specimens.

In the Orchideae no localities are given for the several species of Habenaria except H. cristata, and they are but scantily represented in the Herbarium. No locality is given for the rare Triphora, nor for Corallorhiza maculata; of these the latter is represented by two detached flowers only, collected near Chevy Chase, and by a specimen from Northern New York.

If the student should wish to see these Orchids in the herbarium, he will not find them under the generic names given in the new Flora, for the covers are not labeled Habenaria, but Gymnadeniopsis, Perularia and Blephariglottis; Cypri-
pedium acaule is labeled Fissipes, and Orchis is labeled Gale-orchis. Moreover Polygonum Convolvulus is in a cover marked Tiniaria instead of Bilderdvykia; Oxalis violacea and O. stricta are both labeled Oxalis, while the nomenclature calls for lonoxalis and Xanthoxalis, etc.

In other words the nomenclature followed in the book is not always in accord with the one in the District Herbarium, which, of course, makes it rather inconvenient to the student. As a matter of fact the student will be obliged to locate the genera in the herbarium by means of the synonyms given in the Flora, and afterwards consult Gray's Manual in order to find a correct diagnosis.

With respect to the distribution of the plants as given in the present work, it would have been a great advantage, if the authors had read Professor Brainerd's Flora of Vermont. In this excellent little book the author indicates the degree of frequency of occurrence by means of four adjectives: common, frequent, occasional and rare; these terms are well explained. Moreover Professor Brainerd holds the view, that "it is always a matter of justice to botanical explorers and of interest and stimulus to others to insert the names of the station and of the discoverer of a rare plant." But the new Flora of the District does not give much credit in this respect and seems more inclined to belittle and ignore the work of others. The logical conclusion actually appears to be that the aim of the new Flora is not to open the path to knowledge of the Flora of the District of Columbia, but of the Flora of the National Herbarium.

Exactly the same principle has been followed in another publication from the U. S. Natl. Museum, namely "The North American Species of Panicum" by Prof. Hitchcock and Mrs. Chase (1910). In this voluminous publication credit is given only to those who presented their specimens to the National Herbarium. Although Professor Hitchcock borrowed my complete collection of Panicum from D. C., Virginia, Maryland and Florida, and although most of the rarer species had been recorded in lists of additions, I received no credit whatever. Such procedure is unfair, and does not encourage one to render further assistance. Any effort to monopolize scien-
tific work is so contrary to science, that the inevitable result will necessarily be anything but scientific.

Now with reference to the nomenclature, we have seen from the preceding, that the so-called American Code of Botanical Nomenclature has been followed except that duplicate binomials have not been used. It is not necessary to discuss at length the merits of this Code, nor its disturbing influence; its lack of consistency has long ago been attested by various authors of prominence, for instance by Professor M. L. Fernald, * not to mention the fact that most of our eminent botanists published a signed protest against it.

In the accompanying table I have selected, at random, 16 genera from Gray's Manual in order to give the reader some idea of the changes involved by introducing this nomenclature, the so-called American. According to this table the 16 genera taken from Gray's Manual (1857) represent not less than 28 in the new Flora of the District of Columbia; while only one of these (Andromeda) has been divided into two genera in the last edition of the Manual. The only other change is the placing of Negundo under Acer.

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<th>Plant Name</th>
<th>Synonym</th>
<th>Author</th>
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<td>Recent Botanical Publications, ETC.</td>
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Of the 16 names adopted in the first edition of the Manual only Xolisma and a part of Polygonum have been preserved in the District Flora; some others are even different from those adopted by Dr. Britton, viz. Aureolaria, Rulač, Notholcus, Biderdykia and Campe. If we compare Polygonum with this genus in Glacier Park Flora (l. c.), we notice that Biderdykia, Persicaria and Bistorta are all included in Polygonum. It is also interesting to compare the names of Britton and Brown's Illusr. Flora of 1896 with those adopted in the second edition, 1913; according to the table the second edition of Britton and Brown's Ill. Flora contains not less than 18 names, which differ from those adopted in the first edition. This comparison includes only 16 genera adopted by Gray (1857); if we had extended it to all the genera accepted by Gray, the number of changes would be immense. So after all the American Code of nomenclature cannot boast of either stability or consistency.

Most of the writings of the advocates of this code disclose a further characteristic, which it seems would tend to upset the stability of much of their nomenclature. This is the absurd and preposterous method of name-formation adopted by many of these. We remember for instance Galeorchis, Rubacer, Saxifragopsis, Stellariopsis, and among the specific names such as: Yellowstoneensis, Coloradoensis, perglobosa, tumulicola, nubicola, fissuricola, concinnoides, graminoides, pseudorepens, pseudospectabilis, pseudopubescens, etc. Violent crosses are rarely stable.

I beg leave to recommend the reading of Alph. De Candolle's paper "Lois de la nomenclature botanique" (Paris 1867), where we are told to reject such names as are a combination of two languages *eu* used with a latin name, *sub* with a greek, *oides*, *opsis*, *pseudo* with a latin, etc. The fact that such names actually exist and still are being proposed does not speak in favor of the authors being capable of interpreting even the simplest diagnosis in latin. No wonder the American Code does not demand the diagnoses of new species to be written in latin! In consequence of such facts we are entitled to doubt the correctness of many of the nomenclatorial changes proposed by these authors.

From a merely practical point of view the steadily proposed
changes of names are the cause of great annoyance. I have received several letters from European correspondents, who feel at a loss to keep track of all these changes; especially when exchanging specimens with American Institutions. A recent letter complains that the same genera have been sent to Europe under several different names. And the same would be the case, of course, if specimens of Polygonum Convolvulus were distributed by the Smithsonian Institution some under the name Tiniaria, others as Bilderdykia and still others as Polygonum. Similarly, a recent change of Hierochloa would result in species if this genus being sent under the name of Hierochloa by Harvard University, Savastana by the New York Bot. Garden, and Torresia by the Smithsonian Institution; for in the Flora of the Glacier National Park the last name, Torresia, is introduced by Professor Hitchcock as the oldest name.

As the main points, which characterize this new Flora of the District of Columbia I have cited: 1. The introduction of common words as substitutes for technical and unusual words. 2. The species being based upon specimens in the National Herbarium, and III. The nomenclature being in accord with the American Code of botanical nomenclature.

Would it not have served the purpose better, if this book as well as the Flora of Glacier National Park, had been written in conformity with scientific Botany? So far as concerns the Flora of D. C., this might have been written in the same style as the local Floras published abroad. Among these Flora Berolinensis by Kunth (1838), and Flora excursoria Hafniensis by Drejer (1838) may be mentioned as examples. I wish also to refer to Schuyler Mathew's excellent Field book of American wild flowers (new edition 1912). Thus if the new Flora of the District of Columbia and the Glacier National Park had been elaborated similar to the booklets mentioned above some knowledge would certainly have been gained. But as the books are written, they contain little knowledge, and offer less. They actually "close the path to knowledge with a barrier" of wrong descriptions; wrong application of botanical terms; by following an inconsistent code of nomenclature; by including only such plants as are incorporated in the National Herbarium; by omitting many
important localities, and by ignoring the numerous observations that have been published during the last 30 years on the natural history of our native plants.

Considering the large size of some of the volumes published by the Smithsonian Institution, entitled Contributions from the U. S. National Herbarium, it seems more than strange that said Institution, now for 8 years, has withheld Dr. Edw. L. Greene’s second volume of Botanical Landmarks. Dr. Greene’s painstaking work deserved a better fate; for when considered in comparison with the works discussed in the preceding pages one can scarcely doubt that Dr. Greene’s history is better fitted to fulfill the function for which the Smithsonian Institution avowedly exists, i. e. “For the diffusion of knowledge among men.”

In bringing this discussion to a close, I cannot abstain from expressing the opinion about the new Flora of the District of Columbia, that its aim was not to distribute knowledge among men; but rather to enforce the Brittonian nomenclature, to apotheosize the National Herbarium; and to distribute among men, in the guise of scientific authority, an unprecedented ignorance of elementary Botany.

Clinton, Md., June 1921.

Notes on the Habits of the Soft-Shell Turtle—Amyda Mutica.

BY J. F. MULLER, J. H. U.

The observations forming the basis of this article were made on an island of the Mississippi River, about a mile above Fairport, Iowa, and on the Illinois side, while the writer was serving in the Bureau of Fisheries. This island was very typical of the large number scattered along the river. Approximately triangular in shape, it was bounded on the north by the open river, on the south by a narrow channel, or slough, between it and another island, on the east by another channel and island, and on the west by an area of shallow
NOTES ON THE HABITS OF THE SOFT-SHELL TURTLE

water dropping away toward the north into the navigable part of the river. With gently sloping sand and mud shores, and interior areas of open sand and densely growing willows, it offered a variety of natural conditions. In area it was about a half mile square.

Of the two soft shell-turtles common in the vicinity, Amyda mutica, and spinifera, only the former was carefully observed. This species grows to an approximate length of fourteen inches, carapace measurement, and is highly esteemed as an article of food, being said to taste better than chicken.

During the breeding season, June and July, the turtles frequently leave the water to bask, usually in the morning up until 2:00 P. M., and their tracks being very conspicuous, a count of them gives accurate estimate of their numbers. Observation of these indicated that the turtles prefer beaches with a northern exposure, probably because of the greater amount of sunlight there in summer. The warmer the day, the greater was the number of tracks. On July the second, apparently thirty-seven turtles had congregated within fifty feet of beach on the north side of the island while only three tracks could be found on the entire south side. The turtles emerge from the water in an almost straight line until from four to ten feet up the beach, where they remain awhile in the sun, turning around several times before returning to the water, the return track often overlapping the first. When alarmed, the animals slip down the beach and into the water with great rapidity. On several occasions large females were disturbed while laying their eggs, about fifty feet from water, and covered the distance faster than a man can run. They are not at all awkward in their land movements as might be inferred from their appearance.

In this locality the egg laying season covers the last half of June and the early part of July. In building her nest, the female selects a spot with an unobstructed view of the open water, and from ten to sixty feet inland. Here she scoops out a hole in the sand, about five inches in diameter, and ten inches deep, using her fore paws in the operation, and piling up the loose sand around the hole. The necessary conditions for incubation are sufficient dampness so that the sand will just cling together, and absence of clayey or earthy matter.
which might cause the sand to pack and thus prevent the escape of the young. Often in her search of proper conditions the female will dig three or four holes before laying her eggs. A suitable nest being dug the turtle assumes a position with her hind feet down the hole, and dropping her eggs into her hind paws, arranges them neatly upon the floor of the nest. The hole is then filled in with the sand removed from it, the hind feet being used.

The number of eggs laid varies with the size of the turtle. Eight nests contained respectively 12, 13, 4, 22, 21, 16, 26, 33 eggs. The last nest probably contained an abnormally large number, as in it two double eggs were found, one being oval-cylindrical and having two yolks with no dividing partition, and the other having a sharp constriction and median partition. From this it is evident that the oviducts were crammed beyond their normal capacity. The average annual lay of a female would be around twenty-two. The finished nest appears as a small crater on the sand, about a foot in diameter, or, where the surface is covered with pebbles, as a circular area of clear sand. The temperature of the nests is quite constant—about 90°F. In abandoning unsuitable nests, the female leaves the holes open, to be filled in at the next rain.

Many nests were found the eggs of which had been dug up and eaten as evidenced by the empty shells around. As ground moles were numerous on the island, it is probable that these were responsible. However, coon tracks are sometimes to be found at such ruined nests, and crows are said to dig up the eggs also. The destruction of the species in this way must be considerable, for at least forty such ruined nests were found on the one small island in consideration. Occasionally eggs are found which have been parasited by maggots, presumably of some sort of fly. It is doubtful, however, whether eggs containing healthy embryos are ever attacked in this way, as out of a nest of twenty eggs two may be found to contain maggots, and be in a state of decomposition, while the rest are perfectly sound. An egg of this turtle is about 2.3 cm. in diameter, and weighs about 7 grs.

At first pale yellow, the egg after about eight days development becomes white on the top half, and the yolk rises and
adheres to this pole. The albumen is at first very gelatinous, but later becomes quite mobile.

For studying incubation several artificial nests were prepared in small sandpiles placed in the angle of the floor and wall of an empty cement pond bed. Some eggs were collected when the embryos had attained about three weeks development, and others when recently laid, care being taken to preserve the original position. Advanced eggs were placed so that the white pole would be on top. A week later, however, these eggs showed a new white pole, at an angle to, and lapping over the first. This new pole was tilted toward the south. As the nests were placed against the vertical northern wall of the pond, it is obvious that the south was the direction of most light and heat. Apparently, then, this white pole forms with relation to direction of heat, rather than gravity. In about a month this white area has descended and completely covered the egg, keeping pace with the growing allantois. Before incubation has proceeded far the air chamber appears on the bottom of the egg. Excessive moisture causes the eggs to rot, whereas too little usually merely retards development. As the embryo grows the calcareous part of the shell becomes very much cracked and the shell membrane, yielding to pressure from within, stretches until the egg becomes approximately 2.39 cm. in diameter. The carapace is folded down around the young turtle and the arms are extended in front of the head. The forepaws are thrust thru the shell first in hatching, and this opening enlarged to allow egress for the rest of the body. Altho the young have an egg-tooth below the flexible proboscis it does not seem to be used in escape from the eggs, and is dropped a week after hatching.

The young, which are very circular, have the dull olive carapace marked with many short black lines, and bordered with a margin of pale flesh color, broader to the rear. The feet are well webbed and immaculate below. The following are measurements of five newly hatched A. mutica.
CARAPACE
Length Width
3.5 cm. 3.1 cm.
3.5 cm. 3.23 cm.
3.43 cm. 3.20 cm.
3.67 cm. 3.25 cm.
3.62 cm. 3.2 cm.

PLASTRON
Length
2.5 cm.
2.55 cm.
2.60 cm.
2.57 cm.
2.47 cm.

Weight of an average specimen: 4.97 grs.

The eggs in the artificial nests hatched on July 29, 30, 31. Observation on the island showed that the nests hatched there from July 31 up thru the early part of August. In escaping from the nest the young turtle leaves the egg shell below the surface and tunnels almost vertically upward, leaving a hole in the sand about an inch in diameter to mark the spot of escape. On spots where nests have hatched a number of these holes may be seen on the surface within several inches of each other. No newly hatched turtles were found on the island. They always hatched during the night or early morning, and probably lost no time in getting to the water. Under favorable conditions the period of incubation is from seventy to seventy-five days, depending upon circumstances of heat and moisture.

The young exhibit a marked geotropism, always going downhill, and are photokinetic upon any disturbance. Since the nests are usually so situated that an open sky and sloping beach are presented in the direction of the water it is probable that these two factors guide the young to the river. They are perfect swimmers immediately after hatching and if held and irritated they make repeated efforts to bite. Placed in a sand bottomed aquarium they dig under at once, coming out again only after the suspected danger has passed. They seize edible morsels eagerly after a thorough probing with their flexible noses. At least six or seven years are required before they attain edible size.
BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.


I sent for this book with high hopes; I thought that we might at last have a natural history that would combine the interest of the well-known but obsolete Woods with the discoveries and accuracies of modern zoology. But my hopes were unfounded; there is neither interest nor any great amount of accuracy. In fact, about the only worth while about the volume is a series of plates taken from photographs made at the American Museum of Natural History. It's a pity, too, for the printing and binding of the book are excellent.

The authors attempt to give a review of archeology, ethnology, zoology, mineralogy, paleontology, and museology, all in a volume of 204 pages, and they attempt the impossible. The chapter on ancient man is tolerably good, but after it the book goes completely to pieces. It is little more than a hit-and-miss collection of technical terms and names poorly and incompletely defined, and hysterically emphasized by italics. There is an evident intention to be both popular in material and interesting in style, but the intention is lost in the maze of definitions. The book is a strange hybrid between a child's Natural History and Parker and Haswell's "Zoology," with the bad features of both and the good features of neither.

C. L. F


Dr. Lankester possesses a vagabond interest that makes his books always new and interesting. In "Secrets of Earth and Sea," for example, he goes from the cave-man of ice-covered Europe to the eruptions of Mount Vesuvius; from an article on the world's biggest animal to a discussion of what is meant by a species. The color of water, the cross-breeding of animals, the nature and mining of coal, and the lives of the little "Wheel Animals" of our fresh-water ponds all claim his attention. And about all of them he has something to say that is interesting to read, and worth knowing.

The book is something of a sequel to the earlier volumes "Science from an Easy Chair" and "Diversions of a Naturalist." The essay-
articles that compose it have been published at various times in diverse British periodicals and newspapers, and were re-written and enlarged for publication in book form. "Secrets of Earth and Sea" is modern, interesting and reliable, and is easily the best thing in popular science that has appeared in several years.

C. L. F.


In a book altogether too small to deal adequately with so extensive a subject as evolution Mr. McCabe has done remarkably well. By judicious selection of material he has managed to get into 124 pages of text an outline of the history of the earth, the development of animals and plants, and something about the peculiar evolutionary problems of man. The story is told in plain but attractive English, and there are numerous references to other works in which more elaborate discussion of various points may be found.

As is almost invariable in books that attempt to popularize science, there are some respects in which this volume is hardly to be relied upon. McCabe's preference for the long-disproved Laplacian hypothesis of an originally gaseous and molten earth, and his doubts regarding the reliability of Mendelism indicate that he has an imperfect acquaintance with the literature of modern geology and biology. His explanation of the causes of glacial periods, while an approach to the truth, hardly agrees with present geologic knowledge. But these errors form a very small part of the book, and do not detract greatly from its general value. As a primer for the man unacquainted with the elementary facts of biology "The A B C of Evolution" is not only useful, but good.

C. L. F.

Zoology. By T. D. A. Cockerell. World Book Company, 1920. $3.00

To the person accustomed to the dryness of the average zoology text Dr. Cockerell's book comes as both a surprise and a relief. Although intended primarily for use in college classes, it will be of value to anyone who desires a comprehensive, reliable, and at the same time interesting account of the many divisions of the science of animals. There is no such thing as a good all-round natural history; it is well that there is a zoology that in a measure meets the need of the man who does not care for the "nature study" book, and who has no great interest in the anatomical details on which taxonomy is based.

The book begins with a consideration of some of the fundamental characters of life—reproduction, heredity, sex, nourishment, breathing. There follow an excellent chapter on the history of life, a biography of Darwin, another of Linnaeus, and then a clear and interesting discussion of the whys and hows of classification. To the every-day man the zoologist's complicated system of Latin and Greek names means just about nothing; to the average college student it is merely a use-
less jumble of syllables that must be remembered in a certain order in order to get a grade. Dr. Cockerell shows what classification is, what it means, and why it is used, and when he gets through it is neither formidable nor jumbled. The spirit of science is order, but few texts give that impression to the person reading them; this fact makes this new book stand out as a landmark in zoology texts.

The discussion of the various groups of animals occupies some 240 pages, and is clear, reliable, and interesting. The classification used is thoroughly modern, and the whole treatment is designed to arouse a desire for further information. The chapters on the evolution of horses and elephants and man, the descriptions of the various life divisions of the earth, of the laws and principles of eugenics, and of the work of great zoologists of the last century are fully as satisfactory as the systematic portion of the book, and perhaps even more important. They not only show the progressive attitude taken by Dr. Cockerell, but make his book of exceptional value to teachers, students, and to the interested but untechnical laymen who have never seen the inside of a college.

C. L. F.


This book is a puzzle; one cannot tell what the author is trying to do. He says in his subtitle that the book is an "inquiry and adventure." His preface is a curve labeled: "The Valley," "The Mountain," and "The Outlook," below which is either a dedication or acknowledgment "To the Many Helpers." There are some pages of unintelligible stuff purporting to be a summary, an outline, and something else printed in the manner of free verse and meaning nothing at all. Then comes two pages of mystical gibberish that are not even grammatical, and convey nothing whatever in the way of information. Following this burst comes the first clearly sensible thing in the book: a table of the elements, with their symbols and atomic weights.

The first section of the book is headed "The Valley" and presumably has some relation to the curve labeled "Preface." It consists of multitudinous quotations from various authors, dealing with types and properties of matter, and with various phases of living matter. There are several pages of clippings dealing with natural selection, and numerous others on the effects of environment, stimuli, and so on; finally the section ends in its 118th page.

The second section is called "The Mountain"—probably another reference to the "preface." Here is a fair sample of its clarity of style:

THE METHOD OF SEARCH


How scale this barrier of rocks and overhanging boulders? Silently humble.
Without conceit in the past, without fancy of the future. For to assume is to presume.
A healthy dissatisfaction is not the same as discontent. Accept not for true on the bare assertion. Verify. For it is usually ignorance which keeps people content with the worse; or, in the pithy word of Shakespeare, "There is no darkness but ignorance."

The summary of the section says that it deals with such subjects as: The Spirit of Search, The Need for Inquiry, Difference, and Continuous Oneness of Man. I shall take the summary at its word, being unable to find that it actually deals with anything whatever. The third section deals largely with disease, such as cancer, and has numerous pictures that are quite intelligible.

How are books like this allowed to come into existence? What sort of person, possessing any education whatever, will perpetrate such tommy-rot? Here are 324 pages of letter-press, printed on first-class paper, and bound as well as the average book of today. There are 322 line drawings and half tones, and several plates in color. And the total value of the book is less than nothing by the value of the materials used and the work consumed in its production. Science is neither mysticism nor scissors-work. Popular science, of course, must be dependent upon research work, and in that sense be parasitic, but it does not consist of making dozens upon dozens of clippings and tying them together by a few ill-phrased sentences.

I have just received a book by an Englishman, prominent among the anti-vivisectionists, who maintains that science is responsible for the woes of the world. This creation of Mr. Trumbull's makes me believe the anti-vivisectionist, at least to the point where I wish science had never invented the printing press, or for that matter even a language and alphabet.

Carroll Lane Fenton.
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EDITOR

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MISSISSIPPI RIVER AND TRIBUTARIES
FROM PRESCOTT, WIS. TO LAMOILLE MINN.
MAP SHOWING AREAS SURVEYED IN FRESHWATER PEARL MUSSEL APPRAISAL INVESTIGATION-JULY, AUGUST, 1920
under Dr. Norman M. Grier.
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MAP SHOWING AREAS SURVEYED IN FRESHWATER PEARL MUSSEL APPRAISAL INVESTIGATION—JULY, AUGUST, 1930
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BUREAU OF FISHERIES
Final Report on the Study and Appraisal of Mussel Resources in Selected Areas of the Upper Mississippi River.*

BY N. M. GRIER, PH. D. †

I. INTRODUCTION.

During the months of July and August, 1920, the U. S. Bureau of Fisheries made a study and appraisal of the mussel resources of the Mississippi River in and between the areas commencing at a point about five miles above Red Wing, Minnesota, extending thence through Lake Pepin, and ending nearly 80 miles down stream at La Moille, Minn. More exact boundaries for the areas will be indicated hereafter. The work carried on was with reference to recent administrative action on the part of the states of Wisconsin and Minnesota, which provided for the closure of certain of these areas for the protection of the fresh water mussels, as well as for areas to remain subject to fishery. From the data acquired in this investigation, it is expected to establish a basis for comparison of conditions in the present and after a period of protection.

II. GENERAL CONDITIONS IN THE AREAS.

While usually attaining a depth of from 5-20 ft. within the limits of the state of Minnesota, the river at the time of this investigation was in a flood stage of from 2-9 ft. One apparent effect of the latter condition was to cause a migration of the mussels shoreward, as in general the outer limits of the shell beds are often determined by the deeper waters of the channel. The fall of the river is greater below L. Pepin than

* Published with the authorization of the U. S. Commissioner of Fisheries. Contribution from the Fairport Biological Station.
† During this investigation, Messrs. J. F. Mueller and W. Teachout served as assistants.
above it, resulting in a more rapid current in the former region, which is accelerated by the pressure of the impounded waters of the Lake. Where snags are abundant on the bottom, this current is strong enough to make mussel fishing with crowfoot bars somewhat dangerous.

The bottom of the river within the areas is for the most part composed of fairly coarse gravel mixed with varying proportions of mud and sand. The latter increase perceptibly in the vicinity of the tributary streams of the region, the principal entering streams being the Cannon River at Red Wing, the Chippewa at Read's Landing, the Zumbro near Wabasha, Minn., and the Trempealeau below Winona, Minn. The Chippewa is principally responsible for the enormous quantities of sand brought into these areas discussed below Lake Pepin. Only through the construction of wing dams have the Government engineers been able to preserve a navigable channel. These dams are designed to catch the sand near mid-stream, deflecting it toward the shore where it ultimately forms sand bars or islands, but unfortunately smothering at the same time the valuable clam beds which formerly existed in the Mississippi below Lake Pepin, with the consequent discouragement of the clamming industry. In the opinion of some engineers, it appears practicable to terrace the banks of the Chippewa near Lake Pepin in such a way as to divert the sand to fill up the low lying country nearby, but a better preventative would be the reforestation of the Chippewa drainage basin. The conservation of the national mussel resources in thus seen to be closely related to other problems of national economy.

III. STATUS OF THE MUSSEL FISHERIES IN RELATION TO THE PRECEDING.

That stretch of the river about five miles northwest of Red Wing in the vicinity of Diamond Island, and which is known to old-time clammers as the Trenton Bed, is apparently but little worked, although our observations indicate that such might be profitably undertaken as it is in an area subject to fishery. At Red Wing itself the summer, of the survey, three clammers were observed. They reported that their returns seemed to be diminishing, although in past years this immediate section was considered one of the best on the river.
As will be observed in the accompanying tables, certain species, commercial as well as non-commercial, have been clammed out of this as well as other localities, some trace of them always being found in the piles of shells observed along the bank, or old clammers remembered collecting them in the vicinity.

Within the area studied, the claming center of the river is in that part of Lake Pepin between Lake City and Pepin, as in late years the profitable downstream limit of the mussel fishery in these areas has been found to be the outlet of Lake Pepin about 1 1/2 miles northwest of Read's Landing in an area which has since been closed to claming. Lake Pepin furnishes most of the shells from the areas considered, but its clam resources appear to be attracting but few fishermen. Where in 1914, 100 rigs were observed in operation on the lake, hardly more than 15 were working in the summer of 1920. However, it is stated on good authority, (a), that about 200 tons of mussel shells, with an average valuation of from $50 to $55 per ton had their source in this region. The best pearl found sold for $750, a half dozen others brought from $100 to $175.

South of Lake Pepin during August, 1920, but two other clammers were seen, one rig at Winona, Minn., and a solitary clammer working with a fork in the nearby Straight Slough, obtaining only scanty returns. Piles of dead shells on the banks of the latter indicated the former abundance of the mussel fauna. At one time there existed extensive mussel beds at or near Wabasha, Minn., Teepeeota Point, (about 4 miles downstream from the former); near Alma and Fountain City, Wis.; Minneiska and Winona, Minn. The party found greater or smaller remnants of these formerly worked beds. They appear to be composed of old and sometimes gigantic shells, with an absolute dearth of younger ones. This would indicate that the beds are not being maintained, even if bottom conditions generally are favorable for mussel life. If it were found practicable to restock such beds with juvenile shells, such beds might readily regenerate. Reasons commonly assigned within the last mentioned regions for the de-

\(\text{(p)}\) A well informed manufacturer writes "As near as we are able to estimate, there have been between 200-250 tons of shells collected on the Mississippi River between St. Paul and Winona during 1920, and inasmuch as Lake Pepin is the center of the clamming industry, we believe that 90% of the total amount would represent the quantity taken from Lake Pepin and close vicinity."
pletion of the mussels resources, and the consequent decline of the clamming industry may be given:

1. The smothering of the mussel beds by sand deflected by the dams has been previously indicated. Additionally it may be stated that the increased current thereby insured has the probable effect of sweeping juveniles just dropped from fish long distances down stream, or to lodge them upon the sand bars, where later they may be covered up.

Within the limitations of the apparatus used in this investigation, it was not found practicable to estimate quantitatively the extent of the mussel beds smothered in this fashion. Under such circumstances, the dead shells were difficult to collect by the prevalent method of clamming. To indicate that such beds were formerly extensive are the statements of fishermen as corroborated by the observation of government engineers. Mention is made further on of those beds which came under the party's observation.

2. Destructive fishing methods formerly in use, such as taking very young shells, deliberately clamming out beds, or fishing with the shoulder rake, are also responsible. The party found evidence of the latter in most of the beds last mentioned. However, favorable sentiment toward respecting this part of the protective laws is widely prevalent.

3. The growth of formerly extensive mussel beds near communities situated along the river has been inhibited by the pernicious practice of dumping rubbish of somewhat indestructible nature in the river at those points. While state laws are also clear upon this point, the enforcement of them seems largely a matter of local sentiment.

The remnants of the clam beds at Alma, Fountain City, and Minneiska, appear to be the ones affected in this way. The appraisal work here was unusually difficult due to the fouling of the collecting apparatus on such obstructions as slag, old iron, etc., in the water. From the economic standpoint, the least which may be granted is that such rubbish has the effect of rendering the mussels but difficultly accessible to the fisherman, and he is inclined to let such beds alone. Such mussel resources are therefore not utilized. On the other hand, it is recognized that materials such as sand, coal,
cinders, ashes, logs, decaying wood, bark, sawdust, as were often encountered, have a distinctly injurious effect upon fish when dumped into the water. This is important, when it be remembered that fish carry the larval young of the mussels about with them. Such a combination may account for the scarcity of young shells in the beds, or tend to render the environment a more difficult one to combat, whatever be the more direct reason.

As the situation is today, the sand bars created by the dams may, following certain conditions such as flood or drought, harbor mussels in sufficient abundance as to make their taking by hand fairly profitable. Characteristically abundant and commercial species found on such sand bars are the three-ridge and blue-point, \((Quadrula olicata\) and \(undulata\)), pig-toe, \((Quadrula undata)\), pocketbook, \((Lampsilis ventricosa)\), with lesser quantities of the pimple back, \((Quadrula pustulosa)\), hickory nut, \((Obovaria ellipsis)\), and monkey face, \((Quadrula metanevra)\). Most of these shells, especially the pocket books, were of an excellent quality for button making.

In many cases the mussels, especially the younger ones inhabiting the sand bars, were observed to be dying in large numbers as the result of their inability to move with the water as it fell from the flood stages. The utilization of the mussel resources below Lake Pepin therefore seems to demand that the mussels be taken from the sandbars by hand when desirable for commercial purposes, and that the stranded animals be given the conserving care such as fish receive in rescue work. By way of experiment, the party stocked two sections of an area in which mussels were nearly absent, but in which conditions seemed quite favorable, with younger shells of various species, collected from the sand bars, where, by the way, shells are more abundantly taken by hand than from the bottom by crowfoot bars.

While the sloughs are dammed off from the river for the ultimate purpose of draining them, they are as rich, if not richer in mussels than the main river. Excellent examples of sloughs with a richer fauna are the Belvedere and Straight Sloughs, and the West Newton Chute. In all these, shells were collected by hand or by crowfoot bars. Work
with the latter in deeper portions of Straight Slough and West Newton Chute in their lower stretches, revealed the fact that young beds of shells of commercial quality were flourishing under conditions which might be favorable for restocking, despite the ultimately desired effect of the dams, as the sloughs are to some extent fed with local drainage. Piles of shells at these points indicated the extent of former clamping operations. Certain species, such as the bull head, (Pleurobema aesteus), as we collected it, apparently find their most congenial environment here. Shells collected from the sloughs appear to have brighter colors and a finer grain than those secured from the river proper.

When the preceding data on general conditions in the areas and the status of the mussel fisheries are considered in entirety, it becomes evident that before the mussel resources of these areas can be improved, some practicable basis must be determined, from which measures looking forward to the protection and the improvement of the mussel resources can be inaugurated. This is all the more important when it is remembered that the states of Wisconsin and Minnesota are pioneers in the legislation for the protection of mussel resources, it is quite likely that other states will enact similar measures. The reason for this study and appraisal of mussel resources in certain areas of Wisconsin and Minnesota thus becomes clear.

IV. METHODS.

(a.) Description of outfit for collection of shells.

The work was approached from the standpoint of the mussel fisherman, a bar and crowfoot outfit being used to collect the shells. The outfit was towed from place to place by a Government Launch. In the areas above Lake Pepin, (I-VI. inc.,) 100 hooks were attached to each of the 16-ft. bars. Below Lake Pepin, starting at Read's Landing, (areas VII.-X. inclus.), the river bottom is heavily infested with snags, so the bars were shortened to 10 ft., with a consequent reduction in the number of hooks on each to 75. In the first named areas, the data presented represents the results of three trials of the same length of drag with the bars, (300 ft.) at each of the localities, (those to be checked five years hence), in-
dicated. In the remaining areas, the number of drags was increased from 3 to 4, to compensate for the reduction in the number of hooks, but otherwise the procedure was the same.

Additionally, the john-boat had at its bow, a hand windlass bearing 300 ft. of stout, (\(\frac{5}{8}\) in.) line, to the free end of which an anchor was attached. In proceeding from locality to locality, the windlass was locked, and the boat towed by a separate piece of line. Two separate dredgings were also made of the bottom of the river in each locality, proceeding from the same initial point. The dredge used consisted of a heavy rectangular frame work of iron about 18 in. in length, 6 in. in breadth, at the mouth, and 6 in. in height. To it was fastened a large and very closely woven net with the capacity of about a bushel, and with meshes varying from 1-16 to \(\frac{1}{8}\) in. The net was protected by a canvas cover attached at one end to the iron framework, and open at the other. Ropes, \(\frac{1}{2}\) in. were attached to iron rings on the shorter side of the frame work, and these lead forward to a single rope 50 ft. in length, secured in the stern of the john-boat. The longer and outer edges of the iron framework were provided with coarse, triangularly shaped teeth, 4 in. in length, while the mouth was guarded by 4-5 stout iron wires, running vertically to the longer axis of the iron framework and spaced about 3 in. apart. The teeth provided for the dislodgement of shells and other materials from the bottom of the river, while the guards around the mouth prevented the ingress of very large gravel or other objects. Additionally, the length of rope with which it was attached, provided for reaching the greatest depth of bottom, while after the dredge was lifted, and the attached rope drawn in about 4-5 of its length, the launch could speed up, and thus most of the mud and sand obscuring the contents of the dredge washed away. By means of the dredge, a fair idea of conditions on the bottom of the particular locality could be determined. Such data would later be useful in connection with propagation experiments.

(b). Collecting Mussels for study and appraisal.

When it was determined to appraise a particular locality, a starting point was determined by methods shortly to be described, the windlass and the tow-line were released, and
the launch going ahead unreeled the 300 ft. of line into the water until it was very nearly taut, when the operator of the launch dropped the anchor at the free end. For the purpose of temporarily anchoring the john-boat while the line was being payed out, one of the bars, usually that one to be placed to the rear, was at favorable opportunity, dropped into the water in such a way that it laid at right angles with the shore, and dragged parallel to it. When it had touched bottom, it was secured into position by means of props and by knotting its rope around one of the uprights. As shortly thereafter as the boat had swung into a favorable position as to render less liable the entangling of the hooks of the bars, the remaining bar was dropped and secured likewise.

After the anchor was dropped and the bars properly played, one of the two operators in the john-boat, windlassed the latter by slow and steady turns up to the point where the anchor had been dropped, observing from time to time the relative apparent motion of the shore line to make certain that snagging or fouling of the bars was not causing the john-boat to pull the anchor towards it in the meantime. When such was found to be the case, the bars were pulled up, the catch discarded, and a new trial made. When the john-boat had been properly windlassed up to the anchor, the latter and the bars were pulled up, the mussels taken off the hooks and thrown into a tub. The launch then towed the john-boat back to the original starting place, when this procedure was repeated twice again for each locality, the mussels obtained from the 3 trials being counted together. Dead shells obtained were not recorded.

The use of the dredge has already been indicated to some extent. Mature mussels caught in it were included among those obtained as previously described. The residue of the net was then examined. After the gravel and larger biological specimens which could be easily seen were removed by hand, the remainder was then screened in the water through sieves of varying fineness, until the juvenile mussels which were especially sought could be picked out by hand. Juveniles were also obtained from masses of water weed pulled up by the crowfoot bars and the dredge. The larger number of them
were obtained from the water weed, to which they were attached by their byssus thread. The dredge had the disadvantage of being apt to foul on some obstruction, and was besides very unwieldy, being apt to hinder the progress of the work. Juveniles taken were at once preserved in a mixture of 4 per cent formalin, 70 per cent alcohol and shell dust, the latter substance preventing erosion of the shell by the other chemicals. They were labelled, counted, and shipped to the Fairport Biological Station. The number obtained at each locality is expressed in parenthesis after the number of mature mussels obtained there; upon the sum of the two at any locality all calculations are made. Other biological specimens were at early opportunity shipped to the various specialists for identification, and the results of their work, which is hereby gratefully acknowledged, is comprised in the notes on the various areas.

(c). Determination of localities.

The course of the river was followed by means of a set of maps of the river published by the Mississippi River Commission, and by a copy of the current edition of the light list for the 13th Lighthouse District as in use by navigators on the river. The position of each locality surveyed is indicated on the maps used, which are now in possession of the U. S. Biological Station, Fairport, Iowa. On these maps, the localities are numbered according to area, and to the order in which they were examined. Thus 1-3 on the map indicates Area 1 and the third locality in it. Reference to the data to follow are to be similarly understood. As previously indicated, only the three best localities in each Area are reported upon.

It was not found practicable to draw into the maps these localities on an exact scale. The markings largely indicate the relative position of the locality with regard to the shore line at the time, the more absolute one being obtained by reference to the descriptive material given in connection with the markings on the maps. The more absolute data concerning the position of the locality was obtained by reference to some object or formation along the shore which seemed of a fairly permanent nature, such as the Government Lights or
Day Marks or other improvements along the river, ravines, elevation of adjacent hills, clumps of bushes, trestles, etc. The first 2 types of reference points were not used when anything better could be observed. The light list referred to gives the distances of these markers and lights from more accurately defined points such as bridges, etc. As data furnished by local clammers was sometimes found to be misleading, positions of productive shell beds were frequently determined by a trial drag with a single bar at varying distances from the shore, when, after encouraging results, the three consecutive drags with both bars were attempted. All beds of shells of fair extent which the party encountered are also indicated upon the maps mentioned.

Once the reference point was established, the distance across the water of the starting point of the drag from this was estimated independently by the three members of the party. The average taken of these distances is that one given in the descriptive material of the localities, and in case of great varieties in estimate, the more probable distance was verified by measurement of other points on the map within sight, and by the making of comparisons. A map case of the type used in the U. S. Army, provided with compass and transparent waterproof cover was found to be a convenient carrier for the maps in the field, where the localities could be promptly indicated. A leather-bound notebook of the type used by engineers was found to be serviceably adaptable for the recording of data. It should be borne in mind, however, that as the larger portion of the work was accomplished under conditions of high water, it was difficult to accurately estimate the position of the normal shore line, and the distances given are those of the position of the outfit from the nearest land above water at the time.

V. LIST OF SPECIES COLLECTED.

The following list embraces those species of mussels collected within the areas surveyed. Besides indicating the common name by which the mussels are known to clammers, the older scientific names of Simpson's Descriptive Catalogue of the Naiades are given, and their equivalent in the forth-
coming Pilsbury-Ortman-Walker nomenclature, which follows more closely the rules of modern zoological nomenclature.

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigrerhead</td>
<td>Quadrula ebenus</td>
</tr>
<tr>
<td>Niggerhead</td>
<td>Quadrula solida</td>
</tr>
<tr>
<td>Hickory Nut</td>
<td>Obovaria elliptis</td>
</tr>
<tr>
<td>Pimple Back</td>
<td>Quadrula pustulosa</td>
</tr>
<tr>
<td>Maple Leaf</td>
<td>Quadrula lachrymosa</td>
</tr>
<tr>
<td>Monkey Face</td>
<td>Quadrula metanevra</td>
</tr>
<tr>
<td>Purple Pimple Back</td>
<td>Quadrula tuberculata</td>
</tr>
<tr>
<td>Three Horn Warty Back</td>
<td>Obovaria reflexa</td>
</tr>
<tr>
<td>Pig Toe</td>
<td>Quadrula undata</td>
</tr>
<tr>
<td>Blue-Point</td>
<td>Quadrula plicata</td>
</tr>
<tr>
<td>Three-Ridge</td>
<td>Quadrula undulata</td>
</tr>
<tr>
<td>Wash Board</td>
<td>Quadrula heros</td>
</tr>
<tr>
<td>Buck Tooth</td>
<td>Obovaria tuberculata</td>
</tr>
<tr>
<td>Mucket</td>
<td>Lampsilis ligamentina</td>
</tr>
<tr>
<td>Higgins's Eye</td>
<td>Lampsilis higginisii</td>
</tr>
<tr>
<td>Lake Pepin Mucket</td>
<td>Lampsilis lutecta</td>
</tr>
<tr>
<td>Dartery</td>
<td>Plagiola securis</td>
</tr>
<tr>
<td>Deer Toe</td>
<td>Plagiola elegans</td>
</tr>
<tr>
<td>Pocket Book</td>
<td>Lampsilis ventricosa</td>
</tr>
<tr>
<td>Yellow Sand Shell</td>
<td>Lampsilis anodontoides</td>
</tr>
<tr>
<td>Slough Sand Shell</td>
<td>Lampsilis fallaciosa</td>
</tr>
<tr>
<td>Black Sand Shell</td>
<td>Lampsilis recta</td>
</tr>
<tr>
<td>Bull Head</td>
<td>Pleurobema acousp</td>
</tr>
<tr>
<td>(No Common Name)</td>
<td>Lampsilis subrostrata</td>
</tr>
<tr>
<td>White Hell Splitter</td>
<td>Symphynota complanata</td>
</tr>
<tr>
<td>Fluted Shell</td>
<td>Lampsilis costata</td>
</tr>
<tr>
<td>Pinky Nut</td>
<td>Lampsilis alata</td>
</tr>
<tr>
<td>Rock Pocket Book</td>
<td>Arcidens confragosus</td>
</tr>
<tr>
<td>Elephant Ear</td>
<td>Unio crassidens</td>
</tr>
<tr>
<td>Spike</td>
<td>Unio gibbosus</td>
</tr>
<tr>
<td>Ohio River Pig Toe (?)</td>
<td>Pleurobema pyramidalatus</td>
</tr>
<tr>
<td>Elk Toe</td>
<td>Lampsilis sturata</td>
</tr>
<tr>
<td>Sugar Spoon</td>
<td>Plagiola donaciformis</td>
</tr>
</tbody>
</table>

**NON-COMMERCIAL SPECIES**

| Slop Bucket   | Anodonta grandis |
| Paper Shell   | Anodonta corculenta |
| Squaw Foot    | Anodonta imbecillis |
| Prey Shells   | Strophitus edentulus |
| Snuff Box     | Lampsilis gracilis |
| Floater       | Truncilla triqueta |

VI. RESULTS.

These include data compiled upon the absolute and relative abundance of each species of mussel found in the areas appraised, together with such geographical or other information likely to be of use in expediting the rechecking of these results after a period of protection, or which might have a bearing upon propagation experiments. The number of shells of each species collected in each locality is given under the heading of the latter, and the percentage of this in the total catch in the locality is indicated. The average of the three percentages thus obtained for each species in each area is taken to
represent the relative abundance of that species in the area. An asterisk, (*), indicates that the species was found to be less than 1 per cent in the area and locality involved. A blank space opposite the name of a species indicates that living shells were not collected in either the area or the localities of it.

AREA I.

Boundaries; lower half of Diamond Island, Miss. R. to Red Wing, Minn., at High Bridge. Status, subject to fishery. Length in Linear Miles, 4.2. Physical Conditions, estimated 7-8 ft. high water. Current about 5 miles per hour. Bottom mostly gravel and sand. Middle sections of area infested with snags.

LOCALITIES REPORTED UPON. (ref. maps.)


I—2. Starting point of drags Govt. Day Mark 958-k, (above island 23), Wisconsin side of channel, 30 ft. from shore, about ½ mile down stream from preceding locality.

I—6. Starting point of drags, 300 ft. upstream from Govt. Day Mark 958-g across the mouth of slough about 1 mile above Red Wing on Minnesota side, 50 ft. from mouth of slough. July 9, 1920.
NOTES ON AREA.

Certain species, as *E. dilatatus*, *B. granifera*, are at present present in Area I.

### COMMERCIAL SPECIES *

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality 1.4</th>
<th>% Total Catch in Locality</th>
<th>Locality 1.2</th>
<th>% Total Catch in Locality</th>
<th>Locality 1.6</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusconaia ebena</td>
<td>7</td>
<td>1.5%</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Pleurobema catillus</td>
<td>3</td>
<td>*</td>
<td>3</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Obovaria olivaria</td>
<td>133</td>
<td>36%</td>
<td>141</td>
<td>34%</td>
<td>5</td>
<td>1.9%</td>
<td>21.9%</td>
</tr>
<tr>
<td>Quadrula postulosa</td>
<td>23</td>
<td>5%</td>
<td>*</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Quadrula quadula</td>
<td>7</td>
<td>1.5%</td>
<td>7</td>
<td>1.4%</td>
<td>1</td>
<td>*</td>
<td>1.66%</td>
</tr>
<tr>
<td>Quadrula granева</td>
<td>7</td>
<td>1.5%</td>
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<td>1%</td>
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<tr>
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<tr>
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<td>34</td>
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<td>7%</td>
</tr>
<tr>
<td>Elitio niger</td>
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<td>15</td>
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<td>*</td>
<td>*</td>
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</tr>
<tr>
<td>Elitio dilatatus</td>
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<td>*</td>
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<td>*</td>
<td>*</td>
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<tr>
<td>Amygdalonsion donaciformis</td>
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</tbody>
</table>

### TOTALS

395 8.66% 355 73.7% 94 33.9% 63%

### NON-COMMERCIAL SPECIES *

<table>
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<tr>
<th>Species</th>
<th>Locality 1.4</th>
<th>% Total Catch in Locality</th>
<th>Locality 1.2</th>
<th>% Total Catch in Locality</th>
<th>Locality 1.6</th>
<th>% Total Catch in Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anodonta grandis</td>
<td>1</td>
<td>2.9%</td>
<td>9</td>
<td>2.9%</td>
<td>9</td>
<td>2.9%</td>
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<td>Anodonta corculenta</td>
<td>1</td>
<td>2.9%</td>
<td>9</td>
<td>2.9%</td>
<td>9</td>
<td>2.9%</td>
</tr>
<tr>
<td>Anodonta imbecillis</td>
<td>12</td>
<td>2.7%</td>
<td>3</td>
<td>3%</td>
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<td>3%</td>
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<tr>
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<td>2.7%</td>
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<td>15</td>
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<td>34</td>
<td>13.6%</td>
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<tr>
<td>Proptera laevissima</td>
<td>17</td>
<td>4%</td>
<td>15</td>
<td>3.6%</td>
<td>34</td>
<td>13.6%</td>
</tr>
<tr>
<td>Carunculina parua</td>
<td>17</td>
<td>4%</td>
<td>15</td>
<td>3.6%</td>
<td>34</td>
<td>13.6%</td>
</tr>
<tr>
<td>Truncilla trueta</td>
<td>17</td>
<td>4%</td>
<td>15</td>
<td>3.6%</td>
<td>34</td>
<td>13.6%</td>
</tr>
</tbody>
</table>

### TOTALS

47 10.5% 62 15.6% 161 65.4% 28.2%

TOTALS ALL SHELLS 442 97.1% 408 89.3% 255 99.3% 91.2%

clammed out of this area. Two large piles of these shells, said to have come from this region were observed in Lake Pepin. Indications are that this area constitutes a metropolis.
for *O. olivaria*, although the largest shells of this species were obtained at Wabasha. *A. corpulenta* of the river at this point seems to be much thicker than the same species as obtained from the sloughs. Locality I-2 is known to old time clammers as the Trenton Bed. While still fairly productive, no clammers were observed working it at this time. Juveniles were comparatively rare in this area.

**AREA II.**

Boundaries, Red Wing, Minn., to Bay City, Wis. Status, closed to fishery. Length in Linear Miles, 5.8. Physical Conditions, 7 ft. high water; current about 3 miles per hour; bottom mostly sand and mud; snags most abundant toward the Wisconsin shore. Water weed in lower stretches.

**LOCALITIES REPORTED UPON.** (ref. maps.)

**II—1.** Starting point of drags 300 ft. upstream off Wisconsin shore from Govt. Day Mark 958-e, on edge of main channel about 40 ft. from shore. July 10, 1920.

**II—2.** Starting point of drags 35 ft. from shore, about ¼ mile downstream from Govt. Day Mark 958-d, opposite bathing houses and summer camp on Minn. shore. July 10, 1920.

**II—4.** Starting point of drags 100 ft. downstream from Govt. Day Mark 958-b, 45 ft. from Minnesota shore.

**NOTES ON AREA.**

Collecting in this area was best on the edge of the channel. It was extensively clammed some years ago. At present, there appear to be fewer shells of the Quadrula group than others. *Truncilla triquetra* was first recorded from the upper region of the river at this point. Juveniles, especially of *Anodonta* and *Lampsilis sp.* are more abundant here than in the preceding area.
### AREA II.

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES*</th>
<th>Locality II-1</th>
<th>% Total Catch in Locality</th>
<th>Locality II-2</th>
<th>% Total Catch in Locality</th>
<th>Locality II-I</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
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<td>1</td>
<td>*</td>
<td>1</td>
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<tr>
<td>Pleurobema catillus</td>
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<td>1%</td>
<td>32(4)</td>
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<td>12%</td>
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<td>23.5%</td>
<td>5</td>
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<tr>
<td>Quadraula postulosa</td>
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<td>8</td>
<td>2%</td>
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<td></td>
<td>1.8%</td>
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<tr>
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<td>3</td>
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<td><strong>TOTALS</strong></td>
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<td>149</td>
<td>72%</td>
<td>195</td>
<td>60.8%</td>
<td>58.9%</td>
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<tr>
<th>NON-COMMERCIAL SPECIES*</th>
<th>Locality II-1</th>
<th>% Total Catch in Locality</th>
<th>Locality II-2</th>
<th>% Total Catch in Locality</th>
<th>Locality II-I</th>
<th>% Total Catch in Locality</th>
<th>TOTALS</th>
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</thead>
<tbody>
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<td>Anodontis grandis</td>
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<td>11.9%</td>
<td>17</td>
<td>8.5%</td>
<td>15</td>
<td>5.1%</td>
<td>8.5%</td>
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<td>17</td>
<td>8.5%</td>
<td>16</td>
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<td>8.6%</td>
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<td>13</td>
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<td>1.4%</td>
</tr>
<tr>
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<td>25(1)</td>
<td>28%</td>
<td>14</td>
<td>7%</td>
<td>15</td>
<td>5%</td>
<td>13%</td>
</tr>
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<td>3.9%</td>
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<tr>
<td>Carunculina parva</td>
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<tr>
<td>Trunella trilatrea</td>
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<tr>
<td><strong>TOTALS</strong></td>
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<td>52.3%</td>
<td>48</td>
<td>24%</td>
<td>104</td>
<td>33.4%</td>
<td>35.4%</td>
</tr>
</tbody>
</table>

| TOTALS ALL SHELLS      | 267          | 99.9%                     | 197           | 96%                       | 299           | 94.2%                     | 89.2%  |

### AREA III.

Boundaries, Bay City, Wis. to Maiden Rock, Wis., and Frontenac, Minn. Status, subject to fishery. Length in Linear Miles, 5.7. Physical Conditions, 7 ft. high water; current about 2 miles; bottom, gravel, mud, and some sand. Comparatively free from snags. Water weeds fairly common in upper stretches of area.
LOCALITIES REPORTED UPON. (ref. maps.)

III—1. Lake Pepin, starting point of drags 1,500 ft. towards point with Light 957 from Wacouta Point, Minn., 100 ft. from shore, starting at a clump of low willows. July 14, 1920.

III—4. About 2 miles below Bay City on Wisconsin shore, starting at a clump of willows and poplars at lower end of promontory with an altitude of 680. Drags 75 ft. off shore July 15, 1920.

III—8. Drags from Point No-Point to Frontenac Point in a straight line between them, starting 300 ft. from shore of first, and finishing 75 ft. from shore of second. July 16, 1920.

NOTES ON AREA.

In this section of Lake Pepin there exist clam beds known from their adjacent regions as the Maiden Rock and Warren- ton Beds. After poor success here, we learned from clam- mers, that while this was ordinarily a good locality, it was at this time covered with 6 in. of decaying vegetable matter brought in by the unusual rains of the summer, and this pre- vented the hooks from taking hold. Juveniles were somewhat less abundant than in the preceding area.

During the entire period of our collecting in Lake Pepin, and less noticeably so in the lower stretches of the river, there was observed on the surface of the lake, masses of algal plankton occurring in the form of dots, short rods and ten- drils. Messrs. H. W. Clark and R. S. Corwin of the Fairport Biological Station state additionally concerning it, "the alga is practically all Aphanizomenon flos-aquae. It is predomi- nant in the plankton algae of the Upper Mississippi. It is abundant in Lake Pokegama also. There were one or two colonies of Anabaena spiroides and one Diffugia cratera in the mass examined."

The abundance of such plant food in Lake Pokegama and Lake Pepin may account in some degree for the abundance and excellent quality of the fat muckets found in those Lakes. Fresh water sponge was abundant on the Minnesota side of the lake.
REPORT ON THE STUDY AND APPRAISAL, ETC.

AREA III.

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES*</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
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<td>Fuscona japonica</td>
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<td>Pleurobema catillus</td>
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<td>Obovaria olivaria</td>
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<tr>
<td>Lasmigona complanata</td>
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<tr>
<td>Eliptio Niger</td>
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<tr>
<td>Eliptio dilatatus</td>
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<tr>
<td>Pleurobema pyramidatum</td>
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<tr>
<td>Alasmidonta marginata</td>
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<tr>
<td>Amygdalinais donaeiformis</td>
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</tbody>
</table>

**TOTALS...**

|              | 70 | 89% | 67 | 86.5% | 83 | 83.3% | 84.7% |

**NON-COMMERCIAL SPECIES* **

<table>
<thead>
<tr>
<th>Specie</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Locality</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anodonta grandis</td>
<td>9</td>
<td>10.5%</td>
<td>2</td>
<td>2.6%</td>
<td>1</td>
<td>1.2%</td>
<td>4.4%</td>
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<tr>
<td>Anodonta corculenta</td>
<td>2</td>
<td>2.4%</td>
<td>6</td>
<td>7.8%</td>
<td>1</td>
<td>1.2%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Anodonta imbecillus</td>
<td>2</td>
<td>2.4%</td>
<td>6</td>
<td>7.8%</td>
<td>1</td>
<td>1.2%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Strophitus dentatus</td>
<td>1</td>
<td>1.2%</td>
<td>2</td>
<td>2.6%</td>
<td>2</td>
<td>2.1%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Leptodea fragilis</td>
<td>1</td>
<td>1.2%</td>
<td>2</td>
<td>2.6%</td>
<td>2</td>
<td>2.1%</td>
<td>1.6%</td>
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<tr>
<td>Pterostrobus kevisshigonsa</td>
<td>1</td>
<td>1.2%</td>
<td>2</td>
<td>2.6%</td>
<td>2</td>
<td>2.1%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Truncilla quinquetrigera</td>
<td>1</td>
<td>1.2%</td>
<td>2</td>
<td>2.6%</td>
<td>2</td>
<td>2.1%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

**TOTALS...**

|              | 77 | 100% | 77 | 100% | 77 | 100% | 98.3% | 98.2% |

**TOTALS ALL SHELLS...**

|              | 89 | 16.5% | 77 | 100% | 93 | 98.3% | 98.2% |
AREA IV.

Boundaries, Maiden Rock, Wis., and Frontenac, Minn. to Lake City, Minn. and Stockholm, Wis. Status, closed to fishery. Length in Linear Miles, 6.7. Physical Conditions, 5 ft. high water; bottom varying from pebbles, to sand and mud; current 1½ to 2 miles per hour. Patches of water weed abundant.

LOCALITIES REPORTED UPON. (ref. maps.)


IV—12. At Lake City, between Lake City Point Light and breakwater, starting 40 ft. off shore, from center of space between small house and ice-house. July 20, 1920.

NOTES ON AREA.

Clammers believe this area to be pretty well clammed out, although it contained more juvenile shells than previously encountered in other areas. This fact seems reasonably due to the propagation experiments which the Bureau of Fisheries has been conducting in the region for several years. This area really produces the larger number of juveniles than any other considered, but as adult shells from these localities are in the great minority, the juveniles are not represented in the check localities given. All data submitted for juveniles is from the standpoint of their frequency in clam beds, whereas below Lake Pepin they were found to be most abundant on the sand bars. The juveniles were mostly *L. siliquoidea*. The water weeds encountered were *Vallisneria spiralis*, *Ceratophyllum demersum*, and various species of *Potamogeton*. The party gained the impression that the abundance of juveniles in an area was related to the abundance of the water weed. Species of fresh water snails, and a crayfish collected were determined by Dr. A. E. Ortmann to be *Campeloma subsoli-
**REPORT ON THE STUDY AND APPRAISAL, ETC.**

*dum* (Anthony) species of *Goniobasis* and *Pleurocera*, while the crayfish was *Cambarus* (*Faxonus*) *virilis*, Hagen.

**AREA IV.**

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES</th>
<th>Locality IV-9</th>
<th>% Total Catch in Locality</th>
<th>Locality IV-11</th>
<th>% Total Catch in Locality</th>
<th>Locality IV-12</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusconaia ebena.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Pleurobema catillus</td>
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</tr>
<tr>
<td>Obovaria olivaria.</td>
<td></td>
<td></td>
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<tr>
<td>Quadrula quadrula.</td>
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<tr>
<td>Quadrula metanevra.</td>
<td></td>
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<tr>
<td>R-undaria granifera.</td>
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<tr>
<td>Obliquaria reflexa.</td>
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<tr>
<td>Fusconaia undata.</td>
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<td>Amblyma peruviana.</td>
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<td>16.3%</td>
<td>17</td>
<td>7.3%</td>
<td>27</td>
<td>11.6%</td>
<td>11.7%</td>
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<td>Megalonais heros.</td>
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<td>Quadrula venosa.</td>
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<tr>
<td>Actinonais carinata</td>
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<tr>
<td>Lampsiis bigginisi.</td>
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<td>Lampsiis siliquidea.</td>
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<td>88(1)</td>
<td>40%</td>
<td>91</td>
<td>37%</td>
<td>102(5)</td>
<td>46.4%</td>
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<td>Amygadalinae trunca.ta.</td>
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<td>12</td>
<td>4.9%</td>
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<td>7</td>
<td>3%</td>
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<td>Lampsiis ventricosa.</td>
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<td>5</td>
<td>2.2%</td>
<td>17</td>
<td>7.3%</td>
<td>19</td>
<td>8.1%</td>
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<td>1.8%</td>
<td>4</td>
<td>1.7%</td>
<td>4</td>
<td>1.5%</td>
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<td>Lampsiis fallaciosa.</td>
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<td>Plathobasus cyphus.</td>
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<td>Lasmigona castata.</td>
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<td>Proptera alata.</td>
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<td>Elliptio niger.</td>
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<td>Elliptio dilatatus.</td>
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<tr>
<td>Pleurobema pyramidatum.</td>
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<td>Alasmidonta marginita.</td>
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<td>Amygdalinae donaciformis.</td>
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<td>13</td>
<td>4.9%</td>
<td>12</td>
<td>5.1%</td>
<td>7</td>
<td>3%</td>
</tr>
</tbody>
</table>

**TOTALS:** 195 85.2% 216 87% 211 90% 86.6%

**NON-COMMERCIAL SPECIES**

| Anodonta grandis. | 8               | 6.6% | 7 | 2.1% | 9 | 3.8% | 3.2% |
| Anodonta corpulenta.|     | 5               | 2 | 2.8% | 6 | 2.6% | 2.8% |
| Anodonta imbecilis.| 13             | 3.5% | (1) | 2 | 1.0% | (6) | 2.6% |
| Strophius edentulus.|     | 4               | 1 | 6 | 2.6% | 3(1) | 1.7% |
| Leptodea fragilis.|               | 2              | 1% |                      |                         | 2* | 2%  |
| Leptodea laevissima.|     | 1              | 1% |                      |                         | 1* | 1%  |
| Carunculina parva.|               | 1              | 1% |                      |                         | 1* | 1%  |
| Truncilla triquetra.|     | 1              | 1% |                      |                         | 1* | 1%  |

**TOTALS:** 26 11.2% 17 5.9% 22 8% 8% 8%

**TOTALS ALL SHELLS:** 221 96.4% 233 92.7% 233 98% 94.6%

**AREA V.**

Boundaries, Lake City, Minn. and Stockholm, Wis. to Pepin, Wis. Status, subject to fishery. Length in Linear Mile, 5.3. Physical Conditions, 5 ft. high water during survey; current two miles per hour; bottom mud and sand with a few pebbles; occasional patches of water weed.
LOCALITIES REPORTED UPON. (ref. maps.)


V—10. About 1 1/4 miles from Deer Lake, (Wisconsin shore), and 1/4 mile from pier at Pepin, starting point at nearest house on Wisconsin shore with 2 outbuildings in the rear. 600 ft. off shore.

NOTES ON AREA.

Compared with adults, juveniles were more abundant here than in any other area. This area was the one most worked in Lake Pepin during the summer of 1920, and some valuable pearls had their origin here. While fresh water sponges had been encountered from the beginning of the trip, such were more abundant in Lake Pepin than elsewhere. Specimens collected and forwarded to Professor Frank Smith, University of Illinois, were identified as Spongilla fragilis, Loidy.
### AREA V.

#### COMMERCIAL SPECIES *

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality V-5</th>
<th>% Total Catch in Locality</th>
<th>Locality V-6</th>
<th>% Total Catch in Locality</th>
<th>Locality V10</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
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<td>Fusconaia ebena</td>
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<td>3.7%</td>
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<td>2.4%</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Pleurobema catillia</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Obovaria olivaria</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Quadrula postulosa</td>
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<td>1%</td>
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<tr>
<td>Quadrula quadrula</td>
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</tr>
<tr>
<td>Quadrula tetranevra</td>
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<td>Obovaria reflexa</td>
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<td>1%</td>
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<tr>
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<tr>
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<td>Actinonais carinata</td>
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<td>*</td>
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<td>Lampsilis higginsi</td>
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<td>61 (19)</td>
<td>30.9%</td>
<td>69 (4)</td>
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<td>34.4%</td>
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<tr>
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<td>6</td>
<td>1.5%</td>
<td>2</td>
<td>*</td>
<td>1%</td>
</tr>
<tr>
<td>Lampsilis ventricosa</td>
<td>20 (5)</td>
<td>8%</td>
<td>44 (6)</td>
<td>10.7%</td>
<td>45 (5)</td>
<td>18%</td>
<td>12.3%</td>
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<tr>
<td>Lampsilis fallaciosa</td>
<td>3</td>
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<td>*</td>
<td>*</td>
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</tr>
<tr>
<td>Euryria recta</td>
<td>1</td>
<td>*</td>
<td>9</td>
<td>2%</td>
<td>2</td>
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</tr>
<tr>
<td>Euryria subostrata</td>
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<td>Plethobasus cyphusus</td>
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<td>*</td>
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<tr>
<td>Lasigmia complanata</td>
<td>5</td>
<td>1.7%</td>
<td>1</td>
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<td>2</td>
<td>1%</td>
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</tr>
<tr>
<td>Propsera alata</td>
<td>5</td>
<td>1.7%</td>
<td>11</td>
<td>2.7%</td>
<td>10</td>
<td>4%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Arcidens confragosus</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Elliptio niger</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Elliptio dilatatus</td>
<td>18</td>
<td>6.8%</td>
<td>20</td>
<td>5%</td>
<td>10 (1)</td>
<td>4.4%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Pleurobema graniferatum</td>
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<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Alasmidonta marginata</td>
<td>*</td>
<td>*</td>
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<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Amygdalorais donaciformis</td>
<td>3</td>
<td>1%</td>
<td>2</td>
<td>*</td>
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</tr>
</tbody>
</table>

**TOTALS.** 272 35.4% 386 92.4% 241 89.4% 89.8%

#### NON-COMMERCIAL SPECIES *

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality V-5</th>
<th>% Total Catch in Locality</th>
<th>Locality V-6</th>
<th>% Total Catch in Locality</th>
<th>Locality V10</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anodonta grandis</td>
<td>5</td>
<td>1.7%</td>
<td>4</td>
<td>1%</td>
<td>2</td>
<td>*</td>
<td>1.2%</td>
</tr>
<tr>
<td>Anodonta corpulenta</td>
<td>1</td>
<td>*</td>
<td>6</td>
<td>1.5%</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Anodonta imbecillis</td>
<td>1</td>
<td>1.4%</td>
<td>6</td>
<td>1.5%</td>
<td>3</td>
<td>1.2%</td>
<td>1%</td>
</tr>
<tr>
<td>Strophitus edentulus</td>
<td>4</td>
<td>1.4%</td>
<td>6</td>
<td>1.5%</td>
<td>3</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>Leptodea fragilis</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Propsera lacissima</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Carunculina parva</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Truncella triquetra</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

**TOTALS.** 10 3.1% 11 2.5% 6 1.2% 2.2%

**TOTALS ALL SHELLS.** 282 96.5% 397 94.9% 247 90.6% 92.2%

### AREA VI.

Boundaries, Pepin and King's Coulee to Read's Landing, Minn. Status, closed to fisheries. Length in Linear Miles, 4. Physical conditions, 4 ft. high water; current about 2 miles. Bottom, mud and sand, with a great deal of water weed on the Wisconsin side. Cobble, gravel, and riff-raff on the Minnesota shore.
LOCALITIES REPORTED UPON. (ref. maps.)


VI—6. One mile upstream from bridge at Read’s Landing, 300 ft. s. w. of C. M. & St. P. R. R. at base of stone quarry, 700 ft. from Minnesota shore. July 28, 1920.

NOTES ON AREA.

Next to Area V, the juveniles found were most abundant here. Locality 6 in this area represents a re-juvenating bed at the base of Lake Pepin, clammed out years ago, and at that time producing many niggerheads. The only living specimen of *R. granifera* taken in the lake was secured at this place, although previously large numbers of dead shells were seen. At this point there was collected for the first time, *Pleurobema Pyramidatum*. Both localities 5 and 6 had comparatively few old shells in them. Locality 3 is shunned by clammers on account of the rocky bottom at this place, yet certain clammers who know the region are able to make good hauls here. Juveniles were fairly abundant. Specimens of *Plagiola lineolata* were particularly large. Fresh water sponges, and Bryozoa of species to be later given were also obtained here.
## AREA VI.

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES</th>
<th>Locality VI-3</th>
<th>% Total Catch in Locality</th>
<th>Locality VI-5</th>
<th>% Total Catch in Locality</th>
<th>Locality VI-6</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusconaia ebena</td>
<td></td>
<td>16</td>
<td></td>
<td>3.6%</td>
<td></td>
<td></td>
<td>1.2%</td>
</tr>
<tr>
<td>Pleurobema catillus</td>
<td></td>
<td>7(1)</td>
<td>13</td>
<td>2.9%</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Obostra olivaria</td>
<td></td>
<td>3 *</td>
<td>2 *</td>
<td>1.1%</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Quadrula postolosa</td>
<td></td>
<td>5 *</td>
<td>5 *</td>
<td>1%</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Quadrula quadrala</td>
<td></td>
<td>2 *</td>
<td>3 *</td>
<td>1%</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Quadrula metanevra</td>
<td></td>
<td>23</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>2%</td>
</tr>
<tr>
<td>Rotundaria granifera</td>
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<td>1 *</td>
<td>1 *</td>
<td>1%</td>
<td></td>
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<td>*</td>
</tr>
<tr>
<td>Obliquaria reflexa</td>
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<td></td>
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<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
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<td>138</td>
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<td></td>
<td>22</td>
<td>5%</td>
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<tr>
<td>Amblema peruviana</td>
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<td>5(2)</td>
<td>51(1)</td>
<td>10.9%</td>
<td></td>
<td>66</td>
<td>15%</td>
</tr>
<tr>
<td>Amblema costata</td>
<td></td>
<td>5</td>
<td></td>
<td>15%</td>
<td></td>
<td></td>
<td>10.3%</td>
</tr>
<tr>
<td>Megalonais heros</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Quadrula verrucosa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actionalis carinata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampsilis higginsi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampsilis siliqueidea</td>
<td></td>
<td>33(4)</td>
<td>92(9)</td>
<td>21.2%</td>
<td>55(3)</td>
<td>12.8%</td>
<td>19.8%</td>
</tr>
<tr>
<td>Plagiola lineolata</td>
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<td>3</td>
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</tr>
<tr>
<td>Ambyrionais truncata</td>
<td></td>
<td>5(3)</td>
<td>1.6%</td>
<td>4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampsilis ventricosa</td>
<td></td>
<td>53(5)</td>
<td>26(5)</td>
<td>6.5%</td>
<td>31(6)</td>
<td>8.5%</td>
<td>18.3%</td>
</tr>
<tr>
<td>Lampsilis anodontoides</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampsilis fallaciosa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euonyma recta</td>
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<td>1.8%</td>
<td>*</td>
<td></td>
<td>2 *</td>
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</tr>
<tr>
<td>Euonyma subrostrata</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Plectobasus cypyhus</td>
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<td></td>
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</tr>
<tr>
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<td>4</td>
<td>4 *</td>
<td>1.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lasigmica costata</td>
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</tr>
<tr>
<td>Pterostoma alata</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Arcidens confragosus</td>
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<td>1</td>
<td></td>
<td>*</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Elliptio niger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elliptio dilatatus</td>
<td></td>
<td>5</td>
<td>15.5%</td>
<td>7%</td>
<td></td>
<td>17.2%</td>
<td>12%</td>
</tr>
<tr>
<td>Pleurobema pyramidatum</td>
<td></td>
<td>2</td>
<td>1.8%</td>
<td>2%</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Abalidae marginita</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambyrionais donaciformis</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TOTALS

|             | 132       | 90.6%      | 449           | 91.8%        | 391          | 86%               | 88.6%                        |

### NON-COMMERCIAL SPECIES

| Anodonta grandis | 6 *       | 4.1%       |               | 5.6%         | 3.2%          |
| Anodonta corpulent |            | 10         | 2.1%          | 6            | 1%            |
| Anodonta imbecillus| (1)      |            |               | 21(1)        | 1.1%          |
| Strophitus dentulatus|         | 1          |               | 5            | 1.1%          |
| Leptidea fragilis | 1(1)      | 1.3%       | 1.4%          | 21(1)        | 2.6%          |
| Proctoria laevissima|          | 2           |               | 1.8%         | 2.6%          |
| Carunculina parva | 1          | 1.8%       | 4.4%          | 21(1)        | 2.6%          |
| Truncilla triquetra|           |            |               | 21(1)        | 2.6%          |

### TOTALS

| 10          | 5.4%      | 17          | 3.3%         | 34           | 11.7%         | 6.7%                    |

### TOTALS ALL SHELLS

| 142        | 96%       | 466         | 94.3%        | 425          | 97.7%         | 95.3%                   |

## AREA VII.

Boundaries, Read's Landing, Minn., to Minneiska, Minn. Status, open to fishery. Length in Linear Miles, 20.9. Physical conditions, 5 ft. high water; current 4-6 miles per hour. Bottom, sandy, with many bedded snags, especially in upper portion.
LOCALITIES REPORTED UPON. (ref. maps.)


NOTES ON AREA.

Few juveniles were to be seen in this area. On the site of an old shipyard at Wabasha, remnants of a clam bed with some young shells were found. The bed is hindered in regeneration by the amount of rubbish, iron wire, etc., dumped in the locality. The same conditions hold for locality VII-4. Further down at Teepeeota point was a remnant, composed of gigantic shells of an old clam bed, in which juveniles were totally absent. The bottom in this locality seemed well suited to mussel growth, there being no rubbish, few if any snags. The current has probably carried away the juveniles. Much effort was expended in this and other areas to locate clam beds by the method already described, but most of the productive ones have been covered up. There are few if any water weeds in this area except in the sloughs.

In the vicinity of Alma, (Govt. Light 926 and the R. E. Jones Mill), other remnants of beds exist, composed of giant “niggerheads” and “warty backs.” Only a slight idea could be gained of these latter, as the bottom was so snaggy that it was unprofitable to attempt work with the crowfoot bars. Formerly this bed was worked with a pitch fork. At the lower limits of this area shells were more abundant, and were more easily secured from sand bars than any place else. The upper portion of West Newton Chute was very prolific in this respect. Species of snails and crayfish as recorded previously were common here.
### AREA VII.

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES *</th>
<th>Locality VII</th>
<th>Locality VII-6</th>
<th>Locality VII-14</th>
<th>Localities</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fusconaja ebena</strong></td>
<td>10</td>
<td>6.8%</td>
<td>3</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Pleurobema catillus</strong></td>
<td>7</td>
<td>4.4%</td>
<td>1</td>
<td>4</td>
<td>15.4%</td>
</tr>
<tr>
<td><strong>Obovaria olivaria</strong></td>
<td>2</td>
<td>*</td>
<td>7</td>
<td>5</td>
<td>4.9%</td>
</tr>
<tr>
<td><strong>Quadrula postiposa</strong></td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Quadrula undata</strong></td>
<td>11</td>
<td>6.9%</td>
<td>3</td>
<td>1</td>
<td>1.3%</td>
</tr>
<tr>
<td><strong>Amblema peruviana</strong></td>
<td>17</td>
<td>10.7%</td>
<td>15</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Amblema costata</strong></td>
<td>5</td>
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<td>6</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Actinonais carinata</strong></td>
<td>33</td>
<td>20%</td>
<td>3</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Lampsilis higginisi</strong></td>
<td>2</td>
<td>1.6%</td>
<td>3</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Lampsilis siliquoides</strong></td>
<td>2</td>
<td>*</td>
<td>*</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td><strong>Plagioila lineolata</strong></td>
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<td>46</td>
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<tr>
<td><strong>Lampsilis ventricosa</strong></td>
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<td><strong>Euryinia subrostrata</strong></td>
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<td>3.8%</td>
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<tr>
<td><strong>Lasmigona complanata</strong></td>
<td>140</td>
<td>10%</td>
<td>4</td>
<td>2</td>
<td>7.7%</td>
</tr>
<tr>
<td><strong>Lasmigona costata</strong></td>
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<td>12.6%</td>
<td>6</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Propera alata</strong></td>
<td>26</td>
<td>12.6%</td>
<td>6</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Propera laevissima</strong></td>
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<td>6</td>
<td>1</td>
<td>3.8%</td>
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<tr>
<td><strong>Truncilla triqueta</strong></td>
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<td>2.4%</td>
<td>8</td>
<td>4.9%</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

**TOTALS**: 158 | 96.4%| 141 | 95.5%| 26 | 99.2% | 99.8%

### AREA VIII.

Boundaries, Minneiska, Minn. to Fountain City, Wis. Status, closed to fishery. Length in Linear Miles, 10.8. Physical Conditions, 2 ft. high water; current about 2 miles per hour. Bottom, sand, mud, cobbles, mud, riff-raff, and infested with snags.
LOCALITIES REPORTED UPON. (ref. maps.)


VIII—10. One-half mile around the bend from Govt. Light 896.35 ft. off shore, starting point adjacent to coulee south of Chimney Rock. August 14, 1920.

VIII—19. Straight Slough, 100 ft. south of the north of the first large slough leading from it, (at upper end) to the C. M. & St. P. R. R. tracks from 655 elevation; on opposite shore at distance 20 ft. from banks. August 16, 1920.

NOTES ON AREA.

This area stands third in the abundance of juveniles found. Remnants of a bed were found along the water front at Minneiska. This is given in locality VIII-1. Locality VIII-10 represents the old Chimney Rock Bed. Juveniles secured in this and succeeding areas were obtained from sand bars principally by hand.

In this area, there were frequently collected upon the sand bars crayfish which Dr. A. E. Ortmann of the Carnegie Museum, Pittsburgh, Pa., pronounced to be Cambarus (Eaxohus) virilis Hagen, (males of the second form,) and Cambarus blandingii acutus Gerard, (males of the second forms).

As early as the latter part of July there was noticed a brilliant bluish-green scum upon the shore of the sloughs and sand bars. Some of the material was sent to Dr. G. T. Moore, director of the Missouri Botanical Garden for identification. Dr. Moore stated it “was a mixture of 3 blue-green algae, the major portion being Clathrocystis serrigena, with occasional colonies of Coelosphaerium kuetzingianum, as well as occasional colonies of Anabaena flos-aquae. This mixture is a very common one and has been associated for a number of years with the phenomenon known abroad as the "breaking of the meres." In this country it is generally referred to as the "flowering of the waters."

Dr. C. B. Davenport, of the Carnegie Station for Experimental Evolution, Cold Spring Harbor, N. Y., identified specimens of Bryozoa forwarded him as Pectinatella magnifica. These were collected from Fountain City Bay, Fountain
City, Wis. He indicates that the following additional species may be expected to occur in the Mississippi also, viz. *Urnatella gracilis, Paludicella ehrenbergii, Fredericella sultana, Cristatella mucedo* and various species of *Plumatella*. Some of these species are known from the Illinois River, and on account of the resistance which the statoblasts have to the digestive fluids of birds, have become widely distributed over the whole country east of the Rocky Mountains.

**AREA VIII.**

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES *</th>
<th>Locality VIII-I</th>
<th>% Total Catch in Locality</th>
<th>Locality VIII-10</th>
<th>% Total Catch in Locality</th>
<th>Locality VIII-19</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
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<td>Fusconaia ebena</td>
<td>3</td>
<td>21.4%</td>
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<tr>
<td>Pleurobema catillus</td>
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<td>14.3%</td>
<td></td>
<td></td>
<td></td>
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<td>4.7%</td>
</tr>
<tr>
<td>Obovatia olivaria</td>
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<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4%</td>
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<td>Quadula postulosa</td>
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</tr>
<tr>
<td>Quadula quadrula</td>
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<td>14.2%</td>
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<td>4.7%</td>
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<td></td>
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<tr>
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<td>50%</td>
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<td>50%</td>
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<td></td>
<td>11%</td>
</tr>
<tr>
<td>Amblemma costata</td>
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<td>14.2%</td>
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<td></td>
<td></td>
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<td>11%</td>
</tr>
<tr>
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<td>14.2%</td>
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<td></td>
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<td>11%</td>
</tr>
<tr>
<td>Quadula verrucosa</td>
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</tr>
<tr>
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<td>7.1%</td>
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</tr>
<tr>
<td>Lampsi/us higginisi</td>
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</tr>
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<tr>
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<tr>
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<td>11.5%</td>
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<td>2.8%</td>
</tr>
<tr>
<td>Lampsi/us ventricosa</td>
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<td>8.3%</td>
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<td></td>
<td></td>
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<td>2.8%</td>
</tr>
<tr>
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<td>11.5%</td>
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<td></td>
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</tr>
<tr>
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</tr>
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<td>2.8%</td>
</tr>
<tr>
<td>Lasmi/gona complanata</td>
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<td></td>
<td></td>
<td></td>
<td>2.8%</td>
</tr>
<tr>
<td>Lasmi/gona costata</td>
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<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.8%</td>
</tr>
<tr>
<td>Propera alata</td>
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<td>8.3%</td>
<td></td>
<td></td>
<td></td>
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<td>2.8%</td>
</tr>
<tr>
<td>Arcidens confagrosus</td>
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<tr>
<td>Elijipto niger</td>
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<td>8.3%</td>
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<td></td>
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</tr>
<tr>
<td>Elijipto dilatatus</td>
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<td></td>
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</tr>
<tr>
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<td></td>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>TOTALS</td>
<td>12</td>
<td>85.4%</td>
<td>12</td>
<td>100%</td>
<td>84</td>
<td>87.8%</td>
<td>90.1%</td>
</tr>
</tbody>
</table>

**NON-COMMERCIAL SPECIES * **

| Anodonta grandis      | 2               | 14.2%                    |                  |                          |                  |                          |                  |
| Anodonta corpulenta   | 1               | 1%                       |                  |                          |                  |                          | 5%               |
| Anodonta imbecillis   |                  |                          |                  |                          |                  |                          |                  |
| Strophitus dentiflorus| 1               | 1%                       |                  |                          |                  |                          | 5%               |
| Leptodea fragilis     | 1               | 1%                       |                  |                          |                  |                          | 5%               |
| Trunella triqueta     | 1               | 1%                       |                  |                          |                  |                          | 5%               |
| Propera laevissima    |                  |                          |                  |                          |                  |                          |                  |
| Carunculina parva     |                  |                          |                  |                          |                  |                          |                  |
| TOTALS                | 2               | 14.2%                    | 12               | 100%                     | 11               | 11.4%                    | 8%               |
| TOTALS ALL SHELLS     | 14              | 99.6%                    | 12               | 100%                     | 95               | 99.2%                    | 98.1%            |
AREA IX.

Boundaries, Fountain City, Wis. to Winona, Minn. (High Bridge). Status, open to fishery. Length Linear Miles, 8.6. Physical Conditions, 2 ft. high water; current 4 miles. Bottom, gravel and mud, with less amount of riff-raff than in preceding areas.

LOCALITIES REPORTED UPON. (ref. maps.)


IX—22. Straight Slough, about 3 miles from mouth, across the mouth of the first slough above island with 655 elevation. 25 ft. from north shore. Aug. 21, 1920.


NOTES ON AREA.

An old bed of "niggerheads" existing at Wild's Landing was found to be absolutely covered with sand deflected by the dams. No trace of a bed said to exist in the vicinity of Island 55 was found. The best collecting in this area was from the sandbars, and in the lower portion of the area we frequently encountered very large specimen of Anodonta grandis. Many stranded pocketbooks, (Lampsilis ventricosa) were found cut open for pearls, presumably by the foreign element of the population of Winona.

Locality IX-22 is in the upper portion of Straight Slough near Winona. At the present time it is a flourishing bed, indicating that conditions are favorable here for mussel growth. Fresh water snails, (Pleurocera acuta, Raf.) and a form of Sphaerium stamineum Conrad, as determined by Dr. Bryant Walker, were abundant here.
### COMMERCIAL SPECIES *

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality IX-2</th>
<th>% Total Catch in Locality</th>
<th>Locality IX-22</th>
<th>% Total Catch in Locality</th>
<th>Locality IX-31</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuscionaja ebena</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleurobema catillus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obvialis olivaria</td>
<td>1</td>
<td>3.5%</td>
<td>2</td>
<td>3.8%</td>
<td>13</td>
<td>3.9%</td>
<td>1.9%</td>
</tr>
<tr>
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<td></td>
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<td></td>
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<td>28.8%</td>
<td>49</td>
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</tr>
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<td>11.4%</td>
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<tr>
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</tr>
<tr>
<td>Megalona heros</td>
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<tr>
<td>Actinonais carinata</td>
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</tr>
<tr>
<td>Lampiliis higginis</td>
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<td>2%</td>
<td>18</td>
<td>8%</td>
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<tr>
<td>Plagiola linedata</td>
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<td></td>
<td></td>
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<tr>
<td>Amygdalonais truncata</td>
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<td></td>
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</tr>
<tr>
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<td>28%</td>
<td>4</td>
<td>7.6%</td>
<td>18</td>
<td>8%</td>
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<tr>
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</tr>
<tr>
<td>Lampiliis fallaciosa</td>
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<td>24.6%</td>
<td>3</td>
<td>5.7%</td>
<td>14</td>
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<td>4.2%</td>
</tr>
<tr>
<td>Euryxyla recta</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Euryxyla subrostrata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pletobasus cyphus</td>
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<td>Lasiniza complanata</td>
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<td>5.8%</td>
<td>8</td>
<td>3.9%</td>
<td>3.1%</td>
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<td>Elliptio niger</td>
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<td>Elliptio dilatatus</td>
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<td>1.9%</td>
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<td>3.4%</td>
<td>4</td>
<td>3.4%</td>
<td>1.9%</td>
</tr>
<tr>
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<td>Alasmidonta marginata</td>
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</tr>
<tr>
<td>Amygdalonais donaciformis</td>
<td>1</td>
<td>3.5%</td>
<td>3</td>
<td>1.4%</td>
<td>3</td>
<td>1.4%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

#### TOTALS

|                     | 22 | 77.2% | 46 | 87.4% | 180 | 88.1% | 81.5% |

### NON-COMMERCIAL SPECIES *

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality IX-2</th>
<th>% Total Catch in Locality</th>
<th>Locality IX-22</th>
<th>% Total Catch in Locality</th>
<th>Locality IX-31</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anodonta grandis</td>
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<td></td>
</tr>
<tr>
<td>Anodonta corpulenta</td>
<td>1</td>
<td>3.5%</td>
<td>1</td>
<td>1.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anodonta imbecilis</td>
<td>1</td>
<td>3.5%</td>
<td>2</td>
<td>5.8%</td>
<td>15</td>
<td>7.4%</td>
<td>1%</td>
</tr>
<tr>
<td>Sprophitus edentulus</td>
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</tr>
<tr>
<td>Leptoidea fragilis</td>
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<td>10.7%</td>
<td>3</td>
<td>5.7%</td>
<td>3</td>
<td>3.9%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Proptera laevissima</td>
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<td></td>
</tr>
<tr>
<td>Carunculina paruu</td>
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<td></td>
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<td>Truncilla triquetra</td>
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</tr>
</tbody>
</table>

#### TOTALS

|                     | 4 | 31.2% | 5 | 9.5% | 24 | 11.3% | 13.7% |

#### TOTALS ALL SHELLS

|                     | 28 | 98.4% | 51 | 96.9% | 201 | 97.4% | 95.2% |

### AREA X.

Boundaries, Winona, Minn. (high bridge) to La Moille, Minn. Status, closed to fishing. Length in Linear Miles, 7.2. Physical Conditions. 2 ft. high water; current 4 miles per hour; bottom, sand and gravel; many snags.
LOCALITIES REPORTED UPON. (ref. maps.)


NOTES ON AREA.

Locality X-4 represents what appears to be a thriving and previously unworked bed of shells, extending beneath the Burlington bridge at Winona. While shells are fairly common at Homer Station, riff-raff on the bottom made their collection somewhat difficult. In the vicinity of Govt. Day Mark 851-a (840-86 elevation) the party planted 150 pigtoes, (F. undata), and 100 three ridges, (A. peruviana) in hopes of ultimately starting a bed there. Fresh water sponges and crayfishes of the identification already given were also collected at Homer.
## AREA X.

<table>
<thead>
<tr>
<th>COMMERCIAL SPECIES</th>
<th>Locality X-4</th>
<th>% Total Catch in Locality</th>
<th>Locality X-6</th>
<th>% Total Catch in Locality</th>
<th>Locality X-9</th>
<th>% Total Catch in Locality</th>
<th>Average % Catch in 3 Localities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuscoena ebena</td>
<td>7</td>
<td>7.3%</td>
<td>7</td>
<td>4.9%</td>
<td>7</td>
<td>5.4%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Pleurobema catillus</td>
<td>2</td>
<td>2.2%</td>
<td>9</td>
<td>6.3%</td>
<td>2</td>
<td>1.5%</td>
<td>1%</td>
</tr>
<tr>
<td>Obovaria olivarla</td>
<td>9</td>
<td>2.2%</td>
<td>3</td>
<td>3.2%</td>
<td>41</td>
<td>31%</td>
<td>21.8%</td>
</tr>
<tr>
<td>Quadruma postulosa</td>
<td>8</td>
<td>8%</td>
<td>8</td>
<td>2%</td>
<td>5</td>
<td>5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Quadruma metanerva</td>
<td>4</td>
<td>4.5%</td>
<td>25</td>
<td>17.5%</td>
<td>15(2)</td>
<td>13.2%</td>
<td>12%</td>
</tr>
<tr>
<td>Rotundaria granifera</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Obliguearia reflexa</td>
<td>2</td>
<td>2.2%</td>
<td>4</td>
<td>2.8%</td>
<td>6(1)</td>
<td>5.4%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Fuscoena undata</td>
<td>12</td>
<td>13.8%</td>
<td>9(1)</td>
<td>7.4%</td>
<td>6</td>
<td>4.6%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Amblema peruviana</td>
<td>3</td>
<td>3.4%</td>
<td>4(1)</td>
<td>3.7%</td>
<td>1</td>
<td>*</td>
<td>2.8%</td>
</tr>
<tr>
<td>Amblema costata</td>
<td>2</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Megalonais herosi</td>
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<td>*</td>
</tr>
<tr>
<td>Quadruma verrucosa</td>
<td>2</td>
<td>2.2%</td>
<td>8</td>
<td>5.9%</td>
<td>2</td>
<td>1.5%</td>
<td>3.2%</td>
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<tr>
<td>Actinonais carinata</td>
<td>4</td>
<td>4.6%</td>
<td>3</td>
<td>2.2%</td>
<td>1</td>
<td>3.6%</td>
<td>3%</td>
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<tr>
<td>Lampsilis higginsii</td>
<td>3</td>
<td>3%</td>
<td>2</td>
<td>2%</td>
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<td></td>
</tr>
<tr>
<td>Lampsilis siliquoidea</td>
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<td>Plagiola lincolata</td>
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<td>*</td>
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<tr>
<td>Amygdaloides truncata</td>
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<td>Lampsilis ventricosa</td>
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<tr>
<td>Eurynia recta</td>
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<td>5(1)</td>
<td>4.4%</td>
<td>5</td>
<td>3.9%</td>
<td>2.7%</td>
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<tr>
<td>Plethobasus cyphus</td>
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<td>Lasigmone complanata</td>
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<td>Proptera alata</td>
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<td>Arcidens confraugus</td>
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<td>Elliptio niger</td>
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<td>3</td>
<td>4%</td>
<td>5</td>
<td>4%</td>
<td>2.6%</td>
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<td>Elliptio dilatatus</td>
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<td></td>
<td>1</td>
<td>1.1%</td>
<td>4</td>
<td>2.8%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Pleurobema pyramidatum</td>
<td></td>
<td></td>
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<td>Alasmidonta marginata</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amygdaloides donaciiformis</td>
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</tr>
<tr>
<td>TOTALS</td>
<td>79</td>
<td>87.2%</td>
<td>128</td>
<td>90%</td>
<td>121</td>
<td>91.8%</td>
<td>88.3%</td>
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</table>

<table>
<thead>
<tr>
<th>NON-COMMERCIAL SPECIES</th>
<th>Locality X-4</th>
<th>% Total Catch in Locality</th>
<th>Locality X-6</th>
<th>% Total Catch in Locality</th>
<th>Locality X-9</th>
<th>% Total Catch in Locality</th>
<th>TOTALS</th>
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<tbody>
<tr>
<td>Anodonta grandis</td>
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<tr>
<td>Anodonta corpulentia</td>
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<td>Anodonta imbecillis</td>
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<tr>
<td>Strophitus dentulus</td>
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</tr>
<tr>
<td>Leptodea fragilis</td>
<td>9</td>
<td>10.1%</td>
<td></td>
<td></td>
<td>2</td>
<td>*</td>
<td>1.7%</td>
</tr>
<tr>
<td>Properta laevissima</td>
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</tr>
<tr>
<td>Carinella parva</td>
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<td></td>
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</tr>
<tr>
<td>Truncilla trigonata</td>
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</tr>
<tr>
<td>TOTALS</td>
<td>9</td>
<td>10%</td>
<td>14</td>
<td>8.4%</td>
<td>5</td>
<td>1.5%</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

TOTALS ALL SHELLS: 88 97.2% 142 98.4% 126 93.3% 95.5%
From the data presented under the title of each area, the following tabulation is made, dealing with the absolute abundance of shells in the areas appraised:

<table>
<thead>
<tr>
<th>Area and Status as to Fishery</th>
<th>No. Shells Commercial Species per Linear Mile</th>
<th>No. Shells Non-Commercial Species per Linear Mile</th>
<th>Average All Shells per Linear Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Open</td>
<td>197.1</td>
<td>66</td>
<td>263.1</td>
</tr>
<tr>
<td>II. Closed</td>
<td>84.1</td>
<td>47.9</td>
<td>131.5</td>
</tr>
<tr>
<td>III. Open</td>
<td>39</td>
<td>5.61</td>
<td>44.61</td>
</tr>
<tr>
<td>IV. Closed</td>
<td>92</td>
<td>10.3</td>
<td>102.3</td>
</tr>
<tr>
<td>V. Open</td>
<td>166.8</td>
<td>7</td>
<td>173.8</td>
</tr>
<tr>
<td>VI. Closed</td>
<td>243.25</td>
<td>15.5</td>
<td>258.75</td>
</tr>
<tr>
<td>VII. Open</td>
<td>14.5 (16.13)</td>
<td>1 (6.55)</td>
<td>15.5 (22.68)</td>
</tr>
<tr>
<td>VIII. Closed</td>
<td>10. (43)</td>
<td>1.2 (2.8)</td>
<td>11.2 (45.8)</td>
</tr>
<tr>
<td>IX. Open</td>
<td>28.24 (54)</td>
<td>4.76 (7.6)</td>
<td>33. (61.6)</td>
</tr>
<tr>
<td>X. Closed</td>
<td>45.3 (62.91)</td>
<td>4 (8.3)</td>
<td>49.3 (71.24)</td>
</tr>
</tbody>
</table>

In the preliminary report of this survey, (p. 2) the data given on the absolute abundance of shells in Areas VII-X inclusive, was based in large part on collections of shells by hand from sand bars, as the latter embraced the larger number of best localities in the areas indicated. As it would be difficult to use such data in the future as a basis of comparison and rechecking, there has been substituted in this final report data obtained from other localities in these areas by the use of the bar and crowfoot outfit. Since it is felt that, due to the conditions described, that the latter represents the true absolute abundance of shells in the areas, there are added in parentheses to the above the results obtained from collecting by hand on the 3 best sandbars of these areas. For each of the 3 localities taken in account for each area, the data thus presented embodies the efforts of 3 men collecting by hand 30 minutes, a total consumption of 90 minutes time, and about that required to make 3 drags with the bars in any given locality. The results from the sandbars may be interpreted to represent the maximum of shells in the particular area.

VII. REMARKS AND RECOMMENDATIONS.

The tables given indicate that commercial species of mussels in the areas appraised are most abundant in the vicinity
of Red Wing, Minn., and in Lake Pepin. There is a decline in the number of the mussels in succeeding stretches of the river until the lower half of Lake Pepin is reached. Upon leaving the lake, a most marked diminution in their numbers occurs but on the other hand the absolute number of shells increases going down stream, showing that the necessary conditions for mussel life are present, and, on the whole, steadily improving. When it appears practicable to attempt the rehabilitation of the mussel beds below Lake Pepin, the following recommendations based upon the preceding information may receive consideration, viz:

1. Restoring old, but favorably situated beds in closed areas with advanced juveniles of commercial species. Such beds are those existing at the foot of Lake Pepin, Wabasha, Teepeeota Point, and those at Winona and Homer, Minn. If judged by the abundance of juveniles collected, the areas to be stocked in order are VI, VIII, IV.

2. Restocking and propagation of desirable species in certain sloughs, both in open and closed areas, as the young shells in the former case would be protected by the prevailing sentiment among mussel fishermen toward them. Sloughs offering some promise in this respect are the Belvedere below Minneiska, West Newton Chute near Alma, and the Straight Slough near Winona.

Corrections in Botanical Nomenclature.

OLIVER ATKINS FARWELL.


Mr. A. S. Hitchcock, in The Genera of Grasses of the United States, (U. S. Dept. Agriculture Bulletin No. 772) p. 145, (1920) places the genus Dilepyrum Mx. as a synonym of Muhlenbergia Schreb. and remarks that either of Michaux's species are equally eligible as the type and that the second
D. minutiflorum is chosen in order to conserve the generic name Brachyelytrum. A careful examination of Michaux's generic description and application of same to his two species shows that "either" are not "equally eligible as the type." Michaux says: "Valvis—subulato-lineatibus, carinatis," which is characteristic of his first species but not at all so of his second. Therefore as his generic description is more accurately descriptive of his first species, D. aristosum, than of his second, the former must be considered as the type of his genus. To arbitrarily adopt that species as a generic type which will permit of the reduction of an older name in order to conserve a later name is contrary to all botanical rules and codes, except, of course, where rules or codes specifically name such exceptions. Another reason why D. aristosum should be considered as the type, is that when D. minutiflorum, not considered as the type, is that when D. minutiflorum, not congeneric with the other, is removed to its proper genus, Muhlenbergia, published 12 years earlier, D. aristosum is the only species left in the genus and consequently, the type. Brachyelytrum Beav., Ess. Agrost. 39, pl. 9, f. 2. (1812) must give way to the older Dilepyrum of Mx. under both the Vienna Rules and the American Code, Cannon 15 of which requires that the 1st species, D. aristosum, be considered the generic type.


Three species are known, native of eastern N. America, one extending through British America into n. e. Asia. They are as follows:


Gardenia petiolata (Walt.) n. comb. *Hypericum petiolatum* Walt. Fl. Car. 191 (1788). Louisiana to Indiana, eastward to the coast as far north as New Jersey.

Department of Botany, Parke, Davis & Co., Detroit, Mich.

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**Notes on Birds of the Vicinity of Washington, Pennsylvania.**

**BY DR. AND MRS. W. C. M’CLELLAND.**

The observations that follow were chiefly made during the last ten years, 1911-1921. They give some brief account of bird behavior within an area probably less than a square mile in extent. This base, or locus observandi, includes a leafy suburb of Washington, Pa., valley land and hills, cultivated fields, a cemetery, gardens, orchards and woodland. The orchards are of old apple trees while the forests are deciduous, the white oak being the commonest tree, with varied often thick undergrowth. The elevation is from 1000 to 1400 feet, and the hillsides incline toward all the points of the compass. Latitude 40°, 10"; longitude 80° W.

The permanent bird residents we most often see or hear, summer and winter, include the cardinal grosbeak, the chickadee, the tufted tit, the downy woodpecker, the white-breasted nuthatch, the English sparrow, the song sparrow, the Carolina wren, the Bob-white and the screech owl.

Less common in winter, but often seen at other seasons, are the blue jay, the goldfinch, the red-bellied woodpecker, the cedar wax-wing, and the crow. The hairy woodpecker and the brown-breasted nuthatch though generally rated as permanent residents of Western Pennsylvania, are in our small district rather rare. The screech owl is occasionally heard.

A few robins, and some years a grackle or two, remain with us over winter. The winter wren, the tree sparrow, the brown creeper, the golden-crowned kinglet and in larger numbers the juncos are familiar visitors.

* Contribution from the Biological Laboratory, Washington and Jefferson College, No. 74.
Of familiar summer residents the robins begin to arrive in February; the grackles, the redwings and the bluebirds, early in March. A flicker has been noted February 24th, but usually this genuine harbinger of spring delays his coming until late in March. The mourning dove, reputed to be a permanent resident in our latitude, we have not seen earlier in the season than March 19.

The following according to our field notes, are dates of arrivals of other summer residents: towhee, March 19-23; field sparrow, March 17-25; Phoebe, March 15-25; sparrow hawk, March 19-23; chipping sparrow, April 3-10; brown thrasher, April 7-18; house wren, April 7-20; blue-gray gnat-catcher, April 15-21; yellow warbler, April 21-24; swift, April 15-30; wood thrush, April 25-May 1; catbird, April 26-May 4; Baltimore oriole, April 28-May 2; orchard oriole, April 28-May 4; warbling vireo, April 28-May 5; barn swallow, April 28-May 13; rose-breasted grosbeak, May 5-22; oven-bird, April 28-May 3; great crest, April 28-May 5; Maryland yellow-throat, May 17; redstart, May 8-15; chat, May 13-17; Acadian fly-catcher, May 10-21; indigo bunting, May 8-18; scarlet tanager, May 5-18; red-headed woodpecker, May 10-19; humming bird, May 8-20; purple martin, April 16-May 6; wood pewee and kingbird, May 8. The woodcock has been seen by us about the middle of May but possibly it is a permanent resident. It is not common.

The tardiest of our summer residents to arrive, as it seems to us, are the yellow-billed and the black-billed cuckoos. Usually they do not appear before the last days of May or the first week in June. The yellow-billed bird is the most often heard and seen.

Of the thrushes only the wood thrush nests in Western Pennsylvania. During the spring migration the hermit comes earliest, usually early in April; the veery, April 3-16; the olive-backed thrush seems not to reach our locality until late in May.

As is well known, most of the warblers are transients in and much beyond the field of our observations, only visiting us on their journeys north and south. In the spring they are arriving and departing from the last of April to the last of May in something like the following order: the myrtle, the
black and white, the Nashville, the northern water-thrush, the caerulean, the hooded, the chestnut-sided, the Kentucky the bay-breasted, the parula, the black-throated green, the black-throated blue, the mourning, the prairie, the Tennessee, the magnolia, the Cape May, the golden-winged, the Blackburnian, Wilson's, the black poll and the Canadian. At all events this is the showing of our observations. Of transient sparrows we have noted the fox, the white-crowned and the white-throated; the fox sparrow appears early in April; the other two in May. Both the night hawk and the whippoorwill we have seen and heard, but we have no record of their coming or going. Vesper and grasshopper sparrows, so far as our testimony goes, are summer residents arriving in April. A few birds are seen by us not every year but at long intervals, the parula and the golden-winged warblers for example. The purple finch is reported as a winter visitor but we have seen it only now and then and always in the early spring. Once or twice only, bobolinks have delighted us by a visit of a few days in May to a nearby grassy hillside. A flock of crossbills have given us a single visit. Once a pleasant surprise came in the rare advent of six or eight evening grossbeaks, wanderers from the far Northwest. A single visit from a little green heron proved less exciting. Just once in many years have we heard the honking of wild geese flying north, or in any direction. But these recalled the behavior of a representative of their family. When cannon were being fired one Fourth of July many years ago, our special observation was that at the sound of each explosion a swan would start like a frightened horse, whereas a Canada goose near it in the same pond showed no sign of disturbance. Once each a straggling mockingbird and a bewildered grebe have come our way. Migratory birds are often said to return with great regularity. In confirmation of this we have noted the return of Baltimore orioles April 28th for three successive seasons. An orchard oriole put in a first spring appearance, alighting on a low bush near our breakfast room window at 7:30 one May day morning. The next year it was observed to return to the same bush on the same day and at the same hour precisely.
It may have been another male of the same species, but only one pair of these birds had been nesting in the neighborhood. nor did any other pair take up their abode with us that year.

In our vicinity the cardinal grosbeak has become suburban, building in the vines of porches of our own and our neighbors' houses. To the contrary, English sparrows have almost deserted our streets, since automobiles drop but little half-digested grain. Robins with us are abundant and seem to be increasing in numbers but the blackbirds, or bronze grackles, are by far the most numerous of our feathered populations. In September and October they are about us in imposing flocks that must contain hundreds of thousands of individuals.

Our bluebirds fluctuate greatly in numbers. Once they were not observed for two successive seasons. During their sometimes belated journeys south, violent, cold storms no doubt destroy many of them. The red-headed woodpecker appears of late to be growing very rare. We wonder if such locally new pests as the San José scale may injuriously affect its health. The red-eyed vireo is reported by some observers to be very common in Pennsylvania, but in our neighborhood, so far as our observations go, it is never seen. The warbling vireo is common. Purple martins and orchard orioles have apparently gone from us permanently; the former ousted by English sparrows, the latter disinheritcd by the felling of a thick-foliaged buckeye tree.

The list of birds that we have satisfactorily identified in our area includes about a hundred different species; the number of species seen each year varies from 75 to 85 according to our luck and diligence. Obviously our chances for the thrill of future discovery, even within the narrow confines of our avian territory, "jist here about home," have not been exhausted.
BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.

PRINCIPLES OF ANIMAL BIOLOGY. By A. Franklin Shull. McGraw-Hill Book Co. $3.50.

It is a rare thing for anyone to write a textbook that is revolutionary in its material; it is still rarer for any one to produce a book that demands an entire revision of the teaching of a time-honored subject in natural science. For while we are willing to teach new material, we insist on teaching it the oldest way, and efforts looking toward a change are whole-heartedly discouraged.

But the teacher's worship of what is old seems to possess little weight with Dr. Shull and his associates. He has written a book that, if accepted, calls for an almost complete change in the teaching of zoology. Cutting, slicing, and peering through microscopes all have their place, but according to Dr. Shull, that place is far away from general courses in zoology. He believes that a general knowledge of the larger facts of zoology are more essential than a knowledge of the muscles of a frog's leg; that zoogeography deserves more space in a text than does taxonomy. He begins his work with a chapter on the general divisions of zoology, and a history of the science; he ends it with a glossary of the terms that students are apt to have difficulty with. Between those two chapters are others dealing with such subjects as the morphology of cells, the processes of cell division, physiology of organs, reproduction and breeding habits, embryology, genetics and evolution, ecology, and paleontology. Every chapter is complete in itself; it may be read as well separately as with the balance of the book. Together, these chapters make up a volume that is even more remarkable than Dr. Cockerell's "Zoology." The rebellion of Mr. Shull is complete; he strikes out for himself, and it must be acknowledged that he has gone a long distance. As I read his book I have but one regret—that I do not have the privilege of taking courses under its author's instruction.

C. L. F.

PARACELSIUS. By John Maxson Stillman. The Open Court Co.

Theophrastus von Hohenheim, or as he is more commonly called, Paracelsus, illustrates well the independence, the self-confidence, the
boldness of thought, and the painful confusion of new and old that characterized the time of the later Renaissance. He was born the year following the discovery of America, and lived a life quite as stormy and almost as significant as that of the famed Columbus. The latter made a great discovery and brought about a great revolution in world affairs, industry, and politics; Paracelsus was a not less striking reformer in science, elementary medicine and chemistry.

Dr. Stillman’s book is not offered as any new contribution to the history of a man who has been alternately praised and denounced for hundreds of years. It is a presentation in English of the essence of the long or relatively inaccessible German treatises, and papers, as well as a critical examination of attitudes and philosophy as shown in Paracelsus’ own writings. The struggle with the antiquated medical men, the brief stay at the University in Basel, and the wanderings in various armies are presented only as a background for the later work of the revolutionary physician. The chemistry of Paracelsus is reviewed, and some space is devoted to the forged works that were for many years supposed to have antedated the great man’s contested discoveries. But to the general reader, who must be considered along with the specialist in medicine, the early life of this reformer, his character and beliefs regarding his profession, and the manner in which he died are more interesting than his exact contributions to either medicine or chemistry. Most of us have known of him as a name; the biographical part of Mr. Stillman’s book helps us to know of Paracelsus as a man.

C. L. F.

COMPANIONS, FEATHERED, FURRED, AND SCALED. By C. H. Donald, F. Z. S. John Lane Company. $2.00.

Mr. Donald is one of those fortunate people who are able to “make friends” with birds and other animals of all sorts and dispositions. This ability, aided by a residence in India which allowed him to study first-hand the rich wild life of the Himalayas, has enabled him to write a book that is both interesting and instructive. Mr. Donald makes pets of his animals; he does not “train” them or shut them up in cages. Therefore his accounts have more value than mere comments on circus animals, or on those confined in zoological gardens.

The “companions” range from pythons to eagles; from monkeys to bears. And from the first chapter, telling the adventure of Bhaloo, a bear cub, to the last, which gives the life story of a little fox, the book is full of interesting natural history material. The numerous first-rate photographs of the animals which have at one time or another come into Mr. Donald’s possession add much to the value of the book.

C. L. F.
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Seasonal Dimorphism in Arisaema Triphyllum.

THEO. HOLM.

(With 5 figures drawn by the author.)

Along the Maryland Pike from Silver Hill to Clinton, Prince George County) are several tracts of woodland, mostly with *Liriodendron*, *Liquidambar*, *Nyssa*, *Acer rubrum* and various oaks. There are many creeks and frequently, during the winter months, large areas of the woods become inundated. There is a luxuriance of ferns, notably *Woodwardia areolata*, *Asplenium Filix-femina*, *Polystichum*, *Onoclea sensibilis*, *Dicksonia*, *Osmunda*, and even the rare *Ophioglossum vulgatum* is quite abundant.

But when the Spring commences there is no trace of *Podophyllum*, *Sanguinaria*, *Claytonia*, *Anemonella*, *Dentaria*, *Erythronium* or *Osmorhiza*; the vernal Grasses are scarce. But there are many *Carices*, and *Symlocarpus* is at its very best, not to speak of *Viola cucullata*, *Oakesia*, and *Rhus Toxicodendron*, while *Orontium* follows the creeks. Not until late does *Arisaema triphyllum* appear in these surroundings, and when it commences to bloom, the plant on the Potomac shore near Washington has passed flowering more than a month earlier.

When finding this plant near Clinton barely in bloom in the middle of May, its remarkable low stature attracted my attention, beside the late time of its appearance. "Nana" or "Serotina" would have seemed an appropriate name, but it so happened that the plant proved to be the variety *pusilla* already described by Peck,\(^1\) and recently raised to specific rank: *A pusillum* (Peck) Nash in Britton’s manual.

However, considered as a mere variety or at least as a form this plant seems more interesting than as a new species. It actually indicates how a species may be developed, and from

this point of view the plant will be treated in the subsequent pages. Peck (l. c.) describes the plant as follows: "Plants 3 to 6 inches high; leaves usually solitary, the leaflets narrowed and pointed at the base, 12 to 18 lines long, 7 to 9 wide; the upper part of the spathe commonly dark purple. Millbrook, Dutchess county, June. The plants were in flower June 15th; about a month later than the time of flowering of the typical form of the species in the same locality." No additional characters are mentioned in Britton's manual, and the habitat is given as "open sunny bogs New York."

Having had the opportunity to study the plant throughout the summer, and in localities where it occurs in abundance, I have observed several points in its external structure, by which it may be readily distinguished from the typical form. So far as concerns the vicinity of Washington (Maryland and Virginia) typical Arisaema triphyllum appears to be mostly dioecious. It is a plant of rather robust habit, especially when compared with the var. pusilla (Fig. 1) at the corresponding state. The leaf-segments are elliptical-ovate, pointed, and they are very broad in young specimens (Fig 4), which have not yet reached the flowering state. The relative length and width of the middle segment correspond well with those of the two lateral. The color of the spathe varies from light green to dark purplish-brown or variegated with dark purple and whitish stripes or spots.

Now with regard to the var. pusilla (Fig. 1) the plant is very slender with the scape frequently bent; the spathe and spadix are smaller than in the type, and the color of the spathe is most often dark purplish-brown to almost black or, though more seldom, pale green with no dark spots or stripes. The staminate plant seems to be the most common, and I found no monoecious specimens. The staminate plants are generally of a lower stature than the pistillate, but the color of the spathe varies in both.

While the name "pusilla" is very appropriate to the plant, so far as concerns the small size of the leaves, spathe and spadix, when it appears above ground, the stem or floral scape, does not remain low, but grows rapidly, and may reach the height of 25 to 34 cm. in fruiting specimens, measured from the corm to the base of the spadix. The foliage may
EXPLANATION OF FIGURES.

Figure 1. *Arisaema triphyllum* (L.) Schott. var. *pusilla* Peck; two-thirds of the natural size.

Figures 2 and 3. Leaves of young specimens of same variety, in third year; two-thirds of the natural size.

Fig. 4. Leaf of a young specimen of typical *Arisaema triphyllum* in its third year; two-thirds of the natural size

Fig. 5. Leaf of a mature specimen of the variety *pusilla*; natural size.
also attain quite a considerable size. Concerning the shape of the leaf-segments, these are generally narrower than the type. This difference is evident even in young specimens (Figs. 2-3), which have not yet reached the flowering state. In mature leaves the relative size and outline of the segments are quite distinct from that of the typical plant. As a matter of fact it seems characteristic of the variety "pusilla" that the central leaf-segment is shorter and broader than the two lateral. Furthermore, the lateral segments often exhibit an outline approximately falcate. Among the numerous specimens which I examined, leaves in which the three segments were of uniform shape and size were rare. The leaf figured (Fig. 5) may give some idea of the general size and outline of the leaf of a mature specimen of the variety. The largest leaves are of course to be found in fruiting specimens. When two leaves are developed the basal is always larger than the superior. For instance in a fruiting specimen, collected on the second day of August the two leaves showed the size as follows:

Basal leaf: central segment, length 16.5 cm. width 9.0 cm.
Basal leaf: lateral segment, length 22.0 cm. width 7.0 cm.
Superior leaf: central segment, length 14.0 cm. width 5.5 cm.
Superior leaf: lateral segment, length 15.0 cm. width 5.4 cm.

In a staminate specimen, collected on May 31st, the single leaf measured:

Central segment length 9.5 cm. width 4.2 cm.
Lateral segment length 12.0 cm. width 3.1 cm.

As compared with the typical plant the variety pusilla is thus readily distinguished by (1) its late appearance, late blooming and fruiting; (2) the relatively smaller size of inflorescence, spathe and spadix; (3) the uniform deep color of the spathe, except in chlorotic specimens; (4) the leaf-segments being narrower, and the two lateral being generally longer and narrower than the central (Fig. 5); (5) the approximately falcate shape of the lateral segments; and finally (6) the habitat being either low woods, partially inundated during the winter, or sphagnum-bogs.

I have not, so far, found the typical plant and the variety growing together, and considering the nature of the surroundings, I presume these to be the direct environal cause
of the modified structure observable in the variety *pusilla*. In other words *Arisaema triphyllum* illustrates a case of seasonal dimorphism, which might eventually lead to the segregation of a second species, similar to the species of *Gentiana* and *Euphrasia*, described by Wettstein, and *Alectororolophus* by Sterneck.

In his very instructive work, *Grundzüge der geographisch-morphologischen Methode der Pflanzenystematik* (Jena 1898), Wettstein points out the possibility of ascertaining the phylogenetic relations of species by a comparison of the morphological structure and the geographical distribution. As a point of issue this author maintains, that a species occupying an area, where the conditions suffer no change, may remain constant, except in case of eventual hybridization or individual variation. But, if the conditions become modified in some part of this area, or if the species spreads beyond the limits of the regions with other conditions, the species will naturally adapt itself to the new environments, and so result in the development of a new species. Such new species may be readily connected with the parental, when the areas are not too remote from each other. Some transitional forms may be observed, which morphologically resemble both. If, however, species is capable of being distributed across areas of wide extent, the transitional forms may become obliterated and the actual relation between the parent species and the modified form may be obscured. From whatever cause the species may have become modified it is evident that seasonal dimorphism is one of the fundamental results in such modification.

Such is unquestionably the case in the European species of *Euphrasia* and *Alectororolophus*, which have become modified so as to represent distinct species, simply produced by the changes of conditions at harvest-time in the European meadows.

The history of *Gentiana* is somewhat different. We are here dealing with species, some of which are so closely related to each other that “annual” or “biennial,” flowers “large” or

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3 Sterneck, I. Beiträge zur Kenntniss der Gattung *Alectororolophus* (Oesterr. bot. Zeitschr. 1894.)
“small,” and leaves “obtuse” or “acute” constitute some of the most important characters of distinction, yet with a geographic distribution of so marked characteristic, that their validity as species appears indisputable.

Figure 5. Leaf of a mature specimen of the variety pusilla; natural size.

Regarding Arisaema triphyllum we have a clear case in which “seasonal dimorphism” has produced a type, which I believe is about to develop as a distinct species. And there
cannot be any question of the parental species being the one, which we call typical *A. triphyllum*. For considering its morphological equipment, expressed by the characteristic structure of its organ of vegetative reproduction, the tuberous rhizome, such rhizome belongs to plants inhabiting higher situations, where it typically grows, and not to such as occur in low woods, inundated during the winter, or in bogs, sphagnum-bogs for instance. In the singular environment where the variety *pussilla* occurs, we have a natural explanation of the reason, why it blooms so much later than the typical plant. And accompanying this distinction as to time of flowering and fruiting we have seen the marked color of the spathe and spadix, the frequent variation in the leaf-out-line, and the slender stem. If these characters remain constant, "*pussilla*" may eventually deserve specific rank, and we shall have a well founded proof of how some species may arise and "from more than one single area." For it is hardly possible to believe that the variety *pussilla*, as it grows in Maryland, originally came from the north, where it also occurs, or vice versa. It might have become distributed by means of the berries, but it seems much more reasonable to suppose, that the change of environment has produced this particular type, "wherever it occurs." A conclusion to that effect would only corroborate the view advanced by Wallace: "that every species has come into existence coincident both in space and time with a pre-existing closely allied species"—with the typical form of *Arisaema triphyllum* in this particular case. We would at the same time see no obstacle against believing that each species does not need to have been produced within one area, from where it migrated as far as it could; the origin of the Euprasiae, the Gentianae, the species *Alectorolophus*, and our variety of *Arisaema* seem to depend on factors, some of which are among those which Schouw evidently had in mind, when he wrote his thesis: "De sedibus plantarum "originariis" and reached the conclusion: "Eadem momenta cosmica easdem plantas diversis in locis produxise."

This hypothesis of Schouw was not new however, for it had actually been proposed by Gmelin in his "Sermo de

*Kjøbenhavn 1816."
novorum vegetabilium post creationem divinam extortu. It was accepted by some few of the leading botanists, for instance, by Elias Fries; but while Alphonse De Candolle once adopted and strenuously maintained Schouw's hypothesis, he has in effect discarded it in his "Géographie botanique" (1855).

Since then very little has been written about this subject, at least from the viewpoint of Schouw; there is, however, an interesting paper by K. Mueller: "Über das relative Alter der Alpenflor," in which the probability of several centers of creation is amply discussed in favor of Schouw's hypothesis. Indirectly, on the other hand, the question was brought up again by Kerner, who demonstrates the possibility of hybrids giving rise to new species, when conditions are favorable. And we learn from another publication by this same author, that Asyngamy i.e. Asynchronogamy may result in the formation of new species by means of favoring hybridization, and by rendering formation of new races possible.

Then with respect to seasonal dimorphism, we have in the works of Wettstein, Sterneck and Murbeck, cited above, an excellent illustration of the origin of certain species through factors, that may undoubtedly have exercised the same influence during epochs previous to the recent, and not being confined to a single area, but effective wherever the conditions are favorable.

Clinton, Md., November, 1921.

5 Tübingen 1749.
7 Fragment d'un discours sur la géographie botanique. Bibl. univ. 1834.
10 Uber die Bedeutung der Asyngamie für die Entstehung neuer Arten. (Bericht. naturwiss. Vereins Innsbruck 1874.)
The Evolution of Tools and Implements.

WILLIAM D. JOHNSTON.

Man's happiness today is dependent upon the comforts with which he is surrounded. His home, his clothes, his city, and the great complexity of present day society are the things that make life desirable. The society of which he is a part is dependent for its existence upon a great multiplicity of mechanical devices. Thousands of men go to the steel mills each morning to care for the great furnaces where millions of tons of ore are converted into iron. Thousands of men go to the factories to make machinery and tools from the iron. Again, men use the tools to make machines—great mechanical devices—huge lathes capable of turning an engine wheel; dry docks to float the longest ship; valves through which an automobile can pass—it is upon these things we depend today. They did not come suddenly, but through long, continual inventive effort to use the materials at hand to the greatest advantage.

Before the invention of metals, man's supply of materials with which to work was the flint quarry, the gravel bank, and the chert ledge. His weapons and tools were made of stone; at first in the pieces just as they were picked up; later they were roughly chipped, and in the time just preceding the invention of bronze they were elaborately chipped, polished and often carved.

When man discovered that copper and copper and tin alloys would lend themselves to shaping quickly by pounding, and that the weapons so made could be ground to an edge much sharper than that obtainable in stone, he did not hesitate to discard the quarry for the mine. His stone implements were reproduced in bronze and improved as the toughness and malleability of the metal suggested. His daggers were longer, his axe shorter and less unwieldly, and his arrows had sharper points.

The supplies of bronze were limited, and hence its use was not greatly extended. It was only with the invention of iron smelting processes that man entered into the era of invention and manufacture whose comforts today we enjoy. With such supplies of metal at hand there was no limit to the advancement of mechanical invention. Steel followed as a logical re-
suit, and with the advent of scientific thought and its application to the industries, the mechanical progress in the last hundred years has been enormous.

Let us suppose that a colony of present day people, dependent upon a vast multiplicity of mechanical devices for their well-being, be deprived of all of these things which they look upon as necessary to life and be left upon some island well supplied with the flints, the ores of copper and tin and of iron. Supposing still that, in the course of the first six or seven generations, the metals remained undiscovered and the people had accustomed themselves to an existence upon such plants as could be found and game brought down with stones. The customs of their modern forefathers would soon be forgotten and they would revert to the savagery necessitated by their environment. Then would doubtless follow a repetition of the series of discoveries and inventions which marked man's advance to his present day status. The improvement of stone weapons, the discovery and use of bronze, the use of iron, and then of steel, would come even as it came before. It is true that such a colony would have the mental advantage of hundreds of generations of intensive thinking and inventive people, and that mentally they would be of a type much higher than the primitive users of unworked stones. For this reason the progress would probably be more swift, but the order and method of invention would undoubtedly be the same.

The classification of M. Adrien de Mortillet of simple tools in five groups is given in Table II. His first group contains tools for cutting, edge tools probably the first type to be developed. The older stone flakes referred to the Chellean, found in river terraces of the Paris basin, while known as a "hand-axe" by the English archaeologist, is better described by its French name—the Coup de Poing—and was doubtless grasped in the hand and used as a knife.

From the roughly broken stone fragment held in the hand up to the elaborately chipped blade-like daggers of the American aborigines, made with a skill that no white man possesses, is simply a process of educational evolution—one process leading to the next.

Pointed knives of bone are found in the kitchen middens of

old Hochelaga\textsuperscript{2} and knives of bamboo cane are used today by some Polynesian tribes.\textsuperscript{3} Elsewhere bamboo is used in making handles for other implements.

Many peoples make elaborate handles for rude knife blades, and the preservation of the blade alone, a crudely chipped piece of flint, would give a very low impression of the mechanical art of the people, although the handle by which it was attached may have been elaborately worked.

The primitive shear was a flat flake of flint held in one hand and pressed against a flat stone held horizontally much as a saddler’s draw-knife or a cigar maker’s clip is used today. It may have been provided with a handle as the “ulu” or woman’s knife of the Eskimo.\textsuperscript{4}

The shear made of two movable blades passing over each other was found in ancient Egypt and in China, but was doubtless invented after the “ulu” type of shear had been in long use.

The axe is a development of the stone knife. It would be very difficult to wield a knife as long as many axe-heads without the use of a handle. It was doubtless a red letter day in the history of invention when some Acheulean genius found that by wrapping vines about a sharp flake of flint and twisting the ends into a handle he had produced the first axe.

Axes are in general use throughout Paleolithic times. The method of attachment to a handle varies greatly. In the Solutrean of South Africa\textsuperscript{1} axes were found with slight longitudinal grooves chipped in such a manner as to be firmly held when inserted into a split stick. The head was often locked to the stick by means of green raw-hide which, contracting greatly in drying, binds the blade firmly to the handle. Many of the polished axe heads of Neolithic times are grooved to receive the split handle or lashings, as are many of the axes of the American Indians.

Matlocks, adzes and chisels must be considered as adaptations of axes. A stone axe, while of little use in chopping a log across the grain, is of great use mounted as an adze in splitting it or in hollowing it in the manufacture of a canoe. Likewise, the chisel is but an axe head set in a handle so that the blade is at the end of the handle, and a matlock a longer

\textsuperscript{2} Dawson, F. W., Fossil Men and Their Modern Representatives. 1870. P. 135.

\textsuperscript{3} Polynesian Researches. Vol. IV., P. 346.

adze. The stone blade in these types of cutting tools differed but little among primitive people, the same blade being used for all purposes.

The bronze celts of the Swiss Lake Dwellers are classical examples of the reproduction of stone tool types in bronze.

Osborn⁵ fails to include the flint saw in his tables of implements, but Mason⁶ mentions flint pieces with serrated edges found in many European as well as American caches. These flakes are carefully made and seem to be adaptable for no other purposes than hacking a piece of wood or bone in two.

The use of thin strips of soft wood and sand much as the modern quarryman cut his block of marble into slabs was probably known in Paleolithic times; undoubtedly in Neolithic.

In ancient Egypt a bronze saw was used, and very primitive cross-cut saws of the same metal are in use today in China.

The Aztecs and some modern Polynesian tribes make saws by inserting teeth and bits of stone in a wood handle.⁷

M. Adrien de Mortillet's second group comprises those instruments used for abrasion and for smoothing. He includes in it scrapers, gravers, rasps, files, sandpaper, polishers, burnishers, whetstones and grindstones.

The use of abrasives can not be considered a fundamental operation. Chipping and crushing doubtless came first and the abrasive process was used in finishing the tools roughly shaped by pounding or chipping.

Scrapers were used to prepare skins for use as clothing and coverings. The process of skinning an animal needs necessarily be crude when done with stone knives, and the use of a scraper to remove the mangled flesh from the skin is a normal development. They appear in the Chellean and are most conspicuously developed in the Mousterian and the Aurignacian of the Middle Paleolithic.

The instruments used in polishing stone are of small importance in the Paleolithic, but assume a prominent place among the implements of the Neolithic. Mason⁸ tells of the many reports sent annually to the Smithsonian at Washington telling of the discovery of large blocks of sandstone whose

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8. Ibid. P. 48.
surface shows marks of abrasion indicating their use as grindstones.

The "kitchen middens" of the north of Europe contain whetstones made of the best material the locality affords. Today the whetstone is used by all savage peoples. Often hammers and axes show abrasive marks, telling of their use as grindstones.

Etchers and burnishers come into importance in the bronze age and many of the "Swiss Lake" implements are elaborately etched and doubtless were highly polished when new.

The third division of M. de Mortillet's includes implements use for fracturing, crushing and pounding.

Chipping instruments are in use by all savage people who work in such rock as flints and cherts. Almost all papers discussing flint blocks and arrows go into considerable detail in describing the method of using a pin of bone to do the final finishing of the implement. Today the implements are made of such materials as bone, antler, hardened wood and stone.

In using the chipper, the flint is held in the hand against a piece of leather or another stone, and pressure is exerted downward near the edge of the flint. In this way thin flakes of the material are chipped away and the implement fashioned.

Osborn in his table does not include the chipper among his bone instruments, but there is no doubt that some of the instruments classified by him as chisels or as smoothers were used for this purpose.

The hammer is the universal tool. Dawson's account of the evolution of the hammer is very good. He recognizes these types of hammers:

"Disc-hammers are in their rudest form merely flat pebbles, suitable to be held in the hand, for driving wedges or chisels, or for breaking stones, bones, or nuts. In their more finished forms they are carefully fashioned of quartzite or greenstone, with one side convex and the other flat, or even slightly hollowed, and the edge neatly and regularly trimmed. Stones of this kind are found all over America on old Indian sites, and are almost equally common in Europe; and there can be little doubt from the habits of the modern Indians as to their ordin-

10. Loc. Cit.
ary uses. They were probably hammers, pounders and polishers. Held with the convex side in the palm of the hand, they could be used to drive wooden stakes or to split wood with stone chisels, or to crack nuts or to bruise grain and fruits, or to grind paint on a flat stone. With sand or earth they made efficient polishers for dressing skins, and held edge-wise they served to trim flint weapons or to crack marrow-bones. One of these hammers must therefore have been an indispensable utensil in every household, and a well-made one of durable stone may have been an heirloom handed down for generations.

"The second kind of hammer is of elongated form, round or oval in cross-section, and suited to be held in the hand, though, perhaps, in some cases lashed to a wooden handle. It much resembles the ordinary stone axe or celt, but differs in having a blunt end, indented with blows, instead of an edge. This almond shaped hammer was employed to chip stones, to drive wedges, and to break nuts and bones. One example from Hochelaga has a rough depression on one side, which may have been produced by hammering wedges with the side instead of the end, or may have been intended to give a better hold to the end of the handle. Hammers precisely of this kind are found in the caves of Perigord and in Sweden. The savages of all countries seem to have discovered that dioritic rocks, from the toughness of the crystals of hornblende which they contain, are specially suited for the formation of these hammers, so that wherever greenstone can be found it is employed.

"The third and most artificial kind of stone hammer is that with a groove around it, by means of which it could be attached to a handle or slung upon a tough withe. Such a hammer is sometimes merely an oval pebble with a groove worked around it, but some examples, especially those of the old mound builders, are elaborately grooved and carefully shaped; and there are some with two grooves, the working of which must have cost much labor. Some specimens are so small as to weigh only a few ounces, and one from the ancient copper mines of Lake Superior, now in the museum of the Geological Survey of Canada, is 11½ inches long, and weighs more than 25 pounds. The larger end of it has been much bruised and
broken, and it was evidently a miner's sledge-hammer. Grooved stones of this kind occur on prehistoric sites in Europe, though they have sometimes been regarded as plummet or sling-stones. In America similarly grooved pebbles are often found in circumstances which lead to the belief that they have been sinkers for nets. These are, however, usually of stone too soft to have been used for hammers, and have no marks of use on the ends. The ordinary sinker for lines and nets is, however, on both sides of the Atlantic a pear-shaped or drop-shaped stone, with a groove for the line at the sharp end."

Grinding apparatus is in universal use. The mortar appeared in Azilian times but flat stones were used for crushing grain long before. The lava mortar of Mexican peons is in use extensively in Mexico, and is but little better than those of much more primitive cultures.

In M. de Mortillet's fourth class are included instruments designed for use in perforating.

The borer is recognized from Pre-Chellean times, and remained a recognizable, though not conspicuous, element in the cultured throughout Palaeolithic times. It was used largely for boring out pieces of wood for blade sockets and in the dressing of the skins of the animals slain by the primitive man. Its use upon stone is uncertain in the Palaeolithic, but the use of rock drills in the Neolithic is well shown by the axe-heads of polished stone having a socket for the insertion of a handle found in the late Paleolithic.

The use of stone drills among the North American Indians is attested to by the presence of the calumet in any large collection of Indian implements.

The needle appeared in Magdalenian times and was conspicuous among the implements of the Azilian and Tardenoisian. It was usually in the shape of a long thin piece of bone, without an eye, and used much as the shoemaker's awl is today. With it the old stone age people sewed the animal skins to make clothing.

The late Neolithic and the Bronze Age needles were more elaborate and were in many cases provided with eyes. Other boring tools of the Bronze Age were gimlets, and punches, but the prototype of the modern augur is absent. The principle

of the screw was unknown and may be considered a true
product of modern invention, for in Archaeological discussion
Archimedes has not as yet been relegated to the "bone yard."

M. de Mortillet's last class included implements for grasping
and joining. He divides this into two sub-groups, (a) in-
cluding such articles as tongs, pincers, vices, clamps, and
wedges, and (b) nails, lashings and glues.

Logically his second group should come first, for glues and
lashings are known to savagery long before pincers and
clamps.

From the most primitive culture, in fact wherever imple-
ments of stone are used, they are set into handles, and use is
made of glue to hold them there. The Australian "black-boy"
holds the stone point in the javelin, and modern Indians im-
bed a part of the blade of their flint daggers in pitch to pro-
vide a handle.

Nails are not new. Their forerunner—pins—are found in
the upper Paleolithic made of bone. The Mormons used wood-
en pegs to hold together the timbers of their tabernacle at
Salt Lake just as timbers are joined in China today. The
buildings of the primitive peoples have long ago been de-
stroyed, but it is not logically wrong to suppose they used
such methods of joining as do peoples of comparable cultures
who live today.

The vice and pincers are recent devices. When the old stone
age man split a stick to insert the javelin point and then bound
the split stick below the point with green rawhide he was
using the principle of the vice. The old fable of the bear
whose head became fastened in a split log when he dislodged
the wedge which held it apart in his eagerness for the honey
it contained, suggests to us the possible manner in which the
vice was invented. Later day types in the late bronze age are
included in collections of Roman tools.

In the discussion of these types of implements a parallelism
has been attempted between the modern savages and those
old types whose cultures are comparable with those of pres-
ent day types. On the whole, this parallelism is satisfactory,
and the use of many an old tool has been explained by the
observance of present-day savage people.
### TABLE I.

**SUCCESSION OF HUMAN INDUSTRIES AND CULTURE.**

<table>
<thead>
<tr>
<th>V. Later Iron Age.</th>
<th>Europe, 500 B.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV. Earlier Iron Age.</td>
<td>(Hallstatt Culture.) — Europe, 1000-500 B.C.; Orient, 1800-1000 B.C.</td>
</tr>
<tr>
<td>III. Bronze Age.</td>
<td>Europe, About 2000-1000 B.C.; Orient, About 4000-1800 B.C.</td>
</tr>
<tr>
<td>II. New Stone Age, Neolithic.</td>
<td></td>
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<tr>
<td>3. Late Neolithic and Copper Age. (Transition period).</td>
<td>Europe, 3000-2000 B.C.</td>
</tr>
<tr>
<td>2. Typical Neolithic Age (Swiss Lake Dwellings).</td>
<td>Europe 7000.</td>
</tr>
<tr>
<td>1. Early Neolithic stages (Campignian culture).</td>
<td>— Europe.</td>
</tr>
<tr>
<td>I. Old Stone Age, Palaeolithic.</td>
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<tr>
<td>Upper Palaeolithic</td>
<td>Europe.</td>
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<tr>
<td>8. Azilian—Tardenoisian.</td>
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<tr>
<td>7. Magdalenian (Close of post-glacial time).</td>
<td>Reindeer, Shelter, Drift, and Cave Period—12,000 16,000 B.C.</td>
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<tr>
<td>6. Solutrean (Beginning of post-glacial time).</td>
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<tr>
<td>5. Aurignacian (Beginning of post-glacial time).</td>
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<tr>
<td>Lower Palaeolithic.</td>
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<tr>
<td>4. M ousterian (Fawlk—Glacial time).—40,000 B.C.</td>
<td>River, Drift and Terrace Period</td>
</tr>
<tr>
<td>3. Acheulean (Transition to Shelter).</td>
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<tr>
<td>2. Chellean.</td>
<td>100,000 B.C.</td>
</tr>
<tr>
<td>1. Pre-Chellean</td>
<td>Eolithic.</td>
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</tbody>
</table>

TABLE 2.

M. ADRIEN DE MORTILLET'S CLASSIFICATION OF SIMPLE TOOLS.*

I. For Cutting. Edge Tools.
   Working—
   1. By Pressure
      a. Knives.
      b. Double-edge tools, shears.
      c. Planes.
   2. By Shock
      a. Axes
      b. Adzes.
      c. Chisels, gouges.
   3. By Friction
      a. Saws.

II. For Abrasion and Smoothing.
   Working—
   1. By Pressure and Friction.
      a. Scrapers, gravers, rasps, files, sandpapers, polishers,
         smoothers, burnishers, whetstones, grindstones.
   2. By Shock.
      In wood-working fire is an efficient element in abrasion.

III. For Fracturing, Crushing, Pounding.
   Working—
   1. By Pressure.
      a. Chipping and flaking implements.
   2. By Shock.
      a. Hammers, pestles.
   3. By Friction
      a. Grinding apparatus, mills.

IV. For Perforating.
   Working—
   1. By Pressure and Friction.
      a. Needles, prickers, awls, drills of all kinds.
   2. By Shock.
      a. Punches, pricks.

V. For Grasping and Joining.
   1. Tongs, pincers, vises, clamps, wedges.
   2. Nails, lashings, glues.

TABLE 3.
THE STONE IMPLEMENTS CHARACTERISTIC OF LOWER AND UPPER PALAEOLITHIC TIMES.*

<table>
<thead>
<tr>
<th>The Typical Stone Implements</th>
<th>Pre-Chellean</th>
<th>Acheulean</th>
<th>Mousterian</th>
<th>Aurignacian</th>
<th>Solutrean</th>
<th>Magdalenian</th>
<th>Azilian</th>
<th>Magdalenian</th>
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<tbody>
<tr>
<td>A. War and Chase.</td>
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<td>1. Arrow Point, etc.</td>
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<td>3. Lance or Knife</td>
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<td>4. Lance-Head</td>
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<td>5. Lance-Head</td>
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<td>6. Hand-Axe, Poniard, etc.</td>
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<td>7. Throwing Stone</td>
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<td>8. Knife</td>
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<td>B. Industrial and Domestic.</td>
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<td>9. Lamp</td>
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<td>10. Polisher</td>
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<td>11. Mortar</td>
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<td>12. Chopper</td>
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<td>13. Hand-Axe, etc.</td>
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<td>14. Planing Tool</td>
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<td>15. Scraper</td>
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<td>16. Drill, Borer</td>
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<td>17. Knife</td>
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<td>18. Anvil Stone</td>
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<td>19. Hammer-Stone</td>
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<td>C. Art, Sculpture, Engraving.</td>
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<td>20. Drill, Graver, and Etcher</td>
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<td>21. Chisel</td>
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<td>22. Etching Tool</td>
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<td>23. Graver (Also mortar, hammer-stone, and polisher)</td>
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§ Twice mentioned (in different classifications).

† Denotes an unusual or culminating development.
TABLE 4.
The Bone Implements Appearing at the Close of the Lower Palaeolithic and Highly Characteristic of the Upper Palaeolithic.*

<table>
<thead>
<tr>
<th></th>
<th>Aurignacian</th>
<th>Solutrean</th>
<th>Tardenoisian</th>
<th>Azilian</th>
<th>Tardenoisian</th>
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</thead>
<tbody>
<tr>
<td><strong>The Typical Bone Implements.</strong></td>
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<tr>
<td>A. War, Chase, Fishing.</td>
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<tr>
<td>1. Blades</td>
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<td>2. Dagger</td>
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<td>3. Fish-Hook</td>
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<td>4. Spear Thrower</td>
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<td>5. Harpoon</td>
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<td>6. Javelin Point</td>
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<td>7. Spear Point</td>
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<tr>
<td>B. Industrial and Domestic.</td>
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<td>8. Spatula</td>
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<td>9. Shuttle</td>
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<td>10. Pin</td>
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<td>11. Needle</td>
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<td>12. Blades</td>
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<td>13. Anvil</td>
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<td>14. Smoother</td>
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<td>15. Wedge</td>
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<td>16. Chisel</td>
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<td>17. Awl</td>
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<tr>
<td>C. Ceremonial, Social.</td>
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<td>18. Ceremonial Staff</td>
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<td>19. Wand</td>
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</tbody>
</table>

§ Twice mentioned (In different classifications).
† Denotes an unusual or culminating development.
Nomenclatorial Nates on Certain American Plants—II.

HOMER D. HOUSE.

The second edition of Britton & Brown’s Illustrated Flora (1913), attributes a number of generic names to Philip Miller's 4th Abridged edition of the Gardner’s Dictionary (1754). An examination of the copy of this work in my library shows that there are several generic names which should likewise be credited to Miller. Among such names, the most important, as referring to the flora of the northern and eastern United States are the following:

Abies (Tourn.) Mill.  Melo (Tourn.) Mill.
Alnus (Tourn.) Mill.   Tithymalus (Tourn.) Mill.
Larix (Tourn.) Mill.  Filapendula (Tourn.) Mill.
Castanea (Tourn.) Mill. Ulmaria (Clus.) Mill.
Sabina (Bauh.) Mill.  Cotinus (L.) Mill.
Bistorta (Bauh.) Mill. Opuntia (Baugh.) Mill.
Fagopyrum (Tourn.) Mill. Petasites (Tourn.) Mill.
Paronychia (Tourn.) Mill. Polygonatum (Bauh.) Mill.
Quamoclit (Tourn.) Mill. Onagra (Tour.) Mill.

Of these it might be noted that the first species cited by Miller for Onagra, is a non-binomial, pre-Linnaean name referable to Oenothera biennis L. Likewise under Eruca which Dr. Britton takes up and credits to Miller, the first species cited is referable to Brassica Erucastrum L., and not to Brassica Eruca L.

CUNILA (L.) MILLER

This is based upon “Cunila calycum lacinia superiore latiore ovato trinervos,” Linn. Hort. Cliff., which is Sideritis romana L., in the Species Plantarum (1753), and is quite a different species than the one which is taken by Linnaeus himself for the type of Cunila (Syst. Ed. 10, 1359. 1759). This latter is Satureia origanoides L. (1753); Cunila mariana L (1759), Cunila origanoides Britton.

Kuntze (Rev. Gen. Pl. 520. 1891) has taken up for this genus, the Cunila of Linnaeus (1759), the name Hedyosmus Mitchell (Act. Phys. Med. Acad. Nat. Cur. 8: App. 211. 1748), hence the name should be cited Hedyosmus (Mitchell) Kuntze (1891). The Index Kewensis refers this name to Zizophora.
L., a closely related genus, but not having seen the original publication of Hedyosmus, I am unable to state upon what grounds. Another name referable to the type Cunila mariana L., is Mappia Heist.; Adans. (Fam. Pl. 2: 193. 1763), which under the American code of nomenclature becomes the correct name for this group of the Mint family. Mappia Jacq. 1797, has generally been recognized as a valid genus of the family Olacaceae, and for it will have to be substituted the name Leretia Vell. (Fl. Flum. 99; 3: t. 2. 1825). L. affinis Miers, L. ampla Miers, and L. cordata Vell, to which may be added L. angustifolia (Griseb.) comb. nov. (Mappia angustifolia Grieseb.) and L. racemosa (Jacq.) comb. nov. (Mappia race-mosa Jacq.

The plant of the Mint family heretofore known as Cunila mariana L., may take the name Mappia origanoides (L.) comb. nov. (Satureia origanoides L.)

CAPNORCHIS (Boerh.) Miller:

This name is usually credited to Borckhausen (Roemer's Arch. 1: 46. 1797), and Bicuculla Adanson (1763), has been taken up in several recent publications because it had priority over Capnorchis Borckhausen (1797). Dr. B. L. Robinson (Syn. Fl. 1: 94. 1895) remarks: "Much would have been saved if Bernhardi had taken up the name Capnorchis." Miller's adoption Capnorchis in 1754 will be especially welcome to those who object to Adanson's name. Most of the species of the genus have at one time or another been taken up in Capnorchis, viz:

Capnorchis Cucullaria (L.) Planch.
Capnorchis eximia (Ker.) Planch.
Capnorchis formosa (Dryand.) Planch.
Capnorchis chrysantha (H. & A.) Planch.
Capnorchis canadensis (Goldie) Kuntze.
Capnorchis uniflora (Kellogg) Kuntze.
Capnorchis orchroleuca (Engelm.) Greene.
Capnorchis pauciflora (Wats.) Greene.
Capnorchis occidentalis (Rydb.) comb. nov. (Bicuculla occidentalis Rydb.)
BORBONIA (Plum.) Miller.

This is based upon "Borbonia fructu oblongo nigro, calyce coecineo," Plum., and of which Miller says,—"is pretty common in South Carolina, from whence the seeds were brought by Mr. Catesby to England,—called black-berried Bay in Carolina." This is Laurus Borbonia L., the type of Tomala Rafinesque, a generic name taken up by Dr. Small.

Borbonia Borbonia (L.) House, comb. nov. (Laurus Borbonia L.)

Borbonia littoralis (Small) House, comb. nov. (Persea littoralis Small).

Borbonia humilis (Nash) House, comb. nov. (Persea humilis Nash).

Borbonia pubescens (Pursh) House, comb. nov. (Laurus carolinensis var. pubescens Pursh).

PERSEA (Clus.) Miller.

This is usually credited to Gaertner (1805), and is maintained by Dr. Small as a genus distinct from Borbonia (Tomala). By others Borbonia (or Tomala) is included in Persea. In the latter case Borbonia Miller (1754) has priority of position in Miller's arrangement.

CURURU (Plum.) Miller.

This is based upon "Cururu scandens ennaphylla, fructu racemoso rubro," Plum., which is Paullinia curassavica Linn. (Serjania curassavica Radlk.). Miller's second species is the reference to Plumier's species which is Paullinia pinnata L., and the third one is referable to Paullinia Cururu L.

Cururu curassavica (L.) House, comb. nov. (Paullinia curassavica L.)

In this connection it is important to note that Miller also adopts Serjania (Plum.), usually credited to Schumacher (1794). The arrangement by Miller being alphabetical, Cururu comes first. The species which Miller lists under Serjania are referable respectively to Paullinia polyphylla L. (Serjania polyphylla Schum.), Paullinia mexicana L., and Paullinia sinuata L.
Cururu pinnata (L.) House, comb. nov. (Paullinia pinnata L.)

Cururu Cururu (L.) House, comb. nov. (P. Cururu L., P. nodosa Jacq. Serjania nodosa Radlk.)

Cururu polyphylla (L.) House, comb. nov. (Paullinia polyphylla L.)

Cururu mexicana (L.) House, comb. nov. (Paullinia mexicana L.)

Cururu sinuata (L.) House, comb. nov. (Paullinia sinuata L.)

Cururu brachycarpa (A. Gray) House, comb. nov. (Serjania brachycarpa A. Gray).

Cururu racemosa (Schum.) House, comb. nov. (Serjania racemosa Schum.)

Cururu incisa (Torrey) House, comb. nov. (Serjania incisa Torrey).

GUAIBARA (Plum.) Miller.

This is based upon "Guaiabara alia racemosa, foliis oblongis," Plum., and is referable to Polygonum Uvifera L. (Coccolobia P. Br., 1756; Coccoloba Linn., 1759). The other two species listed by Miller are taken from Houston.

Guaibara Uvifera (L.) House, comb. nov. (Polygonum Uvifera L.)

Guaibara laurifolia (Jacq.) House, comb. nov. (Coccoloba laurifolia Jacq.)

Guaibara venosa (L.) House, comb. nov. (Coccoloba venosa L.)

This is a large genus of chiefly tropical American plants.

New York State Museum
Albany, N. Y.
The Geography of Bird Study.

O. A. STEVENS, FARGO, N. D.

Some time ago the writer undertook to make a brief survey of the work which was being done by the various organizations interested in bird study and protection. The present article is an attempt to show the relative interest in birds in different parts of the United States and to offer some reasons for such distribution. A tabulation of the reports in Bird Lore for December 1917, supplemented by those of 1918 and 1921 gives the following result:

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<thead>
<tr>
<th></th>
<th>1917</th>
<th>1918</th>
<th>1921</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Audubon societies sending reports</td>
<td>20</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>State Audubon societies affiliated but not reporting</td>
<td>6</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Local clubs sending reports</td>
<td>42</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Local clubs affiliated but not reporting</td>
<td>53</td>
<td>72</td>
<td>76</td>
</tr>
</tbody>
</table>

The reports for three years are included as a check on the general trend of the data, rather than for a comparison of the three years. The distribution of these among the different states is shown on the accompanying map, but in order to simplify the details, the number of affiliated clubs for 1921 only is represented. The result may not be quite accurate but is certainly a general index to the interest in birds.

Nine states are entirely blank and about an equal number nearly so. Barely one-half have a state organization. The question arises, what is the function of a state organization, and what is its relation to the local clubs. In some, notably, New York, we see a fine development of the latter without the former. Probably different conditions would be met equally well by diverse organizations. It seems to the writer that the local club is the natural and necessary source of interest but that there should be a real place for the state association in uniting these. The number of organizations for 1921 shows an increase in fourteen states and a decrease in eight as compared with 1917, but the difference is small in most cases.

The distribution of Junior Audubon members provides a second and different method of estimation. Of the 18 states
Fig. 1. Map showing distribution of State Audubon Societies and local clubs affiliated with the National Association. Numbers indicate local organizations affiliated in 1921. Double cross lines indicate state societies submitting reports in 1917, 1918 and 1921; single diagonal lines, report for at least one year; horizontal lines, affiliation for at least one year but no report submitted.
with the lowest showing on the map, only 7 have over 1000 Juniors in 1921; only one of the latter (Nebraska) has over 2000 and the average of the 18 is about 900. For 15 states having 3 or more local clubs, the average is over 8000, only one (Maine) having less than 4000.

The reasons for such distribution seem to be several, and to relate to both bird and human population. The following list may be useful as a basis for study:

1. People—number, character and education.
2. Birds—number, whether resident or migratory.
3. Environment—topography, plants, climate.

These conditions are rather complex, one often affecting one or more of the others. Density of population is probably more important than any other single one, since only a certain number of people may be expected to be naturally interested in birds. This proportion increases to a certain extent with education and may also vary in different sections according to the character of the population. Comparing the map of density of population (Literary Digest for Oct. 29, 1921) with the one here presented, a fairly close agreement is noted. Bird study runs lower in the south-eastern states except Florida where it is higher. It is high also in Indiana, Michigan, etc. These differences can probably be accounted for by character of population.

As to number of birds, migration plays a prominent part. Of the 1200 kinds of birds found in the United States and Canada, one-fourth or more may be seen in a single state. The phenomenon of migration makes one of the strongest appeals to the mind of man but it is to the majority of people of more temporary interest than the study of nesting habits. Thus while migration adds very greatly indeed to interest in birds, the matter of summer residence probably offers the strongest permanent interest. The counts thus far made have indicated a higher number of summer residents for the eastern states.

The character of the country has important influences of many kinds. Lack of trees and especially of thickets reduces the number of tree nesting species. A country of varied topography will have many kinds of birds as there will be ponds for water birds, meadow or prairie for ground dwellers, tall
trees, bushes, bank, cliffs or caves for their respective kinds. Such country offers also a greater variety of plants, insects and other animals which furnish food supplies. Trees, while desirable, have limitations. A dense forest, especially, is composed of only a few kinds of trees, offers only a limited range of conditions and may be as barren of birds as the treeless plain. Fortunately the effect of such conditions often is relieved by proximity of areas of different type.

Climate is important as determining the distribution of birds. It controls their study as well to a considerable extent. The majority of people interested in birds are those who are drawn afield by pleasant weather rather than those who are out regardless of the temperature and moisture. The northern plains in winter or the southern plain in summer offer conditions which are favorable to neither bird nor student.

Changes in population affect also the bird population. This greatly decreases the numbers of certain species (indeed we regret that it has even caused complete extinction of some), but has the opposite effect on others. With an even moderate protection any locality should retain an interesting bird life. The writer has felt that often the greatest need of bird study is for people with natural ability to direct the work. With less capable leaders much more time and energy must be used. This suggests that it is desirable to try especially to interest those who show such ability in other work.
BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.

LIFE OF ALFRED NEWTON. By F. R. Wollaston. E. P. Dutton. $7.00

To hold one position in a great university for 41 years is something of an achievement, but it does not provide a great deal of spectacular material for a biographer. No matter how interesting the work, or how enthusiastic he may be, the scientist who spends his years in a laboratory or class-room cannot be the splendid, gilt-rimmed figure that we are accustomed to look for in biographies. All of this Mr. Wollaston admits at the beginning of his book, and in the absence of adventures in the life of his subject, he goes to the letters which the great professor wrote, as well as those he received. This move, a necessity rather than a choice, has, however, considerable advantages, for it gives the book almost the character of an autobiography.

Alfred Newton entered Magdalene College, Cambridge, in 1848. Six years later he received the Norfolk Traveling Scholarship, and by means of it conducted ornithological field work in Lapland and Iceland, and visited the United States and the West Indies. In 1863, after having done a great deal of work with birds, he moved to Cambridge, making it his permanent home. In 1866 he was appointed professor of zoology and comparative anatomy in the University, and at once began to improve the zoological museum, and to enter into the general life of the university. Mr. Wollaston bears most effective testimony of the fine influence which Professor Newton exerted among students, and numerous letters quoted show that he was equally popular among gatherings of scientists. This association with undergraduates as well as with specialists is an all-important thing for a college instructor who would be something more than research specialists or teaching machines, yet it is neglected, in America at least, by a great number of worthwhile men.

Professor Newton was a staunch Tory, and in all things a conservative. Old things were best; new ones should always be opposed. In politics, while against such men as Gladstone, he did not make any public efforts in the way of campaigns or speeches. Professor Newton showed no such reticence about college affairs. He strenuously opposed such minor affairs as singing at chapel, and the building of a pipe organ where no instrument of any type had been before. But despite his fierce intolerance and violence of prejudice the Professor was a good
loser, a fair judge, and a keen humorist. Mr. Wollastons' book seems to be a good deal like the character of the man whose life he tells, whether by intent or by accident we cannot, of course, determine.

C. L. F.


The author of the volume "Our Friend, John Burroughs," has produced another book, not quite so formless as the first, but still far from satisfactory. The sincerity of Dr. Barrus' desire to bring out an informational account of a very noted man, and the wealth of detailed knowledge which she possesses are evident, but nevertheless she has failed to write a good book. Perhaps ten or fifteen years from now, someone who does not know John Burroughs too well, and who is therefore able to write a really representative biography will do what Barrus has attempted and failed.

In the first place, the book is strangely organized. The chronological method of arrangement is not well suited to a character study, which is evidently the aim of the book. Also Dr. Barrus, along with many others, overestimates the later work of John Burroughs. She tries to make him appear a philosopher as well as a naturalist, which he hardly could claim to be. John Burroughs as a writer of nature essays is deserving of praise; John Burroughs as a nature critic and as a philosopher is a much less striking figure. Because he was a big-hearted, kind old man, who could write beautiful English, knew a great deal of natural history, and had a number of rather spectacular eccentricities that were played upon by magazine writers, the nation idolized him. Nature study clubs had "Burroughs days," and "Burroughs programs;" some book dealers went so far as to label him "America's most noted naturalist." Burroughs became a fad, and as a result we have such books as this one. Some day we may have a clearer evaluation of Burroughs, and then, a worth-while biography of an interesting man.

C. L. F.


By. David Starr Jordan. 12th Ed. A. C. McClurg & Co. $3.00.

This latest edition of Dr. Jordan's standard is highly pleasing. Its purpose is to give students and collectors a ready means of identification, and a comprehensive survey of the characters on which the orders, families, species, etc. of the animals they find are founded. To this end Dr. Jordan makes use of a system of analytical keys by which the differential characters are brought into the sharpest possible contrast. The outstanding fault with these keys in the early editions of the book, namely, the introduction of artificial characters for purposes of differentiation, has been corrected. The keys, while they tend to give the beginner the idea the classification is based on differences rather than
on similarity, are unquestionably of value. And their very abbrevia-
tion makes it impossible for the very new beginner in zoology to use
them and therefore gain erroneous ideas that he will later have to do
away with.

The nomenclature of the book is old. In the attempt to keep the cost
of the volume as low as possible, pages have not been reset in cases
where only names would be changed, the necessary corrections being
made in the appendix. Also, numerous subspecies and varieties are
lacking; thus in the Laniidue we find no mention of the very important
subspecies L. ludovicianus migrans, the Migrant Shrike. It would seem
that, if the book is to be maintained as a standard manual, it would
be worth the while of both the publisher and author to keep it strictly
up-to-date. Students are apt to pay $4.50 or $5.00 for a good, reliable,
modern work, where they will hesitate sometime before investing $3.00
in one that while on the whole pleasing, in the part is very much
antiquated.

C. L. F.

THE NEW PROGRESSIVE GEOGRAPHIES: CALIFORNIA. By Harold W. Fair-

The failings of the old type school geographies are too obvious
to need much explanation. Anyone who has waded through the
smaller Frye only to be confronted by the larger one, and who
found when through with both that the sum of his knowledge was a
little—a very little—above zero does not require further proof. I went
through both; I learned the states in their order, and the capitals for
each state. I learned that cotton grows in Texas and that it is made
into cloth in England and (I think) Connecticut. I did not know why
cotton grew in Texas; I did not know why there were falls where mills
might be located. I did not know why some place was the capital of
Maine, nor why its population was a certain number of thousands,
hundreds, and units. I knew no whys, and I remember very little
geography. I could not now, for the life of me, name the states in
the Union. But I can tell why cotton grows in Texas; why there are
waterfalls in some regions and none in others. If some one will put
the cause as well as the effect into geography it will cease to be a
mechanical affair, and become a live study.

This is precisely what Dr. Fairbanks tries to do. His book for Cali-
ffornia is final; there will be no “follow-up” volume, and the student
may begin it with a light heart in that respect. Facts are treated
from the problem side; questions are asked or statements made, and
then the grounds for the answer expected or the fact laid down are
made clear. Peninsulas are more than “necks of land mostly sur-
rounded by sea;” they are real things, that had a beginning and a
growth. The aborigines are not mere curiosities briefly mentioned;
they are made real by this problem method of treatment. While I
have never taught geography, and probably never shall, I hope that Dr. Fairbanks will produce other books of this high quality and progressive type. C. L. F.


This book, by no means so very elementary as its title might indicate, begins with a "General View of the Structure and Functions of the Human Body." It first considers the functions and form of the body as a whole, and then of the various parts, closing with two most interesting sections, "Life and Death" and "Modes of Death." There follow sections on the circulatory organs, the lymph and lymphatic system, the composition, qualities, and functions of blood, respiration, alimentation, and kindred subjects. The section on motion and locomotion considers those activities in their intimate connection with bodily structure; the sections devoted to the sensory organs deal also with the senses produced by them, the coalescence of sensations, and certain outstanding facts of consciousness. The one dealing with nerves and innervation is especially complete and clearly written. It should be of value not only to the student of physiology, but to those who wish a general physiological groundwork for studies in psychology.

The book is one which, from beginning to end, shows careful, purposeful organization. There is no trace of padding in any chapters, and yet there is a sufficiency of detail for a book of its general and introductory character. It is worth a place on the bookshelf of any zoologist or physiologist, and in these days, when we hear so much of mechanistic concepts of man, "man as an adaptive machine," and so on, it is not without value to the generally educated layman. C. L. F.

HOW TO KNOW TREES. By Henry Irving. Funk and Wagnalls.

This is a convenient little volume, written in popular and most attractive English. It treats the common trees of Great Britain, both native and introduced, in a manner that seems to satisfy the demand of Oliver Wendell Holmes when he said: "What we want is the meaning, the character, the expression of a tree, as a kind and as an individual." There are no artificial keys; no hard, unbeautiful diagrams. Each tree is described with necessary detail, but without technicality. The illustrations, which are excellently selected, show these characters of the trees which can most readily be distinguished by the layman who, though interested in the facts of nature, does not care to systematize them and so become a scientist. Someone would do well to write a similar volume on American trees, or the trees of some particular area of this continent. C. L. F.
NOTE

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J. A. NIEUWLAND, C. S. C., Ph. D., Sc. D., Editor

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Spring and Summer Birds of Northfield, Minnesota, 1921

BY J. W. HORNBECK.

This article forms a second installment of a report on the bird life of this locality for one year. The May number of THE AMERICAN MIDLAND NATURALIST last year contained an article on the fall and winter birds of Northfield, Minnesota, 1920-21. The latter included 65 species, but the Harris Sparrow was omitted by mistake, making a total of 66 different species for fall and winter. The present report includes 122 different species for spring and summer of the same year. In comparing these figures, however, it should be kept in mind that the winter of 1920-21 was extremely mild and consequently brought to us an exceptionally small number of visitors from the North. For example, my records for fall and winter, 1921-22, contain the following nine species which were not observed the previous year: Snow Bunting, Purple Finch, Cooper's Hawk, Marsh Hawk, Red-breasted Nuthatch, Redpoll, Savanna Sparrow, and Bohemian Waxwing.

In column 6 of the table which follows, the date when last seen is given only for migrants; i. e., for those species which go farther north to nest. If they nest in this part of the state, they are listed as S. R. for summer resident, or P. R. for permanent resident. Summer residents go south for the winter, while permanent residents are those which are found here throughout the year.
### Spring and Summer Birds of Northfield, Minnesota, 1921

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<tbody>
<tr>
<td>Bittern, American</td>
<td>May 9</td>
<td>2 May 14</td>
<td>May 14</td>
<td>Com.</td>
<td></td>
<td>Yes</td>
<td></td>
<td>S. R. for summer resident</td>
</tr>
<tr>
<td>Blackbird, Red-winged</td>
<td>Mar. 16</td>
<td>50 Mar. 20</td>
<td>Mar. 20 S. R.</td>
<td>Com.</td>
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<td>Blackbird, Rusty</td>
<td>Mar. 31</td>
<td>8 April 7</td>
<td>April 24</td>
<td>Rare</td>
<td>No</td>
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<tr>
<td>Blackbird, Yellow-headed</td>
<td>May 24</td>
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<td>S. R.</td>
<td>Rare</td>
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<td>Bluebird</td>
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<td>1 Mar. 16 Mar. 16 S. R.</td>
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<td>Yes</td>
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<td>May 9</td>
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<td>S. R.</td>
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<td>May 9</td>
<td>1 S. R.</td>
<td>Rare</td>
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<td>May 20</td>
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<td>S. R.</td>
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<td>Com.</td>
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<td>Chickadee</td>
<td>Mar. 5</td>
<td>3 Mar. 16 P. R.</td>
<td>Com.</td>
<td>Yes</td>
<td></td>
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<td>P. R., Permanent Resident</td>
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<td>Coot, American</td>
<td>April 11</td>
<td>2 Apr. 18 S. R.</td>
<td>Com.</td>
<td>No</td>
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<td>April 25</td>
<td>10 April 25</td>
<td>April 25</td>
<td>Rare</td>
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<td>Mar. 4</td>
<td>1 April 10 April 11</td>
<td>Rare</td>
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<td>COMMON NAME</td>
<td>FIRST SEEN</td>
<td>ABOUT HOW MANY WERE SEEN?</td>
<td>WHEN WAS IT NEXT SEEN?</td>
<td>WHEN DID IT BECOME COMMON?</td>
<td>WHEN WAS IT LAST SEEN?</td>
<td>IS IT COMMON OR RARE?</td>
<td>DOES IT BREED NEAR YOUR STATION?</td>
<td>REMARKS</td>
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<td>Cuckoo, Black-billed</td>
<td>May 27</td>
<td>1 May 28</td>
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<td>S. R.</td>
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<td>Com.</td>
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<td>May 27</td>
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<td>S. R.</td>
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<td>Dickcissel</td>
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<td>S. R.</td>
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<td>Com.</td>
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<td>Mar. 31</td>
<td>S. R.</td>
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<td>Mar. 25</td>
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<td>Mar. 16 S. R.</td>
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<td>May 9</td>
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<td>Oct. 17</td>
<td>Rare</td>
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<td>Rare</td>
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<td>Rare</td>
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<td>Junco, Slate-colored</td>
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<td>Mar. 25</td>
<td>S. R.</td>
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<td>Kinglet, Golden-crowned</td>
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<td>April 18</td>
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<td>April 7</td>
<td>May 20</td>
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<td>S. R.</td>
<td>Com.</td>
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<td>Com.</td>
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<td>Robin</td>
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<td>April 24</td>
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<td>Com.</td>
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<td>Sparrow, Fox</td>
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<td>Mar. 18</td>
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<td>April 29</td>
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<td>Mar. 18</td>
<td>S. R.</td>
<td>Com.</td>
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<td>Mar. 10</td>
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<td>Com.</td>
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<td>Sparrow, White-crowned</td>
<td>May 15</td>
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<td>April 21</td>
<td>May 19</td>
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<td>May 3</td>
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<td>Com.</td>
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# Bird Migration Record

**Made at**

**Notre Dame, Indiana**

**From September 9 to November 30, 1920**

**By Brother Alphonsus, C. S. C.**

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<th>Name of Bird</th>
<th>When First Seen</th>
<th>How Many Were Seen?</th>
<th>When Next Seen</th>
<th>When Did It Become Common?</th>
<th>When Last Seen</th>
<th>Remarks</th>
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<td>Sept. 12</td>
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<td>Nov. 10 A large flock Oct. 7</td>
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<td>5</td>
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<td>Oct. 3</td>
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BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.


This edition of the now famous "Science Sketches" presents some material not found in the first ones, but the book is in general much the same as in the first edition. It is made up largely of sketches reprinted from various periodicals, many of them considerably modified from their original form. Nine out of the twelve chapters deal with present day natural history and naturalists; one chapter is a humorous caricature of protective tariff and human nature; another is a fantastic presentation of life in a Paleozoic sea; the last is an account of the geologic history, and the discovery and reservation as a national park, of the Yellowstone region. The salmon, as is to be expected from Dr. Jordan's special work at the time the book was being written, takes the lead in number of pages devoted to any one subject. But as there is much of little value, and little of much value being published on the habits of fishes, this emphasis is a highly desirable one. Likewise, the biographical chapters on Agassiz and Rafinesque are very welcome in a book of popular science sketches.

C. L. F.

PLANTATION GAME TRAILS. By Archibald Rutledge. Houghton, Mifflin Company. $3.50.

Mr. Rutledge owns an old "before the war" kind of plantation on the Santee River in South Carolina—the paradise of the South, so far as sportsmen and naturalists are concerned. It has been his privilege to follow, for almost thirty years, the game trails in this great plantation region. He has seen the old plantations become great waste tracts; has seen the cultivated land once more become forest; has seen the game come back to its own, a great event in this day of perfected weapons and insatiable game-hogs.

The book is singularly readable, and to a considerable degree valuable from the standpoint of natural history. Such chapters as the one dealing with the behavior of animals in forest fires, and their activities in burned-over districts, and the otter's odd habits of work and play are much worth while. The illustrations, all first-rate photographs, make the volume very attractive in appearance as well as in content. Mr. Rutledge has added a new region to the geography of the sportsman-naturalist, and his addition is one to be welcomed.

C. L. F.

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NOTE

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Published by the University of Notre Dame,
Notre Dame, Indiana

J. A. NIEUWLAND, C. S. C., Ph. D., Sc. D., Editor

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The Histological Structure of the Gills of the Najades with Special Reference to the Histology of the Groove Along the Edge of the Inner Gill.

HIRAM J. BUSH.

I.—INTRODUCTORY.

The primary purpose of the investigation here recorded has been to determine the histological structure of the gill of the Najades with special reference to the groove along the ventral edge of the inner gill. It was at first intended to investigate the groove with the view of ascertaining its function. After some work was done along this line it was found that Allen in a recent paper (2) (1921) had investigated the problem very thoroughly and arrived at conclusions which the present work corroborated in so far as it had been completed, namely that the function of the groove is to act as a channel for conveying food to the labial palps. The first mention of this problem so far as the author is aware is by Dr. Arnold E. Ortmann of the staff of the Carnegie Museum in his Monograph of the Najades of Pennsylvania (4). On page 294 of that publication he says, "Making cross sections through the gills we observe that the outer edge of the outer gill is simply rounded off, while in the inner gill a peculiar longitudinal furrow extends along its edge, which may be seen microscopically. As to the meaning of the furrow, I can not make any suggestion and am only able to state the fact of its presence. By the presence of this furrow an inner may always be distinguished from an outer gill."
Figure I

Transverse section through outer gill
*Lampsilis siliquoides* - male

Figure II

Transverse section through inner gill
*Amblyema peruviana* - female
THE HISTOLOGICAL STRUCTURE OF THE GILLS, ETC. 91

PLATE II

Transverse section through ostia and filaments

Figure IV

Frontal Gland Latero-frontal Lateral

Types of different epithelial cells of the gill
Peck in his "Study of the Lamellibranch Gill" (Quart. Jour. Mic. Sci.) (5) investigated the histological structure of the gills with the object of ascertaining the morphological equivalent of the gill tentacles of other more primitive Pelecypoda. As his work was entirely on marine species of course his work is without mention of the furrow which is the subject of this paper. The author however has found as would be expected, many points of similarity between the histological structure of the gills of the Najades and that of the forms investigated by Peck. Points of similarity will be mentioned later.

The material used in the investigation was entirely from the Mississippi drainage system and consisted of the following species (nomenclature after Ortmann): Lampsilis siliquoidea (Barnes), Anodonta corpulenta (Cooper), Amblema peruviana (Lam.), Elliptica dilatatus (Raf.), Lasmigona complanata (Barnes), Obliquaria reflexa (Raf.), Fusconaja undata (Barnes), Proptera alata (Say), Lampsilis fallaciosa (Smith).

II.—METHOD OF INVESTIGATION.

About fifty different specimens of various ages, and ones representing the different species named in the introduction furnished the material for this study. Such a selection was necessary because Ortmann has shown that in different species there is considerable variation in the structure of the gill especially during the marsupial period (4), and it was desired that the study of the histological structure should be as general as possible with the material at hand.

In every case live mussels were used and when opened the gills were cut out, placed in the different fixatives, and labelled according to name, sex, left or right, inner or outer, gill. In a few specimens the sex as judged from the appearance of the shell was on microscopical examination found to be erroneous and the data changed accordingly. The septa in the female separating the water-tubes in the marsupial gill are much more crowded than in the male, and in the final decision as to sex this point was given preference over shape of the
shell. Ortmann has used this method when a microscopical examination was made.

The fixatives used were Petrunkevitch, corrosive sublimate with glacial acetic acid, Perenyi, Cox-Golgi, and Zenker. Of these the best results were obtained with the first three, Zenker’s fluid was entirely unsatisfactory and the Cox-Golgi was almost as bad. Both showed a decided tendency to distort the gill, and were very hard to remove in washing. Only one gill prepared in each of these two fixatives was sectioned and the results were so unsatisfactory that the sections were discarded without an attempt being made to study them. The Petrunkevitch fluid was found to be the most satisfactory in every way. The gills were washed in tap water for twenty-four hours, and in the case of the corrosive acetic until the iodine test showed that excess fixative had been removed. The material fixed in Zenker’s fluid was washed in semi-darkness in an unsuccessful attempt to avoid precipitation.

The Heidenhain, Ehrlich and Delafield haematoxylins were found to be the most satisfactory stains. All gave very good results and there was little to choose from among them. Mayer’s haem-alum was also used but usually the stain of the nucleus with it was too faint.

The material was stained in bulk for twenty-four hours, being taken from 70% alcohol into the stain; it was then taken back into 70% alcohol to avoid any distortion due to possible diffusion currents and then carried through the alcohols into xylol, remaining twenty-four hours in each. After the material had been in xylol twelve hours, melted paraffin was slowly added until the limit of solubility of the paraffin was reached. In this way the paraffin was slowly infiltrated into the tissue at the same time that clearing was taking place. The vials containing the gills were then placed on a warm plate until most of the xylol was evaporated, and then the tissues were transferred to the melted paraffin of the embedding oven and imbedded in the usual way. By this method of paraffin infiltration all sudden changes of temperature were avoided and the concentration of the paraffin in the tissues very gradually increased as the xylol evaporated.

Serial sections were used throughout the investigation, the
PLATE III

Figure IV

Chitinous rods as they appear in marine Polycopoda
After Pook

Figure VI

Chitinous rods as they appear in the Najads

Diagrams to show the difference in position and form of the chitinous rods in the gill filaments of marine and fresh-water Lamellibranchs.
thickness was varied from 3.3 m. to 20 m. but those from 6.6 m. were most satisfactory and this thickness was used in most of the work. After fixing to the slides the sections were de-colorized by 70% acid alcohol in a Petri dish under observation with the microscope. When the decolorization had proceeded far enough the slides were transferred to distilled water to which had been added a drop of ammonium hydroxide solution to neutralize the action of the acid during the time taken in transferring the slides from the acid alcohol to the water. After washing in this way the stain gave excellent results. The slides were then carried up through the alcohols and xylol and covered with balsam and cover glass in the usual manner. This method of decolorizing sections stained in bulk with haematoxylin and washing in distilled water to which a trace of alkali has been added, was found to be much more satisfactory than the use of ordinary tap water since the sections were entirely free from dirt.

The sections were cut in the three different planes of the gill, that is vertical, longitudinal-lateral, and longitudinal-transverse, the longitudinal-lateral section was only possible with small gills and even then was not very satisfactory since the sections were so large that complete serial sections were difficult to obtain.

III.—CONCLUSIONS AND RESULTS.

The simplest structure of the gills as was previously noted by Ortmann (4) is always found in the gills of the male. Figure 1 is a cross section of an outer male gill and shows the comparatively few filaments or septa between the interlamellar junctions. In figure 2 an inner female gill is shown and the greater distance between the inter-lamellar junctions, as measured by the number of septa between them, is the striking thing noticed. The outer lamella of the inner gill is also convex instead of being parallel to the inner lamella as it is in the other gill. The effect of these differences between the male and femal gills is to give a much greater size to the water tubes in the latter which is of course of great value during the period of incubation of the glochidia.

The sub-filamentar outgrowths are large and abundant so
as to completely mask the primary tubular character of the
gill filaments. These outgrowths at the bases of the filaments
which bind the filaments together into the lamella or plate,
are broken at irregular intervals (o-fig. 1 and 2) giving rise
at these interruptions to the ostia or water openings into the
water tubes (w. t. fig. 1 and 2).

Figure 3 shows a single lamella highly magnified. The
sketch shows the lamella to be covered with ciliated columnar
epithelium of which three kinds may be distinguished. These
may be called from their positions on the filament, frontal (f),
latero frontal (l.f.), and lateral (l).

The cells of the frontal epithelium are ordinary columnar
epithelium averaging 3 microns in length. They rest on a
continuous base of connective tissue which extends along the
lamella bending into each filament, and is only interrupted at
the ostia. The cytoplasm of these cells is very granular espe-
cially near the marginal end while the nucleus is at the base
of the cell or better, the distal end. The nucleus in a few of
the cells is found near the middle of the cell. Some of the
cells are without doubt mucous gland cells and occasionally
one may be seen of the characteristic goblet cell appearance
which has discharged its secretion of mucous. From the ap-
pearance of these epithelial cells it would appear that any of
them can function either as an epithelial ciliated cell or a
glandular cell. The cilia borne on these cells vary in length
from one to two microns. The cells are on the average one
micron or less in diameter giving a ratio of length to width
of 3 : 1.

Adjacent to the frontal epithelium on either side of the
lamella is found the latero-frontal epithelium. The distingui-
shing character of this tissue is the remarkable length of
the cilia and the comparative width of the cells. So long are
these cilia that they bridge the space between the filaments
and are entangled with those from the opposite cells of latero-
frontal epithelium and for this reason the length of these cilia
must be estimated rather than measured. Their estimated
length is about four microns. These cells are very scant com-
pared to the number of the others; usually only four or five
cells occur on each side of the filament, one filament was found
PLATE IV

Figure VII

Longitudinal cross-section through anterior end of gill showing the long cilia in the groove - Drawn with Edinger apparatus

Figure VIII

Structure of blood vessel from interlamellar junction showing attachment of supporting cells

Figure IX

Note - Depth of groove much reduced compared to size of cells

Vertical section through groove
bearing eight cells on each side, counts of three were frequent. Usually this group of cells is separated from the frontal epithelium by a single gland cell which was usually very large, 2 microns wide by five microns long. The mucous globule full of granules was always found extruded from the top of this cell probably due to fixing. The cells of the latero-frontal epithelium were columnar in shape but were larger than those of the frontal epithelium. Their average length was four microns, while the width varied from one to two microns being greater in those cells nearest the distal end. This variation in the thickness of these cells is probably due to less crowding of these nearest the inter-filamentar junction since the proximal cells are on the curve of the filament (see fig. 3). The cytoplasm of these cells is not so granular as that of the frontal epithelium. The nucleus has the same ellipsoid shape as in the frontal epithelium but is slightly larger and located nearer the center of the cell. The nuclolus is always very distinct in these cells.

The epithelial cells from this point gradually assume a more spherical shape and although bearing cilia, the cilia are short, usually less than one micron in length. About one-half the distance from the edge of the filament to the inter-filamentar junction the cells have assumed a spherical shape and the nucleus is also practically spherical at this point. From this point on the cells gradually lengthen in the other plane giving rise to the pavement epithelium lining the ostia and water tubes. The nucleus also gradually lengthen until the ellipsoid form appears again but this time the long axis of the ellipse is parallel to the base instead of perpendicular as before. These cells are from three to four microns long and an average two microns in width. The ratio of length to width is therefore three to two, or rarely four to two, and never becomes as great as that in the frontal or latero-frontal epithelium. It should be remembered however that this ratio is the converse of that mentioned first since the cells are now flattened in the horizontal direction instead of the vertical, that is the former width has by gradations now become the length of the cell and vice versa. Not all of these pavement cells retain their cilia but the number is so variable that no stand-
and can be worked out that will hold true for the whole gill. However almost all the cells lining the ostia and the water tubes retain their cilia and are usually spherical in shape. Some even retain the columnar form and they are never flattened horizontally like those lining the inter-lamellar junctions.

The nuclei of these different types of epithelial cells, though varying in size, in proportion to the size of the cell, are remarkably similar in all other respects so that the following description will hold for all of them. As mentioned before the nucleus is usually ellipsoid in form but is spherical in those cells which may be classified as cubical epithelium. The nuclear membrane is always very distinct and stained heavily with haematoxylin. The nucleoplasm is full of dark-staining granules one of which is much larger and more distinct than the others and for this reason is called the nucleolus. The nucleo-plasm as a whole seems to take a darker stain than the cytoplasm but this appearance may be due to the optical effect of the numerous granules.

The nucleus of the single gland cell between the frontal and latero-frontal epithelium (fig. 4) is very large corresponding to the size of the cell, and at times has the appearance of two or even three nuclei clumped together (fig. 4-b.). When it has this form the nuclear membranes are distinct but touch one another. These cells are therefore sometimes multi-nuclear.

The cells bearing cilia have a striated border at the top to which the cilia are attached. This border is connected with the nucleus by a number of very fine fibrilis which run through the cell protoplasm giving it also a sort of striated appearance. Whether or not these fibrilis are continuous into the cilia, I was unable to ascertain.

The chitinous rods supporting the gill filaments of the Lamellibranches are well known, and their structure was thoroughly worked out by Peck (5). I have found that in the Najades the structure is similar to the marine species used by Peck in that the rods are two in number, one occurring on each side of the filament and similar to his in that they are not continuous throughout the lamella but are composed of a
number of short rods overlapping at the ends. This construction gives the gill far more flexibility than it would have if the rods were a single rigid piece. However in his drawings, Peck places the rods out near the end of the filament while I have found them in the Najades to occur near the base of the filament where it joins the interfilament junction. In the structure they also differ; Peck shows them as cylinders (circular in cross-section) while in the Najades they are greatly flattened so as to resemble a knife blade with the edge perpendicular to the surface of the lamella. These differences are shown in figures 5 and 6.

The connective tissue which underlays the ciliated epithelium corresponds to areolar connective tissue. When examined under the microscope it is seen to be made up of very fine, transparent white fibers. It is very scant in thickness, but runs along the entire lamella underneath the epithelium, as well as under the cells lining the water tubes, only being interrupted at the ostia, where the bundle of fibers divides and encircles the opening. The connective tissue is shown in figure 3 (conn. t.).

The tissue filling up the space inside the filaments as well as the interfilamentar junctions is in the form of a reticulum.

The cells are stellate in form and have long branching processes of cytoplasm which interlace with each other and even appear to fuse at times with those of other cells: The nuclei of these cells vary from the extreme elliptical to the circular in shape but are usually in the form of an ellipse with the short axis about two-thirds of the length of the long axis. The size of these nuclei varies around one to three microns in diameter. The processes of the cytoplasm weave around one another so much that their length cannot be determined, however I have frequently seen a single strand extending across the entire width of the lamella. The tissue resembles in appearance the mesenchymal cells in primitive mesoblastic tissue. Large blood vessels run through this tissue and some of the smaller vessels open into it. This reticulum thus acts as a blood sinus. The circulation in the gills thus can hardly be called a closed system. Since this reticulum extends out into the filaments the animal is rendered partly independent of
the water tubes for respiration as the filaments themselves can carry on that function though only to a limited extent due to the thickness of the layer of epithelium covering them. The epithelium lining the water tubes is much thinner.

In figure 3 these cells are shown (mes.) with their processes, interweaving with each other. The majority of the cells as is shown in the diagram lie along the connective tissue which forms the base for the epithelium, and send out their branches diagonally across the filament, but many of them are found in the center of the filament supported by their processes running to the sides. Frequently blood corpuscles are found in this reticulum (figure 3 b.c.) between the meshes formed by the strands. Blood vessels of large size are found running vertically through the interlamellaiar junctions in every gill (figures 1 and 2 b.v.). These blood vessels are composed of cells which are extremely flattened and united at their ends to form the tubes. The cells are curved in an arc, the amount of curvature depending on the number of cells required to encircle the blood vessel. The mesoblastic cells are in turn attached to these cells by their processes or the mesoblast cell may lie against the blood vessels and send out its projections of cytoplasm to others of its kind in the reticulum. This structure insures the blood vessel remaining in the same position guyed as it were by strands of cytoplasm. The structure of a blood vessel with its supports is shown in figure 6.

At the base of the inner gill the filaments making up the lamellae instead of directly doubling back upon themselves as in the outer gill, are thrown upward into a fold which gives the furrow mentioned in the introduction. The furrow was examined in serial sections of entire gills and was found at the extreme anterior end of the gill although it was very shallow at this point since the filaments are so short at the anterior end. It gradually deepened for a distance of about a centimeter along the edge of the gill until the maximum depth was reached which is continued along the gill for the remainder of its length. This depth varies with the size of the animal and to a small extent in different species. The depth of the groove is from one to three millimeters. The maximum depth of three millimeters was only found in one very large
specimen of Amblema peruviana. Figure 7 shows a vertical section through the furrow, drawn with the Edinger projection apparatus. The lamella are seen to fuse at the top of the groove rather than being united by interlamellar junctions. At the point of fusion of the lamella where the groove is discontinued, the cells are much larger than the usual epithelial cells and are closely packed together. The nuclei at this point are spherical (circular in optical section) instead of the ordinary ellipsoid form, probably due to the crowding of the cells. These cells are apparently similar in function and structure to the large gland cell found between the frontal and latero-frontal epithelium on each side of the filament (figure 3 g.c.). However these glands cells in the groove are not mulatinucleated like the ones on the filaments (figure 4 b.), that they have a glandular function is evident from their large size (four microns by five microns), their lack of cilia, and their granular cytoplasm. This function would correspond with Allen’s discovery that food particles imbedded in mucous globules were transported along the groove, since it accounts for the source of the mucous.

The sides of the groove are covered with latero-frontal or rather an epithelium corresponding to it. They are slightly larger than the latero-frontal cells, being five to seven microns long, and three to five microns in width; they both possess the characteristic long cilia, which in this case sometimes reach a length of as great as twenty microns; the measurements of the cilia were difficult to record due to the entangling with those of other cells. These long cilia undoubtedly serve to convey the food and mucous along the groove.

IV.—SUGGESTIONS AS TO THE CAUSES OF THE PHENOMENON AND POSSIBLE SOURCES OF ERROR.

In the different kinds of epithelium of the gill the clue to the selection of food particles and the rejection of mud and sand might be found. Allen has shown that foreign substances like carborundum, carmine, etc., although introduced into the incumbent siphon are never found in the alimentary tract (Allen 1). He explains this fact by the action of the cilia on the labial palps. The cilia on the gills might help in
this selection, since they must come in contact with these particles before they reach the labial palps. It seems probable that this selection would be made in the groove of the inner gill at least.

The cilia on the gills apparently strain the water entering the gills and probably this is the principal function of the long cilia on the latero-frontal epithelium. These cells are certainly located at a strategic position for this work, situated as they are at the turns of the filaments. The ostia as well as the depressions between the filaments may be compared to streets; these cells might then serve as traffic policemen with their cilia stretched across the opening, permitting the water to enter by turning back dirt and foreign particles.

The method of preparation of the sections, given before, should insure against plasmolysis of the tissues, but it is possible that in some cases this might have taken place. However the uniform results in the tissues investigated makes it very unlikely.

The training of the eye for observation of details is of course an important factor and due to lack of this at the start of the work some important details may have been overlooked. The measurements were taken with standard equipment and it is hardly possible that it was at fault.

The drawings are of course idealized somewhat since all the details of structure would lead to confusion.

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Notes on Alabama Plants.

BY W. WOLF, O. S. B.

A New Monotropoid Plant.

I.

About the first of November, 1901, my attention was drawn to the discovery of a plant by Brother Norbert Knapke, who detected it while he was raking leaves in the forest of the St. Bernard College estate, Cullman County. The man was very enthusiastic about the plant, never before observed by him. He described the plant as leafless, with bell-shaped flowers almost ready to expand. At that time my interest in plant life was very limited. At the man's urgent request, however, I finally consented to accompany him to the habitat of the plant. Having reached the place, he removed the covering viz., fallen leaves of successive seasons, and exhibited a fine group of about a dozen scapes. These scapes were in excellent state and the flower buds far advanced. To all appearance it seemed but a question of a few days or possibly a week until the plant would be in full bloom. Having seen the plant, I was now easily induced to repeat the visit after a few days. In those days, the stock law was not in force, in this section of the state, and this accounts for the loss of the plant. On our next visit we found the whole group of plants up-
rooted. Two scattered scapes were picked up and preserved, more as a matter of curiosity than for any special scientific purpose. The fatal incident, instead of lessening, rather stimulated my interest in the plant. A search to re-discover the plant was immediately undertaken and renewed a few times later, without success. I also desired to learn the name either of this particular plant, or at least of one closely akin. Since the Botanical Department of the College did not exist in those days, I appealed to the librarian of the College, through whose courtesy I became supplied with the fifth edition of Gray's Manual of Botany. Owing to my ignorance of elementary botany, I was unable to master the arrangement of its contents. I succeeded however, in satisfying my desire; for, the text on Schweinitza odorata appeared to represent a plausibly fitting description for the plant of Brother Knapke's discovery. Thus the first phase concerning the newly discovered plant came to an end.

On October 25th, 1905, a tuft of several scapes was discovered by Mr. Gamer and delivered to me. A few weeks later (November 23rd) an undergraduate of the College, now Rev. Bede Knapke, discovered a few other groups. The discovery was promptly reported to me, and stimulated a new impetus in the study. In both cases the plant, including flower buds, were found grown to almost the same degree of development as those discovered in 1901. This fact supported the assumption that the plant might truly represent a fall-flowering species. My interest was aroused in this new direction and, in order to obtain conclusive data on the point in question, I determined to make the plant the object of continuous observation. One group was taken home and transplanted in a secure place in the open ground. The others were left in their native habitat with the intention to visit the place frequently. No result was obtained, however, for the plants in the native haunt, as well as the transplanted one sooner or later died. Most probably, with present-day knowledge concerning the plant's behavior towards the factors of its surroundings, the failure could have been avoided. On December 28th, 1909, an insignificant tuft (three scapes) was found by the original discoverer, N. Knapke. When the re-
port reached me, I set out for the place and made a cut in the ground in order to divide the tuft. One scape was left in the place for control; the others were taken home and potted. The room wherein the potted plant had been placed was kept at a moderate temperature during the day. At night, when weather conditions became severe, the temperature occasionally dropped below the freezing point. The flower buds were already somewhat less than full-size when the plant was discovered. During the following weeks neither the potted scapes nor the one left in the native habitat showed any perceptible progress; neither did they show any sign of deterioration. Five or six weeks after the time of discovery, the scape in the field was found broken and thus lost as control object. The potted plant remained in a state of apparent dormancy during January and February 1910, but became perceptibly active with the approach of March. About the tenth of that month the corolla of the first flower expanded, the others following in turn. Almost simultaneously (in the middle of March) the discovery of a colony of plants offered the opportunity to test the above result under normal outdoor conditions. Comparison proved that the tenth of March is to be considered a somewhat too early date for anthesis. The new discovery marks a further significant date in the history of this Alabama plant in that this colony served for some years as field object for the study of the plant's behavior during the whole course of its season, from the appearance of the scapes to the ripening of the fruit. Afterwards, the plant was discovered more frequently, so that all in all, a few thousand scapes have come to my notice. Thus the plant and its behavior is well understood at present.

I take pleasure in acknowledging my gratitude to Brother Norbert Knapke, the discoverer of the plant. Most of the discoveries must be accredited to him, for without his enthusiasm, his urgent persuasion and his never-failing reports of new findings, I should not have been able to offer this modest contribution to science. For the photographs accompanying this paper, I am indebted to Rev. Bede Knapke, O. S. B., to whom I likewise wish to express my gratitude.
CRYPTOPHILA PUDICA.

PLATE I.

No. 2

No. 3

No. 1
II.

**ROOTS**: The root-system resembles a slender, mostly repeated many-branched, creeping rhizome. It is light brown or yellowish and more or less densely covered by micorhiza, the main strands being about 1 mm. thick.

**SCAPE**: The scapes, underground part included, are from 4.5 to 10 cm. high and mainly 4-8 mm. thick. The average scapes vary from 5-8 cm. in height and even vigorous ones almost invariably do not exceed 9.5 cm. The scape is of a succulent-waxy texture and like all parts of the plant, glabrous. The number of scales varies exceedingly in different specimens—from a few to more than fifty—and are either remote, approximate, or more or less densely imbricated. They are 4-10 mm. long, ovate, ovate-oblong or linear-oblong, but are occasionally of a broad type, especially the lower ones, which are deltoid-ovate to orbicular-ovate. The apex is obtuse or acute, the sessile base truncate and the margin entire or slightly erose near the apex. Their texture is succulent but sooner or later, they generally become membranous.

**INFLORESCENCE**: The inflorescence is racemose but in appearance ranges from head-like to spike-like; it is one-sided, conspicuously bracted and bracteolate, 1-16 (more often 4-13) flowered. The rachis, from lowest to uppermost bract is 0.5-1.5 cm. long—somewhat longer in extraordinary cases—but never exceeding 2.3 cm. The length of the rachis is independent of the number of flowers and may be less than 1 cm. in a 12-flowered inflorescence. The bracts are 8-11 mm. long, 5-8 mm. wide, ovate-accuminate to orbicular-accuminate, entire, erose, erose-denticulate or erose-laciniate above the middle. The two bractlets at the base of the pedicel are somewhat shorter than the bracts, mainly oblanceolate, and more frequently erose. Occasionally from one to three additional bractlets may be present and these are then distributed along the pedicel. In texture the bracts and bractlets are succulent but in most cases become membranous. The pedicels are 2-10 (mostly 4-8) mm. long.
FLOWER: The flowers are regular, pentacyclic and normally pentamerous. It sometimes occurs that one or more flowers in an inflorescence deviate from this plan. In certain cases each and every cycle of the flower becomes affected and the arrangement of such flowers is still according to a uniform plan. In other cases only the androecium, or the corolla, or both androecium and corolla are affected. With a single exception deviation has been found to occur in the direction of an increase of members in the affected cycles. Those flowers which are still arranged according to a uniform plan are either hexamerous or heptamerous. One case is known in which a single octomerous flower occurred, and likewise a single instance is known where deviation from the normal occurred in the direction of reduction. In the latter case the flower was tetramerous. It has been found that if deviation in all cycles occurs only in a single flower, it is always the terminal one, and if in more than one, the terminal one represents one of them. (Lately two scapes with tetramerous flowers have been found; in one instance two flowers, the terminal one among them; in the other one which was not the terminal. Thus the above statement does not hold true in all cases, at least not with reference to reduction-deviation.)

CALYX: The sepals are distinct and vary considerably in length. They are either as long, shorter, or longer than the corolla, measuring 7-13 mm. They are oblong or somewhat oblong-lanceolate, truncate and one-grooved at the base, obtuse, acute or acuminate, entire or slightly erose at the apex. The inner ones are more or less fornicate. Like the scales and bracts, they are of a succulent texture, which character is frequently found unchanged in anthesis. Sepals and corolla-lobes are imbricated in the bud.

COROLLA: The sympetalous persistent corolla is campanulate, cylindric-campanulate, or sometimes cylindrical, 5- (respectively 4-8) lobed, 5- (4-8) saccate at the base, and 7-11 mm. long. The lobes are ovate or round-ovate, obtuse or acute, one-third to one-fourth the length of the corolla, and spreading in anthesis. In texture the corolla is succulent or rather waxy, especially the lobes.
**DISK:** The hypogynous disk is distinctly 5-lobed; each lobe is reflexed and manifestly emarginate.

**ANDROECIUM:** The androecium consists of twice as many stamens as there are members in the calyx, corolla and pistil. The stamens opposite the sepals are inserted below the disk, those opposite the sepals apparently between the lobes of the disk. The anthers are adnate, the connective is manifest and rather stout in comparison to the size of the anther which is transversely 2-saccate with one sac superposed above the other, the sacs facing introrsely. The connective is generally reddish or brownish-purple, the sacs white or cream-color, becoming yellow at maturity. A shallow groove along the connective indicates the position of the vertical partition which is as long as the anther. It is not marked off along the introrse face of the anther, because it is only imperfectly developed; its best development being in the region where it is crossed by the transverse partition. The transverse partition is small but for the first more complete than the vertical one and is responsible for the transverse constriction of the anther. As development of sporogenous tissue progresses, the sacs bulge out considerably and become confluent. The line of constriction does not become markedly obscured and the individual sacs are still recognizable at maturity. Before the anthers mature, two oval spaces become faintly marked off, one on each side of the connective, which develop into large pores through which the pollen is discharged. The partitions remain attached to the connective which, at maturity of the anther, loses its prominent character on account of exsiccation and of warping. With the approach of maturity the anther makes a turn of less than 90 degrees; thus the pores assume a terminal position. The filaments are at first somewhat stout but become filiform and are generally reddish or purplish.

**GYNOECIUM:** The compound 5-(respectively 4-8-) carpellate pistil is snow-white and of a firm waxy texture. The ovary is subglobose to globose-ovoid, slightly 5-(4-8-) lobed by primary grooves and, in its lower part, 10-(8-16-) lobed through additional secondary grooves. The style is short, about 1.5 mm. long and thick, not hollow but inconspicuously
CRYPTOPHILA PUDICA.

PLATE II.

No. 1

No. 2

No. 3
5-(4-8) cleft. The stigma is subglobose or hemispheric (not angled), and appears as if 5-(4-8-) valved or crenate owing to longitudinal ridges extending, and gradually decreasing towards the base of the spical funnel-form apperture which at maturity is filled with secretion. The cavity of the ovary is distinctly one celled with 5 pouches near the the base, the large parietal placentae are cordate-deltoid in cross-section, and covered all over with numerous anatropous ovules.

**FRUIT:** The indehiscent fruit is baccate, subglobose, tipped with the persistent style and stigma, and 0.7 to hardly 1 cm. in diameter. In shrivelling it becomes more or less ovoid-rostrate and corrugated. The red or orange seeds are about 0.5 mm. long oval to ovoid and flexuously sulcate or somewhat reticulated. The testa is firm and in conformity with the nucleus.

III.

There exists a certain degree of relationship between the Alabama plant and the genus *Monotropsis* Schweinitz (*Schweinitzia Ell*). Thus a brief comparative study concerning these types may not be out of place. For this purpose the following literature has been consulted:

1. Elliott, Steph., A Sketch of Botany of South Carolina and Georgia. 1: 479. 1821.*
5. de Candolle, A. P., Prodromus Systematis Naturalis Reg. Veg. 7: 780. 1839.
12. Small, J. K., Flora of the Southern United States. 880. 1903; also 2d. ed.


Monotropsis has a calyx of 5 distinct sepals and a sympetalous corolla. It has also a manifest disk, which is described by earlier authors as 5-cleft (1), (2), (3), (4), (5) and by later authors as 10-crenate (8), (10), (11), (15), respectively 10-toothed (13). A detailed statement on the position of stamens by Rafinesque (3) reads: "Stamens 10, a pair between each angle of the nectary." The anthers are in general described as clavate-saccate (1), (5), 2-saccate (6), (13), awnless (6), (8), (9), (11), (12), (13), (15), 1-celled (2), (4), 2-celled (6), (13), confluent (10), (11), (12), opening by pores (2), (4), (5), (8), (10), (11), (12), horizontal in the bud (8), (10), (11). Besides there are two statements by Gray (7) which are worth citing because the only ones referring to a transversely 2-saccate character of the anther; they read: "The anthers. . . . in the flower bud are horizontal, so that one cell stands directly above the other"* and "antherae. . . . in alabastro transversae."

On comparing the description of the Alabama plant with the above compilation the following result is obtained. In both the Alabama plant and Monotropsis, the calyx consists of a complete series of distinct sepals and a sympetalous corolla. Both have a manifest hypogynous disk which is 5-lobed, with the lobes manifestly emarginate in the Alabama plant, and most probably so in Monotropsis. I base this assumption on the fact that the earlier authors describe the

* The figured anthers in Britton & Brown's "Illustrated Flora" are not transversely saccate. Anthers like this cannot be expected to have one sac stand directly above the other in the bud except one supposes a twist of the filament.
disk of Monotropsis as 5-cleft, while later authors describe it as 10-crenate and consider the difference rather a matter of degree in that the earlier authors ignore the secondary lobation as a mere trifle, referring only to the primary lobation while later authors seem to overrate the deepness of the secondary lobation. It may be stated here that the descriptions of certain, if not most of the authors, are not original, or else are based on herbarium material of this rare plant. The arrangement of the stamens in the Alabama plant is 2-cyclic in conformity with the pentacyclic flower-plan, which is the normal for the group of monotropoid plants. Rafinesque's statement cited above, indicates that in case of Monotropsis, deviation from the normal plan occurs. In accordance with the statement we are to assume suppression of one staminal cycle, the antipetalous one, accompanied by duplication of the members of the other (antisepalous) cycle. Now, as mentioned before, the later authors describe the disk of Monotropsis as 10-crenate, which means that there are ten spaces left which are not occupied by the disk. These unoccupied spaces correspond in number with the stamens, of which there are likewise ten. This suggests that each space represents the position of a respective single stamen. Judging from this point of view, it seems more likely that the arrangement of stamens is the same in Monotropsis as in the Alabama plant. I surmise that Rafinesque, relying on Schweinitz's conception of a 5-lobed disk, based his opinion upon the same evidence used in the above argument, viz., the number of available spaces—five in consequence of a 5-lobed disk. If so, then the presenting of mere inferences as positive facts would appear somewhat unscrupulous. In Monotropsis as well as in the Alabama plant the anthers are awnless, transversely 2-saccate, the sacs introrse, horizontal in the bud with one sac superposed above the other, vertical in anthesis, becoming confluent and opening by pores.

The conception of the genus Monotropsis is originally based on Schweinitz's description published in Elliott's Sketch (1). Unfortunately the text is seriously incomplete, containing no statement on the internal structure of the ovary and none whatsoever on fruit. It is therefore of no service for further
comparative study. Nuttall (2) has a statement on fruit, but this becomes worthless because appended by a question-mark. It reads: "Capsule 5-celled?" It is copied by Don (4) and De Candole (5) has adopted it with reserve, placing the responsibility on Nuttall. Some of the later authors describe only the fruit as a 5-celled capsule (6), (9), (13); others mention also a 5-celled ovary (10), (11), (12). How far the statements of the respective authors are based on personal observations, I am unable to decide, for those on fruit as well as those on ovary are very uniform. It seems best, therefore, to rely on Gray's authority, as he was very much interested in the genus. Furthermore, as late as 1884 he established the species *Monotropsis Reynoldsiae* (7) of which he had at his disposal, besides other material, "A full series of freshly gathered specimens." In the Synoptical Flora (8) *Monotropsis* is classed with the tribe *Eu-monotropeae* which is based on "Ovary 5-celled, or sometimes 4-celled; the placentae projecting from a thick central columella." The fruit character for the whole subfamily *Monotrepeae* is specified as "Capsule loculicidal."

In the Alabama plant, on the contrary, the ovary is 1-celled, 5-pouched, only at the base, and the placentae are parietal; the fruit is indehiscent and baccate. Because of these essential differences the Alabama plant is to constitute a distinct genus, which becomes:

**CRYPTOPHILA** gen. nov.

CRYPTOPHILA PUDICA.
PLATE III.
CRYPTOPHILA PUDICA spec. nov.  
(Herb. St. Bernard College no. 1071.)

Planta perennis glabra. Radices usque ad 1 mm. crassae communiter coopertae densa micorrhiza. Scapus erectus 4.5-10 cm. altus; squamulae sessiles, remotae, approximatae vel imbircatae, ovatae, ovato-oblongae, lineares-oblongae vel inferiores triangulariter ovatae, obtusae vel acutae. Inflorescentia quasi spica vel capitulum; flores 1-16; bracteae conspicuae orbiculato-acuminatae vel ovato-acuminatae; bracteolae oblanceolatae; pediculi 2-10 mm. longi. Sepala oblonga, obtusa vel acuta, interiora fornicata, 7-13 mm. longa. Corolla 7-11 mm. longa, campanulata, cylindrico-campanulata vel cylindrica, in basi gibbose 5-saccata; lobi ovati, obtusi vel acuti. Discus 5-fides; lobi reflexi et emarginati. Filamenta filiforma; connectiva conspicua, rubicundula vel purpurea; sacci albi-cantes post ea lutei. Germen parum 5-lobatum in inferiore parte 10-lobatum. Stylus brevis crassus. Stigma subglobosum vel hemisphaericum intus 5-fidum secundum apicalem infundibuliformem aperturam.—Flores raro tetramerosi, hexamerosi, heptamerosi vel octomerosi.—Bacca subglobosa 0.7 vix 1 cm. in diametrum. Semen circiter 0-5 mm. longum, test firma-flexuose sulcatum vel parum reticulatum. Herba scaposa; scapus squamulosus. Planta non parasitica.—In silvis xerophilis Comitatus Cullman, Alabama.

There has also been discovered a single tuft of three scapes, which, were from 15 to 20 cm. high. Scapes of intermediate size between this extreme form and the typical one have never been observed. It may thus be distinguished from the type as:

CRYPTOPHILA PUDICA forma MAXIMA f. nov.  
(Herb. St. Bernard College no. 1452.)

On the other hand, the colony discovered in March 1910, already referred to in this paper, represented an extreme dwarf form. Under observation for some years, it showed no deviation during any of these seasons. It may, therefore, be designated as:
CRYPTOPHILA PUDICA var. KNAPKEI var. nov.  
(Illustration 3 of Plate II.)

Radices usque ad 2 mm. crassae parum coopertae micorrhiza. Scapus subterraneus erectus 1.5-2 cm. altus exclusa inflorescentia. Inflorescentia supra terram paululum in terra infixa, capitulum; flores 3-9; rachis minus quam 1 cm. longa. Bacca circa 5 mm in diametrum.

The small group of plants known as Monotropaceae, Monotropeae, Monotropoideae, Hypopityaceae and Hypopithieae has been repeatedly changed with regard to rank and position in the systems of classification, due rather to minor points, for its relation to the large body of the Ericas is well established. Even at present no agreement has been reached and thus we find the group considered a distinct family, or a subfamily of the Pyrolacia, or again a subfamily of the Ericaceae according to the opinions of different authors. As the group itself retains its integrity regardless of supposed rank or position, the matter is of no consequence in the present case. However, in order to determine the position of the new genus within the group of monotropoid genera we are concerned with the subdivision of the group into tribes of which two have been recognized hitherto, the Eumonotropeae and the Pleuricosporeae. Cryptophila differs from the Pleuricosporeae mainly in the ovary structure and the fruit character, and from the pleuricosporeae mainly in the anthers, in the presence of a manifest disk and in fruit. The arrangement thus becomes:

Tribe I. Eumonotropeae: Ovary several-celled; placentae projecting from a central columnella; fruit a loculical capsule; disk present or none. It includes the genera Allo tropa, Pterospora, Sarcodes, Monotropsis, and Monotropa.

Tribe II. Pleuricosporeae: Anthers opening by longitudinal slits; ovary one-celled or falsely several-celled through fusion of the 2-lamellate placentae; placentae parietal; fruit a loculical capsule; disk none. It contains the genera Pleuricospora, Newberrya and Chei lo theca.

Tribe III. Cryptophileae Anthers opening by pores;
ovary for the most part one-celled, several-celled near the base; placentae parietal; fruit indehiscent, baccate; disk manifest. Single known genus, Cryptophila.

IV.

With regard to the extent of the geographical range of Cryptophila pudica nothing is known at the present time. The only known station is St. Bernard, Cullman County, located east of longitude 87°, north of latitude 34°, and an approximate altitude of 800 feet above sea-level, in the southern part of the Carolinian area of the Upper Austral Life Zone. Topographically, the locality is part of the table-land of Northern Alabama. It is intersected by the channels of the Eight Mile Creek and its contributory brooks and brooklets, rather deeply cut and bordered by gradual or somewhat steep slopes or occasional bluffs. As the slopes approach more or less closely to the water channels the spaces of lowlands left are very insignificant as to extent. However, as to plant association these narrow stretches are to be considered distinct from the upland by its rather mesophile character. It is in the upland that the physiognomy of the regional plant formation, a xerophile mixed forest, finds its expression. Originally, the hardwood timber predominated; at present conifers (pines) gain preponderance, and in small areas the mixed forest has become replaced by pine growth. The mineral constituent of the soil of the place is derived mainly from the surface rock, which is sandstone. Along water-courses alluvial soil predominates, which is a soil too loose for the requirements of Cryptophila pudica, and in accordance with this fact the lowlands have not proved a habitat of the plant. Likewise, the plant does not occur in pine-lands, however, for a different reason viz., lack of protective cover. The true habitat of Cryptophila p. is the xerophile mixed forest of the upland. Here, with certain insignificant exceptions, the soil consists of a compact fine sandy loam. When I first began to investigate the character of the root-system (inquiring at the same time about the plant’s relation with regard to parasitism or saprophytism) I found the ex-
tracting of relatively uninjured root-systems a more tedious undertaking than I had expected, and this was due to the peculiarity of soil conditions in connection with the plant. To liberate root-systems of Cryptophila p. from the interwoven tangle of surface roots and rootlets of various herbaceous, exceptions, the soil consists of a compact fine sandy loam. should naturally represent its difficulties. Contrary to my expectation, however, I found the soil in close contact with the roots of Cryptophila p. and the interwoven tangle to be a clayey loam instead of sandy loam, fine-grained and sticky when moist, pulverulent when dry. Further investigations proved that this peculiarity* is a general feature and that the kind of soil is provided by extremely scant deposits not discernible in a general survey of the soil surface. Occasionally the roots are found growing in a mixture of clayey and sandy loam.

The season of the plant extends from the fall of the one to the summer of the next year, and is autumno-hyemal with reference to appearance of scapes and their full development, vernal with regard to anthesis, and aestival as to ripening of fruit. The earliest date recorded of scapes observed above ground is September 12th. This, however, like those cases where full-grown scapes were found in October or the early part of November are to be considered exceptions to the general rule. It is noteworthy, however, that the scapes of the colony of the variety Knapkei, discovered in March 1910 and under observation for some years, always appeared as early as the later part of September, while on the other hand, the first flowers always opened as late as the middle of April.

* The discovery of this soil-peculiarity at first led to wrong conclusions concerning the real habitat of the plant. Characteristic of the locality are, (or better were) small areas of the upland; shallow depressions with insufficient drainage and inundated during parts of the year. Here the soil is a similar clayey loam. As the areas are small there is no marked interruption in the general physiognomy of the xerophile upland forest. But the difference shown by the undergrowth is remarkable because, decidedly mesophile, or rather semipaludal. Since then experience proved that the xerophile forest is the true habitat of Cryptophila, and it has never been found in places like those just referred to, not even occasionally.
As a general rule scapes appear most frequently during the months of October-November, less frequently in December, and more rarely in September. The roots vegetate mainly about 1.5-2 cm. beneath the surface of the ground, and adventitious buds may be found at almost any time of the year. All parts of the plant are formed in the hypogaeus stage; scales and bracts reach more or less normal size but scapes and flower-buds become developed only to a certain extent; the flower-buds measure from 2-4 mm. at the time when the scapes emerge and are protected by the closely appressed bracts and bractlets. Scapes which appear above ground without having developed flower-buds in the hypogaeous stage do not, as far as observed, form such afterwards. The process of emergence requires a considerable space of time—from more than two to approximately five weeks. It is accomplished through the growth of the scape, much like many seedlings emerge i.e., the scape describing a semi-circle thereby lifting the inflorescence in a drooping manner, which position the inflorescence retains during the whole winter. The scapes grow slowly to about normal size while the flower buds become fairly developed—sepals more or less to full size, corolla to about two-thirds of the full length. The winter is then passed by the plant in apparent dormancy till March or the approach of April. The proper month for anthesis is April but early flowering plants may be found in bloom in late, or in rare cases, as early as the middle of March; while on the other hand, stragglers may flower as late as early May. The fruit ripens in July or early August.

_Cryptophila pudica_ is never found freely exposed to the open. It grows, flowers and fruits under a cover of leaves which is twofold in character. The lower bulk, 2.5 to approximately 5 cm. thick is dense and consists of well settled fallen leaves accumulated during several successive years, and gradually decayed towards the lower strata, which are in contact and pass into the scant humus. These lower strata are generally much interwoven by hyphae and are thus felt-like. The top cover is rather loose and consists mainly of fallen leaves shed during the previous season. The cover is an essential feature to the welfare of the plant. Without it, _Cryptophila_
pudica, depending on a season which extends over a period of from eight to eleven months, should have little chance to endure the severe changes of climatical conditions. The clayey instead of a sandy loam represents an additional protective factor against changes of meteorological conditions as it retains moisture more tenaciously. It is true, the amount of clayey deposits is too small to be effective under exposure but becomes so under the dense cover of leaves. While this cover is an essential factor to the general welfare of the plant it represents, on the other hand, an object of disadvantage in point of pollination, responsible for the fact that fruits are rarely produced. The pollen is shed in the bud upon the inner face of the corolla-lobes. Insects are attracted by the strong, not fragrant but aromatic odor. It strikingly resembles the odor of the Carophyllii aromatici (commonly known as cloves) and the oleum caryophyllorum (clove-oil) with a slight deviation in as much as it is not quite as pungent as that of the former, nor quite as mild as that of the latter. The spread of the odor is hardly perceptible except when the dense lower cover of leaves has become fissured and it is in this latter case that the strong insects are found actively engaged in forcing access to the hidden plant.

As the extent of the plant's season indicates, the plant is to pass the long period of the year above ground when temperature is low. The location of the station close to the 34° of latitude indicates that winters should not be considered severe in comparison to winters of more northern regions. On the other hand, the locality is freely exposed, being sheltered in no way by a mountain barrier against the influx of air currents. It may be said, in general, however, that if cold weather is continuous and lasting, night temperatures are rather even and the absolute minimum remains normally above 20 degrees. Otherwise it occasionally falls lower, even to 10 or still more rarely to 8 degrees. It has been proven during many years that all such temperatures are not harmful to the plant under its protective cover. A few instances are known where the floor-cover of certain areas had been removed and where afterwards plants have been discovered which were exposed to severe temperatures, probably even
10 degrees. Some of the plants had succumbed, others were not perceptibly injured; still, even of these, some died in course of time, the rest flowered in due season. Only in very exceptional instances does it occur that the temperature falls for a day or two below zero in this locality. As long as Cryptophila pudica was under observation such occurred only in 1918 and 1919. During both winters only a few groups were under observation or were discovered shortly after the cold waves. These were not injured at all and some of them, in time of anthesis, ranked among the finest specimens ever seen. The table below shows the absolute minimums for the months September to April with reference to the locality, which is taken from the official records of the U. S. Weather Bureau Station, located up to 1916 in Cullman, but since transferred to St. Bernard. Snow is of such rare occurrence and of such short duration that it is of no consequence as a factor in connection with the plant.
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The color range of *Cryptophila pudica* is rather wide. Reddish tints in all degrees of shade, from reddish-pink to brownish-red predominate, while bluish tints from light lavender to darker hues, delicate pink, white with only the bundles red or pink, which shine through the semi-transparent tissue of
scape, and pure white specimens are more rarely found. Frequently, scapes of lighter shades turn in course of time, into darker shades of red, while scales and bracts often, sooner or later, lose their succulent-waxy texture, becoming membranous, and fade to a grayish or yellowish brown. In such a state, especially in cases where numerous scales and the bracts are densely imbricated, the plant assumes an exsiccate appearance. This is to a great extent an individual character but it is frequently caused or furthered by meteorological factors, especially drought. The sepals retain the succulent character and original color longer, often till, or during time of anthesis, while the corolla, growing to fullness only shortly before the flowers expand, exhibits always a fine appearance as to color and texture in anthesis. Its tube is mostly of a slightly darker shade than the color of the plant in general and the lobes are white-margined. Individuals which in state of anthesis exhibit all their parts in the original freshness of color and texture represent beautiful specimens, especially those of lighter shades and the pure white ones. The surface of all parts has a slightly polished waxy lustre which adds to the fine appearance of the plant. The odor of the fresh flowers is that of cloves. In a specimen of peculiar beauty all the parts were of a light lavender, but the centers of the petals were dark blue or almost bluish-black, and contrasted strongly against the snow-white margin of the lobes. The plant finally becomes black with the exception of scales, bracts and sepals, in case these have changed color and texture beforehand, and the plant now assumes a disagreeable sour odor.

*Cryptophila pudica* may be considered a moderately rare plant with regard to its occurrence in this locality, although its hidden condition practically places it among the rarest plants. I must confess that neither I nor anyone else have ever come upon the plant under ordinary circumstances. It has been found only by way of raking the floor-cover of fallen leaves, which is a common practice among agriculturists of this region. As a result of such practice together with the felling of timber-trees, and partly of fires, the cover of leaves becomes too scant to provide effective shelter for the
plant. Furthermore, claims on forest lands for agricultural purposes and for pasturage are factors in reducing the habitat of this plant. Fires, frequent in former times, proved most destructive not only as to the scapes of the respective seasons, but also to the root-systems. Therefore, in the last few years very little material has come to my notice, generally only scant remains from formerly known habitats.

With reference to the relation of Cryptophila pudica towards other plants, viz., parasitism, I must state that in no case have I found roots of this plant connected with roots of any other plant.

EXPLANATION OF PLATES ON CRYPTOPHILA PUDICA.

PLATE I.

1. Group of large scapes, showing both extremes, a one-flowered scape at the right, a sixteen-flowered scape (x) somewhat to the left—1 1-6 natural size.

2. Same sixteen-flowered scape, front view, at upper right corner—natural size.

3. Fruit at upper left corner—natural size.

CRYPTOPHILA PUDICA.

PLATE II.

1. Scapes with roots about natural size.

2. Roots 1 1-4 natural size.

3. Part of a colony of Cryptophila pudica var Knapkei; natural size.

PLATE III.

Figure 1.—Flower-bud showing position of bractlets. x3.

Figure 2.—Bracts. x2.

Figure 3.—Sepal. x2.

Figure 4.—Corolla in bud-condition. x3.

Figure 5, 6, 7, 8.—Young stamens. x20.

Figure 9, 10.—Immature stamens. x20.
NOTES ON ALABAMA PLANTS

Figure 11, 12.—Sections of anthers, lengthwise. x10.
Figure 13.—Section of anther, transverse. x10.
Figure 14.—Mature stamen. x10.
Figure 15.—Dorsal face of anther showing the large pores. x10.
Figure 16.—Pistil with hypogynous disk. x8.
Figure 17.—Section of pistil, lengthwise. x8.
Figure 18, 19, 20, 21.—Sections of ovary, transverse; (18) at the base, (19) near the base, (20) below the middle, (21) slightly above the middle. x8.
Figure 22.—Seed. x25.

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BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.

WOODLAND TALES. By Ernest Thompson Seton. Doubleday, Page & Co. $2.00.

This new book of Mr. Seton's is addressed primarily to children of the ages of six to twelve years. But in the belief that the mother and father, or perhaps the campfire leader and scoutmaster, will act as leaders in the work, those chapters dealing with woodcraft are addressed to grown-ups.

The greater part of the book, however, consists of children's stories with a fable and fairy tale flavor. Their subjects, however, are plants and animals, and great care has been taken to make them both instructive and thoroughly accurate. The book is divided into sections, four dealing with the seasons, and seasonal aspects of biology, and two with nature games, woodcraft, etc. The whole reminds one of Mr. Seton's excellent nature manual, "Two Little Savages" in its wide scope and pleasing style, but is adapted to the use of smaller children than those who read the latter book. "Woodland Tales" may not make naturalists, but it will go far toward making nature students; in giving the child
an interest in plants, animals, and other phases of nature, that will last him for years to come.

C. L. F.

BRITAIN'S HERITAGE OF SCIENCE. By Arthur Schuster and Arthur F. Shipley. E. P. Dutton Co. $5.00.

This book is an attempt to present, within a moderate size volume, a general survey of the scientific history of the British Empire. It opens with a consideration of what the authors call the "ten landmarks of physical science"—great events such as the electrical discoveries of Faraday, and the founding of modern chemistry by Dalton. Each of the men who played important parts in the creation of these "landmarks" receives a brief but tolerably comprehensive biographical note.

The next section is devoted to a study of the scientific influences of the colleges and universities of the seventeenth and eighteenth centuries, followed by a similar study of non-academic centers of scientific research. The progress of the physical sciences during the nineteenth century is reviewed in some detail, as are also the many applications of sciences, and the various scientific institutions. The remainder of the book is devoted to the history of the more strictly "natural" sciences. These are botany, zoology, physiology, and geology, the science of anatomy being for some reason omitted. Each chapter is a more or less complete survey of one of the sciences named, and affords a concise and unusually comprehensive summary of its subject.

C. L. F.

STORY LIVES OF MEN OF SCIENCE. By F. J. Rowbotham. Stokes.

This volume seems to be a reprint of an early volume. The scientists treated are such well-known men as Galileo, Isaac Newton, Lamarck, Pasteur, and Darwin. The biographical sketches are well written, and, if one does not have a reliable encyclopedia at hand, are worth while as references. The illustrations are zinc etchings that have the appearance of having been made after woodcuts, and are very unsatisfactory.

C. L. F.
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J. A. NIEUWLAND, C. S. C., Ph. D., Sc. D., Editor

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Observation on the Rate of Growth of the Shell of Lake Dwelling
Fresh Water Mussels.

N. M. Grier, Ph. D.

I. — Introduction and Statement of Problem.

Nearly all our present knowledge of the rate of growth of fresh water mussels is confined to studies of the development of juvenile mussels through the period of infection by the glochidia upon the host fish to a time not exceeding six years thereafter, the rate of growth of the animal being most conveniently determined by the rate of growth in length of its shell. Portions of these studies having a direct bearing upon the subject of this paper are now cited.

Curtis and Le fevre, (14), indicate that juveniles of Lampsilis ventricosa first observed in the second year of free life, may nearly double in size by the close of the fourth year of growth. Coker, Shira, Clark and Howard, (2), reporting upon pond raised specimens of Lampsilis luteola remark that four additional growing seasons are required for such shells to double in length after the second growing season. Lampsilis gracilis, a thin shelled species, was found to increase in length at the rate of about 190% a year. They add that since these species are all mussels of river habitat, it can not be assumed that growth in ponds is representative of the rate of growth in a natural environment. They then record an experiment with principally thick shelled, (Quadraula), mussels, which were placed in a crate in the Misisissippi river for nearly one year. None of these mussels were over three inches in length, and after 10 months and 12 days had increased in length as follows: Q. eburneus, 3%; Q. pustulosa, 5%; Q. metanevra, 9%; Q. plicata, 8%; Q. undata,
24%. While granting that the conditions of the experiment were somewhat unfavorable to growth, an impression gained by these investigators was that thick shelled mussels, after they are half-grown, increased in size at the rate of 1/4 in. a year or less. In summary, they state that the rate of increase in length of fresh water mussels varies from 1/2-2 inches in "paper shells," (Lampsilis lacvissina), to 1/4 in. more or less in the "niggerhead," (Q. cbeuus), and related shells, while an intermediate rate of 3/4 in. or 1 in. per year characterizes the muckets and pocketbooks, (L. luteola and vepricosa), with a slightly more rapid rate for the yellow sand shell, (L. anodon- toides).

Isely, (10), made a notable experimental study of the growth and migration of fresh water mussels. He collected some hundreds of mussels of various species, and after properly marking them and making necessary records as to their weight and dimensions, he returned them to their usual environment, reclaiming specimens at intervals for further observation. For 12 specimens of Q. lachrymosa, undulata, pustulosa, rubiginosa, he finds an average per cent of aggregate gain of 13% in length, 121/2% in height, 14% in breadth. Other data set forth by him will be referred to in discussion of the individual species dealt with in this paper. Howard, (9), attacks the problem of the growth of fresh water mussels from a broad biological standpoint. The length of juveniles of L. luteola growing in a floating crate at the end of the first growing season was observed to be 128 times that of the original juvenile at the beginning of free life. Depending most probably upon the conditions of the season, by the end of the second summer, these juveniles were found to have increased from 212-475% in length. As previous investigators had found, he observed that maximum growth was not attainable under the best artificial conditions of culture. All these investigators agree that growth is most rapid in the juvenile period, decreases noticeably with age, in advanced years being almost imperceptible.

It has probably become evident to the reader that the methods devised for the culture and propagation of mussels are so recent that at the present time and for some subsequent period, they will be unable to throw any light upon the rate of growth of these animals in their later years. For this reason, I believe that certain data of mine will upon analysis with fair qualifications add to our knowledge
of the rate of growth of certain species, particularly for that period after the juvenile stages. Additionally, the present paper contributes further to a series of biometric studies of mussels in relation to their environment inaugurated by Ortmann, (16), continued by the writer, (3-8), and by Ball, (1), in a recent paper.

II.—List of Species and Source of Material Used.

The material studied consisted of juvenile and adult specimens of the following species, which are listed in conformance with the recent changes in the nomenclature of the Naiades sponsored by Ortmann and Walker, (17). The older name by which certain of them are known is indicated in parentheses.

1. Fusconaja flava parvula (Grier).
2. Amblema plicata (Say).
3. Pleurobema coccineum paupereulum (Simpson).
4. Elliptio dialatus sterkii (Grier).
5. Lasmigona (Symphynota) costata eriganensis (Grier).
6. Anodonta grandis footiana (Lea).
7. Leptodea (Paraptera) fragilis (Raf.).
8. Proptera alata (Say).
9. Anodontoides ferrussacianus subcylindranceus (Lea).
10. Ligumia (Lampsilis) recta (Lam.).
11. Lampsilis siliquoidea (Luteola) rosacea (DeKay).
12. Lampsilis ovata canadensis (Lea).

The species listed represent well defined varieties of the parent Upper Mississippi species, (3, 7). They were collected by Dr. A. E. Ortmann of the Carnegie Museum in Lake Erie over a number of years, (1903-07), for a study of this kind, and are now in the collection of the Museum. Most of them were obtained at Presque Isle Bay, but a smaller amount came from La Plaisance Bay and Cedar Point. I am indebted to Dr. Ortmann for the use of the material, as well as to the authorities of the Museum for the fullest use of its facilities.

III.—Physical Conditions and Type of Mussel Fauna.

The type of mussel fauna has already been admirably treated in papers by Walker, (18), and Ortmann, (15). These and the physical conditions concerned have already been discussed fully by the writer elsewhere, (7), the latter being ably given for Lake Erie by Jennings, (11). For sake of convenience, however, the outstanding points concerning the physical conditions are given in the following
contrasting columns, when the relation of the lake environment to this problem will eventually become clearer.

**LAKE ERIE**

Water colder than in Upper Ohio, with more even regulation of temperature. Currents much less rapid than in streams, water less agitated except by moderate currents carrying but little sediment. Bottom composed of pebbles, sand, or a mixture of these depending on region of lake, with coarser sediment derived from wear of land. Temperature conditions favor more uniform production of food, while the water contains more lime.

**UPPER OHIO DRAINAGE**

Water warmer than in L. Erie, greater extremes of temperature. Streams more rapid than currents of L. Erie and more greatly agitated, frequent falls and rapids, short stretches of quiet pools. Rivers carry a load of debris, moving quickly over the bottom, consisting of mud, glacial till, cobbles. Food conditions, (due to extremes of temperature), are less stable, even if at times, food is more abundant.

It may be noted here that Lake Erie varieties of shells as a whole possess brighter and clearer colors than their parent shells of the Upper Ohio and Upper Mississippi; are exceptionally polished, and otherwise characterized in distinction by their well developed lines of growth. It has also been suggested that certain depauperate qualities of these shells, such as their dwarfed condition and thinness, may be due to the chemical quality of the water, (5), the influence of brackish water upon fluviatile species being well known.

**IV. Method.**

A common method of estimating the age of a mussel has been to count the so-called rings or lines of growth. Studies by previously mentioned investigators, (10, 2), have shown that, under certain conditions such a procedure would yield an unreliable estimate of the animal’s age. For example, mussels living in rivers undoubtedly form a growth ring every winter, but what was not certainly known, was that a period of summer drought, or even temporary removal from the water, would cause a superficially similar reaction, and so far as estimating age was concerned yield misleading results.

As will be observed in the section dealing with physical conditions, not all bodies of water present the extreme conditions in relation to mussel life as those possessed by the rivers. Conditions are seen to be fairly uniform in Lake Erie, and such could be conceded to favor uniform conditions of growth. This being the case, the number of rings of growth on the shell could be reasonably conceived to represent the number of years the animal has lived.
Previously, this and other data had been gathered while making a study of the morphological characteristics of mussel shells inhabiting Lake Erie, (7), and there but remained the task for the present paper of regrouping the data chronologically, when percentages indicating the rate of growth based on the more commonly taken measurements of the shell—length, height, and inflation, as well as others not commonly made, could be calculated. A detailed description of the method of making these measurements is given in the paper cited, but for the convenience of the reader they are stated to consist of the following:

1. Length, \( L \).
2. Dorso-ventral diameter, (height), \( DVD \).
3. Dextro-sinistral diameter, \( DSD \), (breadth).
4. Distance anterior, \( AD \), and posterior, \( PD \), from \( DVD \), to extremities of valve, the sum giving the total antero-posterior dimension.
5. Distance anterior, \( AD \), and posterior, \( PD \), from \( DVD \), to extremities of valve, the sum giving the total antero-posterior dimension.
6. Distance anterior, \( AD \), and posterior, \( PD \), from \( DVD \), to extremities of valve, the sum giving the total antero-posterior dimension.
7. Distance anterior, \( AD \), and posterior, \( PD \), from \( DVD \), to extremities of valve, the sum giving the total antero-posterior dimension.
8. Thickness of valve just superior to the pallial line in the region beneath the umbo. The measurements and calculations made from them constitute the results.

V.—Results.

In the following tables, each species is first dealt with separately. The ages indicated were obtained by counting the lines of growth on each specimen. In the two columns to the left are indicated the number of specimens used for an estimated age. The remaining columns contain first, the mean of the measurements described above and expressed in centimeters for the youngest juvenile of the species available. The rest of the columns consists of the mean of the dimensions of juveniles and mature shells of succeeding ages expressed in percentages of the corresponding dimensions of the youngest juvenile. The comparisons, etc., following the tables of percentages for each species are based most largely on the average of these percentages for the probable number of years represented by the series of material of that species. At other times, however, conclusions taken are based upon direct inspection. All percentages expressed are an index to the amount of growth in a particular part of the shell for the time stated. Finally, for the convenience of both reader and writer in making a comparative study of the rate of growth in different species,
the important data for each species is summarized in the table on "Comparative Growth of Species Studied," following the individual discussion of species.

1. FUSCONAJA FLAVA PARUOLA

<table>
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<th>Spec.</th>
<th>Age</th>
<th>No.</th>
<th>L.</th>
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<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
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<tr>
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<td>2</td>
<td>1.7cm.</td>
<td>1.3cm.</td>
<td>.7cm.</td>
<td>1.3cm.</td>
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<td>.4cm.</td>
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<td>220%</td>
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<td>200%</td>
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<td>212%</td>
<td>500%</td>
<td>300%</td>
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</table>

Average growth per year in each dimension for 12 years, 143% 150% 209% 161% 110% 192% 116% 87%

Deductions from Table of Percentages and Remarks.

In this species, increase in the various dimensions of the shell is greatest in later years. The increase in DSD, PHL and L is the greatest, TH the least. AD and AHL increase uniformly. From years 8-11 inclusive, DVD, DSD, PD, PHL, and AHL increase more rapidly than from 4-7 inclusive. The increase in thickness is less marked in later years, while that of AD is also low.

The conditions under which Iseley, (10), did his work, probably prevented any attempt upon his part to estimate the age of the muscles used in his study. However, in the river form of this species, (Quadrula rubiginosa), he gives, (p. 10), the average yearly growth of 3 young specimens as an increase of 6.1% in length, 5.6% in height, 5.3% in breadth. From p. 11, an increase of 3% in these dimensions in two other specimens can be inferred, while 9.2% gain in length is deduced from the records of two additional specimens given on p. 12. It is unfortunate that none of the juveniles I had access to had quite reached the dimensions of the shells he used, but my results check with other investigators in that the rate of growth diminishes with age. Had it been possible to make a comparison on size alone, it would have been seriously discounted by the fact that lake dwelling shells are often depauperate. On the basis of the statement of authors cited, (2), that shells of the niggerhead and related species increase 1/4 in. more or less in a year, my averages indicate in con-
trast, that up to 12 years the increase is more like an inch for this species.

In a related form, Quadrula (Fusconaia) undata, the last investigators cited give 15.8 mm. as the length of a pond raised specimen at the close of the second year. This checks fairly well with my estimate of 2 year specimens of F. flava, as well as does the increase in two years of .44 in. which equals 11.17 mm.

2. AMBLEMA PLICATA

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec.</th>
<th>Age</th>
<th>L (cm)</th>
<th>DVD (cm)</th>
<th>DSD (cm)</th>
<th>PD (cm)</th>
<th>AD (cm)</th>
<th>PHL (cm)</th>
<th>AHL (cm)</th>
<th>TH (cm)</th>
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<td>295%</td>
<td>360%</td>
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<td>16</td>
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<td>352%</td>
<td>368%</td>
<td>436%</td>
<td>286%</td>
<td>429%</td>
<td>332%</td>
<td>421%</td>
<td>421%</td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 16 years,
166% 147% 142% 182% 104% 170% 125% 112%

Deductions from Table of Percentages and Remarks.

In this species, the dimensions of L, PD, and PHL increase most greatly with age. DVD and DSD increase at about the same rate. TH and AD show the least increase. Increase in size is continuous from year to year, but shells 14-15 years of age are as large as some older ones. From the ages 8-12, DVD and DSD increase more rapidly than in early years, as do also PD and PHL. While the increase in TH is relatively less, that in AHL is relatively more.

This species is most likely the one studied by Isely, (Quadrula undulata). In young specimens, (p. 10), he observed a gain of 21% in length, 20% in height, and 19% in breadth. In my specimens, the ones most corresponding with his in dimensions are aged 6, 8 and 9 years. My specimens for those years check up length 20%, height 22%, breadth, 1%. The small number of variants used might explain the greater discrepancy between these, or the fact that lake dwelling forms are usually smaller than river specimens, even earlier.
in life. Isley also records, (p. 11), the growth of other specimens of this shell, the smallest of which most closely corresponds to the oldest of my material. Here the rate of growth obtained in the 3 dimensions in order is 15%, 10%, 11%. Using the shell dimensions composing the means for 15 and 16 years, I obtain 11%, 12% and 14% which allowing for environment seems fairly close. Coker, Shira, Howard and Clark, (2), studied Quadrula plicata, a closely related species. They report it 13.5 mm. in length at the close of the second year as reared in a pond. This is nearly a mm. smaller than my youngest specimen of plicata. They, however, recognize the fact that conditions of pond life are apt to produce stunting effects. They record another specimen which increase 5.17 in. in 2 yrs., 3 mos., 2 weeks. I find a similar increase in my specimens of costata between the ages of 2 and 4.

I find I can select a series of variants which will exhibit very nearly the same percentage of yearly increase as Iseley's remaining data on Q. undulata, (p. 13). Isely found a specimen 48 mm. in length increased 13% in that dimension in one year; a 64 mm. specimen, 12%; a 70 mm. specimen, 107%; 72 mm., 108%; 82 mm., 103%. The ages of my material to which these correspond are 5, 9, 10, 10, and 14 years.

My results, as obtained by the method described, indicate that Isely's estimate of a yearly growth in length of from 5-25 mm. is somewhat conservative for one based on the smallest and youngest specimens. I find that by applying the average growth in length, it is at least 31 mm. in lake shells. Within the limits of my material, it seems probable that a length of 110-120 mm. could be reached at 15 years, as Isely found in the case of mussels from Shoofly Creek. Undoubtedly the environment is a very large factor in determining the rate of growth.

### 3. PLEUROBEMA COCCINEUM PAUPERCULUM

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
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</thead>
<tbody>
<tr>
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<td>5.84 cm.</td>
<td>4.47 cm.</td>
<td>2.85 cm.</td>
<td>4.8 cm.</td>
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<td>3.12 cm.</td>
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<td>103%</td>
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<tr>
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<td>10</td>
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<td>114%</td>
<td>160%</td>
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<td>104%</td>
<td>77%</td>
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</table>

Average growth per year in each dimension for 12 years. (oldest shell),
- L: 4.6% 2.5% 4% 61/4% 7 1/2% 6 1/4% 9 1/4%
- DVD: 6% 9% 15% 18% 15% 15% 22%

Average growth per year in each dimension for 5 years. (8-12 yrs. inclus.)
- L: 11% 6% 9% 15% 18% 15% 15% 22%
Deductions from Table of Percentages.

As the few shells of the series obtainable were quite old, it is difficult to come to any satisfactory conclusion concerning their rate of growth, and I have felt that the best insight is obtained by presenting the results as I have above. Within the limits of these observations, growth appears more rapid in the following dimensions, \( PD, AD, AHL, PHL, \) and \( TH \). It is relatively slower in \( L, DVD, DSD \). Specimens may be larger at 10 years than some others at 12 years. Increase in thickness is most marked. The rate of growth in \( PD, AD, AHL, PHL \), is nearly the same.

4. ELLIPTIO DILATATUS STERKII

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
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<td>2.09cm</td>
<td>1 cm</td>
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<td>.45cm</td>
<td>1 cm</td>
<td>.3 cm</td>
<td>.05cm</td>
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<tr>
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<td>123%</td>
<td>132%</td>
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<td>128%</td>
<td>113%</td>
<td>13%</td>
<td>15%</td>
<td>200%</td>
</tr>
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<td>433%</td>
<td>660%</td>
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<td>4</td>
<td>12</td>
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<td>374%</td>
<td>556%</td>
<td>407%</td>
<td>322%</td>
<td>440%</td>
<td>533%</td>
<td>600%</td>
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</table>

Average growth per year in each dimension for 12 years:

\[ \begin{align*}
& 144\% \\
& 160\% \\
& 219\% \\
& 156\% \\
& 108\% \\
& 172\% \\
& 179\% \\
& 85\% 
\end{align*} \]

Deductions from Table of Percentages and Remarks.

The greatest increase in the dimensions of this shell during the period indicated are to be found in \( DSD, PHL, AHL, \) and \( Th \). Growth appears to be continuous through the years. \( PD \) and \( DVD \) increase at practically the same rate, while the increase in thickness is relatively large. Some of the shells are as large at 11 years as others are at 12. The rate of growth appears to be more rapid between the years 9-12 than years 4-8. This increase is not as well marked in \( AD \) as in other dimensions.

Authors cited, (2), record a growth of 4.3 mm. for a medium sized specimen, \( Unio gibbosus \), in a crate anchored in the Mississippi river in a period a little over 2 years, 3 month, (p. 127). This amount of growth, which is a yearly average of 2.2 mm., is found in my specimens between the ages of 4-5, 8-9, 9-10, 11-12.
5. LASMIGONA COSTATA ERIGANENSIS.

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH.</th>
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<td>7.41cm. 4.05cm. 2.59cm. 5.50cm. 1.9cm. 3.62cm. 1.7cm. 2.1cm.</td>
<td>101%</td>
<td>105%</td>
<td>106%</td>
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<td>109%</td>
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<td>117%</td>
<td>111%</td>
<td>124%</td>
<td>91%</td>
<td>100%</td>
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</tbody>
</table>

Average growth per year in each dimension for 10 years. (oldest shell),

- 4% 5% 4% 4.4% 1.6% 4% 9.2% 7.6%

Average growth per year in each dimension for 5 years. (6-10 yrs. inclus.)

- 10% 12.5% 9.2% 11% 4% 10% 23% 19%

Deductions from Table of Percentages.

As the few shells of the series obtainable are somewhat advanced, it is not easy to draw satisfactory conclusions concerning their rate of growth. However, DVD, PHL and TH increase most rapidly, the large increase in AHL is probably accidental. Increase in thickness is not so well marked.

6. ANODONTA GRANDIS FOOTIANA

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH.</th>
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<td>5.27cm. 3.27cm. 2.24cm. 3. 6cm. 1.65cm. 2. 3cm. 1. 3cm. 1.4cm.</td>
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<td>127%</td>
<td>143%</td>
<td>144%</td>
<td>140%</td>
<td>130%</td>
<td>138%</td>
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<td>196%</td>
<td>168%</td>
<td>184%</td>
<td>160%</td>
<td>128%</td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 9 years. (oldest shell),

- 34% 29% 32% 39% 27% 31% 28% 16%

Average growth per year in each dimension for 5 years. (5-9 inclus.),

- 61% 53% 57% 70% 48% 56% 50% 28%

Deductions from Table of Percentages and Remarks.

The greatest increase in the years represented is in the dimensions of PD, DSD, PHL. The latter appears to enlarge uniformly. It is noted that shells may be as large at 6 years as at 9; the relative increase in thickness is apparently small. Isely, (10, p. 15), made studies of the parent species A. grandis. The nearest specimen to his I studied and no larger one, was aged 9 years. It showed an increase of 3% in length, 20% in height, and 47% in breadth over the average for 8 year specimens, against 4%, 3.2% and 6.7% in Isely’s specimens. The tremendous increase in inflation is undoubtedly due to the lake environment, the greater height of my specimen seems to be that of an unusual variant, since the height Isely gives may be obtained in my material by selection of the variants.
7. LEPTODEA (PARAPTERA) FRAGILIS.

No.  Spec. Age  L   D V D   D S D  P D   A D   P H L   A H L   T H.
1  3   4.44cm. 3.14cm. 1.44cm. .3cm. 1.1cm. 2.2cm. 1.2cm. .9cm.
2  4   125%  114%  131%  125%  145%  118%  110%  128%
2  5   220%  202%  218%  252%  201%  222%  170%  166%
4  6   203%  195%  216%  220%  218%  222%  175%  144%
4  7   208%  227%  230%  233%  213%  216%  176%  177%
4  8   201%  196%  203%  215%  223%  221%  170%  188%
4  9   191%  189%  148%  213%  190%  192%  157%  155%
4 12   290%  256%  262%  316%  309%  325%  250%  244%

Average growth per year in each dimension for 12 years.
61%  57%  59%  73%  67%  68%  42%  42%

DEDUCTIONS FROM TABLE OF PERCENTAGES AND REMARKS.

Growth increase appears most rapid in PD, AD, and PHL; least in AHL, TH. Increase is at the same rate in L, D’V’D, DSD, while according to this data, growth is greatest at 12 years, increasing steadily up to this period. D’V’D, AD, PHL and TH apparently grow the most rapidly in the years 7-9, inclusive. PD, however, increases most rapidly years 4-6 inclusive.

Two related species, Lampsilis gracilis and Lampsilis laevissima, have been observed by authors cited, (2). They found the first named of these species to increase 190% in length in one year. By my data, such a specimen would be between 11-12 years. The second is cited as one of the "paper shells," increasing 1/2 to 2 in. per year, (12.7 to 50.80 mm.), in length. The latter represents in its lower ranges the amount of increase found among my shells.

8. PROPTERA ALATA

No.  Spec. Age  L   D V D   D S D  P D   A D   P H L   A H L   T H.
1  2   1.28cm. .85cm. .35cm. .85cm. .33cm. .55cm. .45cm. .05cm.
1  3   112%  120%  120%  117%  121%  136%  78%  140%
1  5   105%  105%  105%  105%  136%  118%  180%  90%
1  6   257%  320%  328%  241%  379%  309%  363%  120%
1  7   201%  247%  240%  202%  267%  245%  133%  100%
1  8   371%  461%  554%  417%  369%  481%  255%  220%
1  9   384%  473%  520%  423%  363%  473%  233%  240%
1 10   511%  623%  780%  541%  560%  563%  493%  480%
1 12   703%  854%  1017%  764%  757%  927%  377%  700%
1 13   668%  755%  871%  741%  681%  836%  365%  600%
1 14   523%  600%  745%  568%  576%  636%  300%  400%
1 15   859%  854%  1128%  930%  1072%  1178%  471%  880%
1 16   750%  820%  911%  823%  785%  909%  377%  500%
1 20   812%  840%  1148%  930%  757%  1054%  400%  640%
1 22   788%  794%  837%  811%  694%  863%  366%  480%

Average growth per year in each dimension for 22 years.
260%  294%  364%  282%  280%  324%  129%  190%
Deductions from Table of Percentages.

The greatest increase of any of these dimensions is seen to be in DSD and PHL. While an increase is noted throughout the years, it is nearly uniform in PD, AD, and DVD, and rather large in TH. Growth is most rapid between 12-16 years, when it is especially noticeable in L, DVD, TH, DSD; less so in AHL.

9. ANODONTOIDES FERRUSSACIANUS SUBCYLINDRACEOUS

No.

<table>
<thead>
<tr>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4.78cm.</td>
<td>3.1cm.</td>
<td>1.65cm.</td>
<td>3.67cm.</td>
<td>1.1cm.</td>
<td>2.02cm.</td>
<td>.93cm.</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>111%</td>
<td>115%</td>
<td>121%</td>
<td>111%</td>
<td>112%</td>
<td>124%</td>
<td>113%</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>128%</td>
<td>99%</td>
<td>136%</td>
<td>135%</td>
<td>134%</td>
<td>133%</td>
<td>134%</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>140%</td>
<td>108%</td>
<td>149%</td>
<td>150%</td>
<td>138%</td>
<td>154%</td>
<td>136%</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>145%</td>
<td>113%</td>
<td>147%</td>
<td>148%</td>
<td>140%</td>
<td>163%</td>
<td>146%</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>151%</td>
<td>119%</td>
<td>163%</td>
<td>141%</td>
<td>172%</td>
<td>123%</td>
<td>200%</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>162%</td>
<td>121%</td>
<td>180%</td>
<td>150%</td>
<td>200%</td>
<td>148%</td>
<td>155%</td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 9 years,

26%  8%  33%  26%  33%  27%  32%  39%

Deductions from Table of Percentages.

Increase with age is most marked in DSD, AD, TH and AHL. All dimensions grow more rapidly between 6-9 years than between 3-6. Increase in height, DVD, is little; growth of L, PD, PHL is uniform, that of thickness, rapid. This shell is one which is rarely found in large rivers.

10. LIGUMIA, (LAMPSILISP RECTA.)

No.

<table>
<thead>
<tr>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>6.1cm.</td>
<td>2.3cm.</td>
<td>1.45cm.</td>
<td>4.8cm.</td>
<td>1.13cm.</td>
<td>3.1cm.</td>
<td>85cm.</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>155%</td>
<td>200%</td>
<td>170%</td>
<td>150%</td>
<td>185%</td>
<td>180%</td>
<td>167%</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>146%</td>
<td>166%</td>
<td>168%</td>
<td>141%</td>
<td>172%</td>
<td>150%</td>
<td>188%</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>146%</td>
<td>167%</td>
<td>165%</td>
<td>141%</td>
<td>184%</td>
<td>150%</td>
<td>176%</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>178%</td>
<td>193%</td>
<td>190%</td>
<td>182%</td>
<td>185%</td>
<td>201%</td>
<td>188%</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>191%</td>
<td>191%</td>
<td>213%</td>
<td>191%</td>
<td>222%</td>
<td>235%</td>
<td>200%</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>148%</td>
<td>153%</td>
<td>182%</td>
<td>145%</td>
<td>177%</td>
<td>170%</td>
<td>170%</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>182%</td>
<td>169%</td>
<td>211%</td>
<td>186%</td>
<td>195%</td>
<td>191%</td>
<td>190%</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>155%</td>
<td>211%</td>
<td>209%</td>
<td>185%</td>
<td>146%</td>
<td>229%</td>
<td>192%</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>170%</td>
<td>174%</td>
<td>200%</td>
<td>176%</td>
<td>160%</td>
<td>190%</td>
<td>153%</td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 18 years,

57%  72%  81%  59%  74%  79%  72%  106%

Deductions from Table of Percentages and Remarks.

Within the limits of the ages represented, it seems clear that DVD, DSD, PD, PHL, and AHL increase most rapidly with age. The rate is greater in TH; L and AD have apparently the same rate of growth, while the remaining dimensions, with the exception of TH,
grow largely at the same rate. It is observed that some specimens are as large at 14 as at 18 years.

The preceding observations are based largely on the averages, but a comparison of from age to age of the above percentages indicates that DSD increases steadily throughout, as well, as PHL and PD: AD seems to relatively diminish with the years, while in later ones, PD, DVD, and DSD tend to increase relatively more rapidly than the length. The rate of growth of the hinge lines is approximately the same. Certain specimens reach a maximum growth earlier than others.

Of the 19 species of Unionidae studied by authors cited, (2), the greatest growth for a period a little over 2 years, 3 months, was observed in a medium sized example of this species. The gain in that period was 44.7 mm. in one specimen alone, a yearly average of 2.23 cm. Referring to my data, I find even a greater growth between the ages of 9-10, 11-12, 15-16.

11. LAMPSILIS (LUTEOLA) SILIQUOIDEA ROSACEA.

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec.</th>
<th>Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>104%</td>
<td>102%</td>
<td>108%</td>
<td>130%</td>
<td>119%</td>
<td>115%</td>
<td>112%</td>
<td>130%</td>
<td>112%</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>106%</td>
<td>112%</td>
<td>116%</td>
<td>121%</td>
<td>113%</td>
<td>115%</td>
<td>112%</td>
<td>120%</td>
<td>130%</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>121%</td>
<td>118%</td>
<td>121%</td>
<td>113%</td>
<td>115%</td>
<td>112%</td>
<td>120%</td>
<td>120%</td>
<td>120%</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>125%</td>
<td>131%</td>
<td>136%</td>
<td>139%</td>
<td>132%</td>
<td>128%</td>
<td>126%</td>
<td>130%</td>
<td>120%</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>135%</td>
<td>140%</td>
<td>146%</td>
<td>149%</td>
<td>143%</td>
<td>137%</td>
<td>134%</td>
<td>136%</td>
<td>130%</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>143%</td>
<td>148%</td>
<td>151%</td>
<td>155%</td>
<td>150%</td>
<td>144%</td>
<td>139%</td>
<td>136%</td>
<td>130%</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>155%</td>
<td>160%</td>
<td>165%</td>
<td>169%</td>
<td>164%</td>
<td>158%</td>
<td>153%</td>
<td>149%</td>
<td>145%</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>167%</td>
<td>172%</td>
<td>176%</td>
<td>180%</td>
<td>175%</td>
<td>169%</td>
<td>164%</td>
<td>160%</td>
<td>156%</td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>175%</td>
<td>180%</td>
<td>187%</td>
<td>191%</td>
<td>185%</td>
<td>180%</td>
<td>175%</td>
<td>171%</td>
<td>167%</td>
</tr>
<tr>
<td>10</td>
<td>17</td>
<td>184%</td>
<td>189%</td>
<td>194%</td>
<td>198%</td>
<td>193%</td>
<td>187%</td>
<td>182%</td>
<td>178%</td>
<td>174%</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>192%</td>
<td>197%</td>
<td>202%</td>
<td>206%</td>
<td>201%</td>
<td>195%</td>
<td>190%</td>
<td>186%</td>
<td>183%</td>
</tr>
<tr>
<td>12</td>
<td>19</td>
<td>200%</td>
<td>205%</td>
<td>210%</td>
<td>215%</td>
<td>210%</td>
<td>205%</td>
<td>200%</td>
<td>196%</td>
<td>193%</td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 19 years:

26%  25%  42%  32%  21%  41%  40%  54%

Deductions from Table of Percentages and Remarks.

Throughout the life of the animal, as illustrated in the above series, growth is most rapid in DSD, PD, PHL, AHL and in TH. Specimens may be as large at 17 years as at 19. Thickness exhibits the most outstanding increase. According to these results, the shell grows somewhat more rapidly after twelve years than in the six preceding ones, the thickness nearly doubling. L, DVD, DSD grow largely at the same rate.

This species of mussel is of considerable commercial importance,
and its rate of growth has been studied in greater detail than in any other mussel. Coker, Shira, Howard and Clark, (2), record its growth as follows, p. 126.

<table>
<thead>
<tr>
<th>Age</th>
<th>Length</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>43.4mm.</td>
<td>158%</td>
</tr>
<tr>
<td>3</td>
<td>68.8mm.</td>
<td>177%</td>
</tr>
<tr>
<td>4</td>
<td>77 mm.</td>
<td>180%</td>
</tr>
<tr>
<td>5</td>
<td>80.6mm.</td>
<td>180%</td>
</tr>
<tr>
<td>6</td>
<td>84.9</td>
<td>170%</td>
</tr>
</tbody>
</table>

Howard, (9), p. 70, records even a greater average increase in length from mussels reared in a floating crate—209%. My youngest L. Erie specimen was 6 years old and had a length of 51.2 mm. against 84.6 mm. for those from the Upper Mississippi River. However, it is well known that the lake forms of this species, as will be taken up in detail later, are unusually depauperate when compared with those from the Mississippi. The average rate of growth calculated from their data is 62%, while between the years 6 and 7, I record a minimum of 82%.

12. LAMPSILIS OVATA CANADENSIS

<table>
<thead>
<tr>
<th>No.</th>
<th>Spec. Age</th>
<th>L</th>
<th>DVD</th>
<th>DSD</th>
<th>PD</th>
<th>AD</th>
<th>PHL</th>
<th>AHL</th>
<th>TH.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>7</td>
<td>1.9cm</td>
<td>1.29cm</td>
<td>0.74cm</td>
<td>1.28cm</td>
<td>1.22cm</td>
<td>.67cm</td>
<td>.42cm</td>
<td>.12cm</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>272%</td>
<td>339%</td>
<td>400%</td>
<td>336%</td>
<td>164%</td>
<td>400%</td>
<td>352%</td>
<td>183%</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>317%</td>
<td>360%</td>
<td>480%</td>
<td>479%</td>
<td>155%</td>
<td>388%</td>
<td>326%</td>
<td>208%</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>340%</td>
<td>372%</td>
<td>425%</td>
<td>343%</td>
<td>152%</td>
<td>417%</td>
<td>262%</td>
<td>191%</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>350%</td>
<td>400%</td>
<td>423%</td>
<td>365%</td>
<td>170%</td>
<td>440%</td>
<td>356%</td>
<td>250%</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>423%</td>
<td>460%</td>
<td>509%</td>
<td>453%</td>
<td>190%</td>
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<td>373%</td>
<td>291%</td>
</tr>
<tr>
<td>13</td>
<td>378%</td>
<td>460%</td>
<td>509%</td>
<td>453%</td>
<td>190%</td>
<td>552%</td>
<td>373%</td>
<td>291%</td>
<td></td>
</tr>
<tr>
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<td>520%</td>
<td>453%</td>
<td>173%</td>
<td>522%</td>
<td>380%</td>
<td>308%</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>452%</td>
<td>482%</td>
<td>573%</td>
<td>484%</td>
<td>178%</td>
<td>609%</td>
<td>440%</td>
<td>333%</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>460%</td>
<td>509%</td>
<td>556%</td>
<td>476%</td>
<td>212%</td>
<td>606%</td>
<td>440%</td>
<td>308%</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>503%</td>
<td>527%</td>
<td>635%</td>
<td>541%</td>
<td>210%</td>
<td>716%</td>
<td>416%</td>
<td>350%</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>515%</td>
<td>529%</td>
<td>623%</td>
<td>586%</td>
<td>188%</td>
<td>619%</td>
<td>511%</td>
<td>366%</td>
<td></td>
</tr>
</tbody>
</table>

Average growth per year in each dimension for 19 years, 186% 206% 249% 210% 47% 256% 187% 106%

Deductions from Table of Percentages and Remarks.

The average increase is most marked in the dimensions of DVD, DSD, PD, PHL, growth in AD being less. Growth appears to be somewhat irregular, some specimens being larger at an early age than others. TH increases consistently with age, and the rate of growth of DSD, TH, and PHL is most similar. Growth appears to be greater in years. (7-11). than in later ones, (12-16). During the latter period, however, growth in thickness is most rapid, PHL markedly more, AD, L, and AHL relatively less.
Coker, Shira, Howard and Clark, (2), report that this species attained a length of 41-47 mm. in two growing seasons, 65 mm. by August of the third growing season. Specimens 45-47 mm. in length, evidently in the second year of free life, were measured and planted in the Mississippi river by Lefevre and Curtis. When recovered by the former authors, they had attained a length of 81-85 mm. None of my specimens were so large at 4 years, the nearest corresponding being at 7-8 years, while the nearest specimen attaining a length of 81-85 mm. were between 12-13 years of age. Here again the environment may exercise a deterrent effect upon growth. The average increase in length of the specimens described by these authors—90%—is far lower than the one I have derived.

**Table of Averages Indicating Comparative Growth of Species Studied.**

<table>
<thead>
<tr>
<th>Species Studied</th>
<th>Total shells examined</th>
<th>No. years basis of average length</th>
<th>Average increase in dimensions per year, mm.</th>
<th>Average yearly increase in dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>DVD</td>
</tr>
<tr>
<td>Fusconaia flavus parvula</td>
<td>34</td>
<td>12</td>
<td>5 mm</td>
<td>143%</td>
</tr>
<tr>
<td>Amblema plicata costata</td>
<td>45</td>
<td>16</td>
<td>8.3 mm</td>
<td>166%</td>
</tr>
<tr>
<td>Pleuro, coccin, paucipulculum</td>
<td>10</td>
<td>12</td>
<td>2.7 mm</td>
<td>4.6%</td>
</tr>
<tr>
<td>Elliptio dilatatus sterkii</td>
<td>28</td>
<td>12</td>
<td>7.1 mm</td>
<td>144%</td>
</tr>
<tr>
<td>Lasmingon costata eriganensis</td>
<td>10</td>
<td>10</td>
<td>3.1 mm</td>
<td>4%</td>
</tr>
<tr>
<td>Anodonta grandis footiana</td>
<td>14</td>
<td>9</td>
<td>8.7 mm</td>
<td>34%</td>
</tr>
<tr>
<td>Leptodea fragilis</td>
<td>22</td>
<td>12</td>
<td>10.1 mm</td>
<td>61%</td>
</tr>
<tr>
<td>Proptera alata</td>
<td>19</td>
<td>22</td>
<td>7.9 mm</td>
<td>260%</td>
</tr>
<tr>
<td>Anodontoides ferox. subcil.</td>
<td>17</td>
<td>9</td>
<td>8.2 mm</td>
<td>26%</td>
</tr>
<tr>
<td>Ligumia reta</td>
<td>13</td>
<td>18</td>
<td>6.3 mm</td>
<td>57%</td>
</tr>
<tr>
<td>Lampelis siliquoides rosacea</td>
<td>35</td>
<td>19</td>
<td>5.7 mm</td>
<td>26%</td>
</tr>
<tr>
<td>Lampelis ouata condensis</td>
<td>40</td>
<td>19</td>
<td>5.4 mm</td>
<td>186%</td>
</tr>
</tbody>
</table>

The following is evident from the preceding table as to the average growth per year in the different groups of mussels, with regard to the dimension of length:

Hard shell, slow growing Quadrula mussels,
(species 1, 2, 4) ........................................... 6.8 mm. or .27 in.

Paper or thin shell, rapid growing mussels,
(species 6, 7, 9) ........................................... 9 mm. or .36 in.

Intermediate or Lamellina group mussels,
(species 8, 10, 11, 12) ................................ 8.2 mm. or .33 in.

The numbers of shells in the series representing Pleurobema and Lasmingona, were too small to be taken into consideration in this comparison. Comparing with the data cited from Coker, Shira,
Howard and Clark, (2), it is evident that my data checks only with their observations for the Quadrulas, the average of growth for the remaining groups being considerably less.

VI.—Correlations.

From the tables of percentages calculated for each species, the following correlations may be derived as to the growth of the different regions of the juvenile shell:

1. Greater degree of inflation. DSD is associated with less dorsal ventral diameter. (D'ID), (height), in all the species.

2. In all but three species, (to which there are exceptions), there is a greater degree of inflation. (DSD), associated with greater posterior development of the shell, PD. The exceptions are Pleurobema, Ligumia, and Anodontoides.

3. In all but three species, (to which there are exceptions greater PD is associated with greater PHL.

4. Greater DSD, PD, PHL and less D'ID are associated with less TH in all species excepting Pleurobema, Elliptio, Lasmigona, Anodontoides, Ligumia, and Lampsilis siliquoides.

5. These correlations of growth in juvenile shells are found to be very similar to those obtained from measurements of adult shells, (7, P. 173).

VII.—Conclusions.

In addition to the data already presented as to the rate of growth in the different species, we may add the following conclusions to be derived, viz.:

1. Fresh water mussels dwelling in lakes, like their river relatives, grow most rapidly in the earlier years of their lives, and the process of growth slows down considerably with advanced age. It must be remembered in this connection that none of the shells reported upon had reached an extreme old age.

2. The rate of growth is highly variable, even in mussels of the same species.

3. With the possible exception of the mussels of the Quadrula group, lake dwelling mussels as a rule grow more slowly than those from rivers, at least with regard to the dimension of length.

4. The growth of juvenile shells of the species discussed exhibit mostly the same correlation in growth of parts as do the adult shells.
VIII.—Suggestions as to Causes of Facts.

Allusion has been continually made to the depauperate quality of many lake shells, so for the most part the results as obtained in the "paper" and Lampsilinæ groups of shells are those which would have been expected. In a previous paper, (5), I have been able to show that the thickness of shell of mussel species from L. Erie is negatively correlated with the percentage of calcium carbonate in the water, whereas in the Upper Ohio River Drainage, a positive correlation exists. L. Erie water, besides containing more calcium carbonate, contains greater quantities of other alkaline substances. The substances mentioned appear to act in such a way as to prevent less absorption of calcium carbonate by the L. Erie shells than by those of the Upper Ohio; as a consequence the L. Erie shells are thinner.

It has also been previously stated that a convenient index to the rate of growth of a mussel lies in the rate of growth of its shell. Although length has been the common dimension by which the rate of growth has been estimated, and while thickness of the shell is the characteristic which may be associated with the amount of calcium carbonate in the water, it seems plausible to assume that the inorganic salts in L. Erie water may through favoring the development of a thinner shell, cause a corresponding inhibition of the development of other parts of the shell architecture, the reaction of the mussel being to maintain the "biological balance" of the different parts. This seems best illustrated with the results of the Quadrulæ in L. Erie. They are always slow growers, and develop a thick shell. However, in L. Erie they have a thinner shells, so if growth in length is in pace with that of the shell, it seems to be at the expense of thickness. Under this combination of circumstances, the shell may take from the water, just what it needs in the way of lime—a point which is in accord with our knowledge of the absorption of inorganic salts by living shells.

An interesting example in connection is that of Lampsilis, (luteola) siliquoidea which in Lake Erie develops into a thin and dwarfed shell. Yet in Lake Pepin, an expansion of the Mississippi river in southern Minnesota, which possibly presents all lake characteristics cited for L. Erie, except the high mineral content of the water, this species reaches its maximum size and development.
With regard to the exceptions in the general trend of the correlations as presented for certain species, the cases of Pleurobema and Lasmigona are difficult to comment upon on account of the small amount of material. Nor am I able to add anything for the other species furnishings exceptions to the general trend of correlations beyond suggestions presented in another paper, (7, p. 174), beyond stating the results may have been occasioned by unusual variants.

The fact that juvenile shells exhibit mostly the same correlations as adult shells may indicate that the lines along which they develop are largely predetermined. Predetermination in this case, however might indicate a sufficiently rigid uniformity of environmental conditions to guide the shells in their development along the lines of their ancestors, or the inherent nature of the mussel protoplasm itself.

IX.—Possible Sources of Error.

It is true that in the experiments dealing with mussel culture I have cited, that all the shells were subjected to identical environmental conditions, which in itself probably insures a greater uniformity of results for the types of environment studied. A small amount of the material needed to obtain as complete a series as possible came from other localities in L. Erie besides Presque Isle, the source of most of it. There need be raised on this account no serious objection as from the aspect of environmental effects upon shells, the broad idea of the lake environment being more important in the present discussion than that of any separate effects of the smaller localities involved in it. If anything, it is more probable that greater balance has been given the calculations on account of some of the material being from different localities.

Undoubtedly the results would be more satisfactory to some, if it had been possible to compare equal numbers of shells in all cases, but the results obtained have so fitted in with what was previously known of the growth process in these animals, that it is felt no serious objection can thereby be interposed.

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*Correction*:—The table of absolute minimum temperatures of the last issue (Vol. VIII, Nos. 4, 5, July-September, 1922), gives 17 degrees above zero for January, 1918, and 11 degrees above for January, 1919. Both of these should read "below zero," or minus 17 and minus 11. See page 123.
Euglena Viridis (Ehrenberg.)

By Sister M. Ellen.

This flagellate was found in unusual abundance early in January, 1921, in a little spring-fed creek which remained open all winter. This creek is the watering trough for cattle and other farm animals and the water is more or less polluted as seems to be the characteristic condition under which Euglena viridis grows in abundance. About the middle of January, it was observed that the bottom of this creek was completely lined with the rather gelatinous, green masses of Euglena cells. This condition continued all winter and, at the suggestion of Dr. Bert Cunningham, the following investigations were made:

**Test of Evolving Gas**

On April 12, much inflated masses of the Euglena cells were floating on the surface of the water. A quantity of the material was collected and a test of the evolving gas proved it to be oxygen. Masses of the material, especially after they had stood in the laboratory for a few hours, invariably emitted a decidedly 'fishy' odor. Such an odor is mentioned by Butschli in describing E. sanguinea.

**Tests for Chlorophyll**

After a quantity of the material had stood for several hours in a large stender dish exposed to the light, the thick, green, oily layer of Euglena cells was poured off and allowed to filter, the cells remaining on the filter paper. The filter paper was then transferred to a beaker of methyl alcohol which was heated to the boiling point over a water bath. In order to check the results of the test another alcoholic extraction was prepared in the same way from fresh parsley leaves. After the extraction from the Euglena cells was complete, the green liquid was put through a filter, leaving the cells on the filter paper. These, when examined under the microscope, showed practically none of
their original color, but were intact and but little shrunken by this treatment. The separation of the pigments of the chlorophyll extractions, both of the Euglena cells and of the parsley leaves was done by adding to about 20 c. c. of each of the extracts the same amount of benzine. The vials were then shaken vigorously and their contents allowed to stand until the pigments separated. The yellow alcoholic layer and the blue-green benzine layer were identical in the two extracts. The fluorescence, too, both of the chlorophyll solutions and of the cyanophyll-benzine layers were the same in the Euglena and the parsley extractions. Tests for the effect of sunlight and of darkness on both extracts gave corresponding results.

Some of the Euglena cells were boiled in water for a minute or so. No pigment of any kind discolored the water and the cells themselves, when examined under the microscope, showed no color change and but little distortion or shrinkage. It was observed, however, in the cells subjected to this treatment, that the flagella were made quite prominent.

Cultures

Such media as tap water,* creek water, (filtered and unfiltered) Marschal's solution, Byrenck's solution, very dilute solutions of cane sugar, prune juice, egg white, egg yolk, whole egg, and milk, all tried in darkness and in light under the same conditions of temperature, gave results, that is, motility, growth, and reproduction, incomparably better in the light than in the darkness. The best results obtained from the inorganic nutrients, creek water, and tap water, in moderate light. These results were all about equally good. The second best results were in the organic nutrients in the light. The cultures which ranked as a distant third were those in the organic nutrients in the dark. In these, a comparatively few cells divided longitudinally after a few days, but there was little motility. The chloroplasts in these cells, in general, did not disintegrate any more rapidly than did the cells themselves. A very few motile cells showed a number of non-green plastids.

Among the hindrances in the cultural work, are the numerous protozoan forms which thrive in the cultures about equally well in light and darkness such as species of Paramoecium, Vorticella, Stylonychia,

*This is deep well water which, on chemical analysis, yields calcium, iron, magnesium, the hydroxyl, sulphate, and carbonate radicals, and a trace of chlorine.
Dileptus, Amoeba, etc. Numerous Rotifera, too, together with the protozoa, decrease the cultures by feeding on the Euglena cells. Protozoa as well as bacteria were ripe in the organic nutrients but not in the inorganic nutrients nor in the creek water and tap water.

While the encysted cells are still alive, the water mould, Polyphagus Euglenae grows rapidly in the cultures, especially so in the unfiltered creek water. The growth and decline of this mould are an index on the condition of the encysted Euglena cells. Thus, it declines in the cultures in the darkness sooner than in the light. It was observed that, like some of the other water moulds such as Saprolegnia, the zoospores of Polyphagus Euglenae swarm only in the morning.

Reproduction

Reproduction in the successful cultures begins about the second or the third day and, at first, there is only longitudinal division, the parent cells coming to rest at night, and the daughter cells separating in the morning. As the cultures (in light) advance, many of the cells encyst and there arises from each encystment, four, eight, and even sixteen cells; four being the most common number. There are many eight-celled encystments but relatively few sixteen-celled groups.

Summary

1. The discharge of oxygen gas from masses of Euglena cells in the sunlight indicates the process of photosynthesis.
2. The green plastids of Euglena viridis are chlorophyll-bearing.
3. Euglena viridis does not thrive in the dark and it, therefore, must depend, at least very largely, upon photosynthesis for its nutrition. There is an indication, however, that Euglena viridis does make use of organic nutrients to a very slight degree, in the fact that it seems to be a little more successful in such media when in the dark than in inorganic nutrients. This may be accounted for in part, however, by the fact that the protozoa and other enemies of Euglena are less dependent upon it in organic media than they are in the inorganic media.
4. Reproduction in Euglena viridis, as observed in this study, is by longitudinal fission of resting cells, and by the division of encysted cells into four, eight, or even sixteen cells.

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Evidences of a Differential Death Rate of the Sexes Among Animals.

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(From the Zoological Laboratory of the Johns Hopkins University.*)

I.—INTRODUCTION.

It has long been known by actuaries and statisticians that in the human species the death-rate of males is greater than that of females. This is true not only for deaths occurring after birth, but also for prenatal deaths.

Long before the time of DARWIN (1871) attention had been called to the fact that males greatly outnumbered females in stillbirths. An overwhelming mass of statistical data gives evidence of this phenomenon. Thus, (to cite some older and some newer work) it may be noted that for the decade 1865-1875 in the various countries of Europe, where reliable statistics are to be had on this point, the proportionate numbers of male stillbirths to female stillbirths was very high. In France, during this decade, the index-number for males was 144 (as compared with 100 for females) while in Italy, Belgium, Sweden, and Prussia, the index numbers were 140, 135, 133, and 129, respectively. In 1895 the index-number for males in Berlin was 137; in Hamburg, in 1896, it was 125. In fine, all available data on this point evidence this relation in the proportionate death-rates of the sexes before birth. It would appear rather clearly indicated that the unborn male human infant is less viable than the female.

The post-natal mortality of the males, also, is higher than

*With hearty acknowledgments to Professor S. O. MAST, for direction, criticism, and help.
that of the females. (Darwin, 1871; Pearson, 1897; Newsholme, 1899; Webb, 1911; Yule, 1911; Whipple, 1919, et al.) To illustrate: in England and Wales during the period 1901-1905, the death-rate ¹ for males was 53.8 per M. as compared with 44.9 per M. for the females. These rates were calculated for the total population under five years of age. In the urban districts the statistics showed death-rates for children under five years of 61.0 and 51.3 per M. for male and females, respectively. In the rural districts the corresponding death-rates were 40.1 and 32.2 per M. for males and females, respectively. In this body of data, only in the age-group of 5-15 years did the death-rate of females exceed that of males. (Webb, 1911; cf. Newsholme, 1899, p. 117.)

Bills of mortality from city boards of health and registry-offices in all civilized countries show a considerably greater expectation of life for women. (See, e. g., Abridged Life Tables for States and Cities of the United States, 1920 (1922). The higher death-rate thus implied for adult males has generally been attributed to the "greater hardships and dangers" of a man's work. However, in such an attempted explanation the fact is lost sight of that this marked vital discrepancy between the adult sexes finds its counterpart in the diverse rates of infant mortality. Tatham (1897) in his English Life Table shows that of 1,000,000 infants of each sex born, 161,036 males and 131,126 females die in the first year (a death-rate for the males of 161.0 per M. as compared with 131.1 per M. for the females.) It will thus be seen that the males had a death-rate 122.8% of the female death-rate. For Germany, the Statistisches Jahrbuch für das deutsche Reich, 1914, (Bd. 35, pp. 30-31) in a general mortality table for the decade 1901-1910, gives data showing the same relation. The mortality per M. (exclusive of still-births) for infants under one year was 202.3 for males and 170.4 for females—a male death-rate 118.0% of that of the females. ²

Newsholme (1899, p. 125) has called attention to the fact that in infants under one year of age the rates of deaths due to debility, atrophy, and inanition show a differential death-rate of the sexes. (Males, 25.1 per M.; females, 20.3 per M. Such a differential death-rate in infancy cannot be explained
on the basis of "greater hardship and danger" of the males. It would seem, rather, to be due to a general lack of resistance, both to disease and to harmful environmental factors.

Whipple (1919, p. 228) has stated the general facts for man in the following words:

"In infancy the death-rate for males exceeds that for females by 20%. Between 5 and 25 years of age the differences vary considerably in successive years, but average about 10%. Above age 25 the male death-rate begins to exceed the female death-rate by considerable amounts, and this continues to the age of 40, when the excess is 35%. After that, it steadily decreases. In old age, the two rates are much alike."

II.—SEX-RATIOS AND DEATH-RATES IN FISHES.

In fishes, the proportions of the sexes are often reported as very unequal. This has been particularly true in recent years in reports on the Poeciliidae, or top-minnows. In other families of fishes, also, divergences from the typical, or approximately 1:1 ratio of the sexes in the higher animals have been noted. We are indebted largely to Darwin (1871) and Fulton (1890, 1892, 1903) for what little we know of the sex-ratios of fishes.

The reasons for the paucity of literature on the sex-ratios of fishes is not far to seek. In sharp contrast with most mammals, among the lower vertebrates the sexes are indistinguishable at birth. Often a long period elapses before the young fish has developed secondary characters indicative of the sex of the individual. As a consequence the investigator of the sex-ratios of fishes has usually contented himself with study in groups of adult fish. No account was taken of juvenile mortality. The connotation of the term "sex-ratio" then has been "sex-ratio of collection."

In nearly all reported sex-ratios of fishes the populations involved were not under experimental conditions. It is therefore clear that the ratios are complicated by unknown factors. Most of these ratios varied markedly from the "typical sex-ratio" in which the sexes are practically equal in number. Different habitats of the sexes, or differential migration to the spawning ground, or sex-peculiarities of behavior at the
time of spawning:—all these have been suggested in explanation of atypical sex-ratios found in catches of adult fish. If we disregard for a moment these factors, there are two alternative explanations that appear *a priori* most probable: (a) a possible differential death-rate of the sexes during the juvenile and adult period, and (b) an atypical distribution of sex-determining chromosomes during the maturation divisions of the germ-cells. As a result of such an unequal distribution of sex-chromosomes, a preponderance of one sex over another could be conceivably be produced. For simplicity's sake we exclude here from consideration possible causation of atypical sex-ratios through the operation of a differential chance-of-fertilization of the two kinds of gametes in fertilization.

Cytological investigation of maturation-divisions of the germ-cells of bony fishes has failed to throw light on their chromosomal constitutions; genetic study of the Poeciliids *Aplocheilus latipes* (AIDA, 1921) and *Lebistes reticulatus* has, however, demonstrated them to be of the XX, XY type.

A corollary of this finding would be the practical numerical equality of the sexes at birth (assuming no differential chance-of-fertilization or differential mortality of gametes.) This corollary has been established for a number of species of fishes: cytological examination of the gonads of litters of certain fishes (*Cymatogaster*, EIGENMANN, 1896; *Spinax*, PUNNETT, 1904; and *Gambusia*, Geiser, 1922) have shown the proportions of the sexes at birth to be practically equal. It remains to be ascertained whether in fishes as a group, the sexes are not nearly equal in numbers at birth, the atypical ratios later found being due to the operation of a differential death-rate.

While ransacking the voluminous literature of the fishes the present writer found recorded numerous data which appear to indicate in fishes a differential death-rate of the sexes similar to that found in man. As much of this evidence is published in out-of-the-way places, or in serials not readily accessible, it has seemed well to bring it together in a general paper. Together with this evidence for a differential mortality in the fishes, the writer has also found in the literature strong indications that the same thing holds for other animals,
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*E.g.*, crustacea, insects, and other mammals besides man. In the following pages the evidence for the existence of such a differential death-rate is presented.

a). The Plaice, *Pleuronectes platessa* L.

In the common plaice, which occurs abundantly over a wide distribution on the shores of western Europe, a considerable number of workers have gathered data which demonstrate the operation of a differential death-rate of the sexes. Fulton (1902, p. 356) first called attention to the fact that while in population taken as a whole, the sexes are practically equal (a conclusion drawn much more cogently from larger masses of data by Hefford, 1909, Atkinson, 1908, *et al.*) nevertheless with older populations marked discrepancies from the typical sex-ratio occur, due to the "slower growth and earlier death of the males." Petersen, Garstang & Kyle (1907, Table LXVI) showed by age-frequency tabulations of German and English investigations (the condition of the otoliths being the criteria of age) that the proportions of males to females progressively decrease with age. Wallace (1907) independently arrived at the same conclusion respecting the plaice of the southern North Sea. Atkinson (1908) found the same general age-frequency relation in plaice from an unfished area, the Barents Sea, thereby disposing of the objection that this relation is due only to an "artificial" factor, *i.e.*, trawling and fishing in the North Sea. He concludes that "it is probable that the rapid diminution in numbers and final disappearance of males" in the age-groups is "accentuated by an earlier mortality of that sex." Thus, while in the 4511 young plaice which he measured and studied the males were nearly as numerous as the females (males, 47%; females, 53%) in the older fish 50-plus m. long the proportions were: male, 2-minus %; females, 98-plus %.

Hefford (1909, 1916) and Wallace (1914) have shown with a large mass of carefully analyzed data the same relation. The work of Hefford (1909) is especially thorough-going, and its implications clear. This writer made a statistical analysis of the records of measurements of plaice caught in the period of 1903-1907 by the various international re-
search vessels, in order to ascertain to what extent seasonal variations occurred in the proportions of males and females caught in various parts of the North Sea. The total number of plaice studied was 179,118; of these, 89,945 were males and 89,173 were females. The percentages in the different length-groups (5-cm. increment) ranged from 55% males, 45% females, for the youngest fish, to 8% males, 92% females, for the oldest fish. WALLACE (1914, p. 79) showed for different areas that while for the average populations investigated in different areas of the North Sea during the year 1906-1909 the males were usually almost as abundant as the females (ca. 45% males), nevertheless, after the sixth, and particularly, the seventh, year of life, practically all the individuals were females (ca. 80%-100% females.)

b.) The Canadian Plaice, Hippoglossoides platessoides Fabr.

HUNTSMAN (1918) finds evidence to show in this fish that for the first two or three years of life there are more males than females, but that the older the fish become, the smaller is the relative number of males, until finally, females alone are found among the oldest fish. In the Gulf of St. Lawrence, where there are fish of many different ages, he found the males more numerous than the females among the three-year-olds, but for the later years fewer and fewer males, until finally after an age of 14-24 years (with the single exception of the 21-year-old group) only females were found. He concludes that "there must surely be a higher death-rate among the females in early life, and among the males later, and this is not influenced by the temperature, as similar proportions of the two sexes for the various years of life are found both where there is rapid growth and early maturity in warm water, and also where there is slow growth and late maturity in cold water."

c). The Witch, Pleuronectes cynoglossus L.

FULTON (1904), p. 195) has called attention to the abundance of males among populations of young witches, while among the older populations the proportions were reversed.
Thus, among 2748 young, mostly 10 to 13 inches long, 915 were females and 1833 were males (66% males) while with a group of 422 fish 34 to 50-plus cm. long, 306 were females and 116 were males (27% males.)

d). The Salmon, *Salmo salar* L.

*Masterman* (1913) made a study of the salmon with especial reference to age-determination by study of the scales. He found that the male sex predominated numerically in the early years and (*Masterman, 1913a*) that this predominance is lost in the higher age groups, and is replaced by that of the females.

*Menzies* (1916) has also shown a lower percentage of males with increase in age. Thus, in a group of 1294 yearlings, the sex-ratio was 100 females to 71 males, while in a group of 347 two-year-olds, the ratio has been reduced to 100 females to 43 males. *Menzies'* (1921) data also, though somewhat confusing, bear out his earlier conclusion. He found that in the salmon of Thurso Bay, about one-third of the total catch were males. The different age-groups, however, varied considerably. Thus, among the "grilse" (1-plus years) group the average percentage of males for the whole season was 57, while for the "small summer fish" (2-plus years) group there was an average percentage of males of only 21.

e). The Smelt, *Osmerus eperlanus* L.

*Masterman* (1913a) by the dissection and study of 217 fish ascertained that in this species the males predominated in numbers in early years: a predominance that is lost in the higher age-groups and is replaced by that of females. Thus, the oldest and largest fish were found to be females. From this he concluded that the probability of life is less in the male than in the female sex.

f). The Dogfish, *Spinax niger*.

*Punnett* (1904, p. 321) by the microscopical examination of the gonads of 308 dogfish embryos found the sexes to be approximately equal in numbers at birth. (This conclusion is strengthened by the fact that in the three different years—
1901-3—in which embryos were collected, the proportions of males to females were respectively 35:39, 48:46 and 66:74.) However, in adult populations, the females are very much in the majority, being twice as numerous as the males. He concluded, consequently, that the post-natal mortality is greater among the males than among the females—a conclusion which was pointed independently by a statistical treatment of the meristic variations.

PUNNETT's study suggests that a differential death-rate of the sexes may be responsible for the low percentages of males found in certain rays, as reported by FULTON (1903.)

**g.) The Top-Minnow, Gambusia holbrooki Grd.**

GEISER (1921) showed a greater death-rate among the males in shipments of top-minnows. This obtained in both cold weather and warm weather shipments. Thus, in cold weather the male death-rate was one and one-half times the female death-rate; in warm weather, it was two and one-half times the female death-rate. The same writer (GEISER, 1922) has also noted that, the proportions of the sexes of this fish at birth are practically equal. Adult populations, on the other hand, show a great preponderance of females, thus indicating a higher male death-rate after birth. Further experimental studies yet unpublished, demonstrate a differential death-rate of the sexes when diverse harmful substances are added to the environment.

**III.—EVIDENCES FROM OTHER GROUPS OF ANIMALS.**

The writer has not been able to ransack the literature of other groups in a thoroughgoing fashion. There have, however, a number of pieces of work and observation appeared which appear to indicate unmistakably the operation of a lethal selection such as has been shown so well in the fishes. These will be briefly referred to in the subsequent paragraphs.

a.) **Mammals other than Man.** JEWELL (1921) in his study of foetal cattle found a differential death-rate of the sexes similar to that found in man, and in fishes.

b.) **Crustacea.** PUNNETT. (1904a) has noted that in the Shore-Crab, Carcinus moenas, the males are less viable than
the females. More recently BLEGVAD (1922) has shown in
the Amphipod Gammarus locusta, and in the Schizopods Mysis
clexuosa, M. neglecta, and M. inermis, the same sex relation.
c.) Insecta. Dr. ELEANOR CAROTHERS has found among
Orthoptera that while the sexes are produced in practically
equal proportions, the ratio of the sexes in adult populations
often varies considerably, due to the lesser viability of the
males. When the insects are attacked by disease or by fungus-
infestation, they are the males who suffer most severely.
PHIL & NELLIE R AU (1914) have also shown that in the
Polyphemus moth, the male is much shorter-lived than the
female. It is only fair to say, however, that they do not find
this relation universal among the Lepidoptera. Thus, in the
Ceeropia moth, the male is found to live as long or even a
little longer than the female. It has been suggested by ento-
omologists, however, that a great many of the insects show
a difference of longevity of the sexes, in favor of the female.

IV.—CONCLUSIONS.

From the foregoing, it appears conclusively to the writer
that in many diverse groups of animals a lesser viability of
the males is indicated. What this may be due to, remains to
be ascertained by future investigation. It appears, however,
that this differential death-rate cannot be due to deleterious
influences in the environment to which the two sexes are
unequally subjected, but is merely the expression of a greater
stability, or survival-value, in the female of animals generally.

1 Average annual death-rates for the 0-5 year period.
2 Glover in his United States Life Tables (U. S. Bur. Census, 1921) has in his
Tables 75 and 76 given data on the differential mortality of the sexes during the first
year of life in all countries registering births and deaths. His data show death-rates
for males averaging 120% that of the females.
3 Occam's Razor will exclude the suggestive hypothesis put forward by Huxley, in
the December, 1920, number of the Journal of Eocology to account for reported abnormal
sex-ratios in Lebistes, a poecililid Teleost.
4 These very conclusive demonstrations are to be found in a paper by Schmidt, 1920,
in the Comptes-Rendus des Travaux du Laboratoire Carlsberg, 14me volume, No. 8, and
in the more extensive paper by Tatzo Aida, cited in the literature. Since this paper
was written, Wingz (Jour. Genetics, Vol. XII, No. 2, Oct. 1922) has demonstrated
cytologically the XX, Xy constitution of Lebistes, and greatly extended the genetical
studies of Schmidt.
5 Personal communicaton from Miss Carothers.
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An Amateur Wild Flower Bed.

O. A. STEVENS, FARGO, NORTH DAKOTA.

The present is a brief account not of what can be done with wild flowers, but of what has happened with just ordinary treatment and ordinary neglect. The work was begun in the spring of 1917. The space used is a trapezoid with one end oblique, 5½ feet wide, 12 and 9 feet long on the inner and outer sides respectively. It occupies a corner at the north end of an east porch, partially protected by the corner of the house and bounded on the outer side by a cement walk which goes to the side door.

The Fargo soil is a black alluvial clay which is very sticky when wet and becomes hard and lumpy when dry. The lighter colored subsoil is still more sticky and quite intractable where basement excavating has left it to form a part of the lawn or garden. The house had been rebuilt the preceding year, and the soil of the bed in question contained a small amount of subsoil in the surface and more or less debris of building. A few pieces of decaying wood brought from the woods were put in the ground at the start. Some years it has had a covering of leaves raked upon it in the fall, in others only what might naturally accumulate. Usually there is a good covering of snow during winter but the outer edge next to the walk is somewhat windswept. The plants have suffered more or less from children jumping off the porch rail upon them and from other natural accidents.

The plants will be enumerated under three heads: (1) Those intentionally introduced, (2) those unintentionally but artificially introduced, and (3) those naturally introduced. I have put off writing the account and neglected to keep notes in the meantime so that some of the details have been lost. The sharp angle at the front is occupied by a small Spiraea and a Cornus sanguinea was put at the other end against the house. The latter has not been very successful, as it grows too large for the space and is inclined to become scraggly and to droop over the bed. It is usually infested with aphids which attract warblers and vireos during their spring migrations.
Unless otherwise stated the plants have been brought from the nearby woods of the river. A few from the prairie were put in the outermost corner.

I. PLANTS INTENTIONALLY INTRODUCED.

1. *Mattencia struthiopteris*. Ostrich Fern. This was the first plant introduced, three or four large crowns being brought from the woods before the frost was entirely out of the ground. Such good specimens were expected to produce handsome plants but no amount of watching could detect signs of growth. After some time plants appeared at one side of the old crowns. Gray's Manual states that "the underground stolons bear fronds the next year" but does not indicate the length of life of the crown. These stolons are peculiar, the scale of the node appearing as if a knife cut had been made about an inch long and midway through the stem. Two or three small plants transplanted the last of May showed little ill effect.

2. *Uvularia grandiflora*. LARGE BELLWORT. A large clump of this was transplanted the last of May when flowering was nearly past. It has done well and is a valuable addition to the collection.

3. *Uvularia sessilifolia*. SMALL BELLWORT. One lot of this was brought in but I believe the plants have not survived after the first year or two.

4. *Trillium cernuum*. NODDING WAKE ROBIN. These seem to have grown fairly well but have been in only a couple years.

5. *Erythronium albidum*. WHITE ADDER'S TONGUE. Bulbs from northeastern Kansas were planted in the fall of 1918. The plants have come up each spring but have not made a very good growth. No flowers have been produced.

6. *Vagnera stellata*. STAR-FLOWERED SOLOMON'S SEAL. This was brought in one spring but I do not remember whether it is alive yet or not.

7. *Anemone quinquefolia*. WIND FLOWER. Two attempts were made to transplant this but it has not become established.

8. *Aquilegia canadensis*. COLUMBINE. This was brought
in at the same time as the Large Bellwort and again by accident with the small ostrich ferns. Previous experience had shown that this plant takes kindly to the flower bed and is one of our most valuable wild flowers for cultivation. It can be depended upon to attract humming birds.

9. *Actaea rubra*. BANE-BERRY. A large red fruited plant was moved in the fall and has grown well.

10. *Caulophyllum thalictroides*. BLUE COHOSH. This was introduced in spring and has been fairly successful. The flowers are inconspicuous but the meadow-rue like foliage is rather pretty and the peculiar blue seeds are interesting.

11. *Sanguinaria canadensis*. BLOODROOT. Two introductions in flowering stages, neither one successful. Fresh seeds were collected and sown in 1921 but no results are available at the present time. A nice bed of the plants used to be in front of the east porch of a house not far away.

12. *Sieversia ciliatum*. TORCH FLOWER. Some sods of this were brought from the prairie the first year and placed in the outermost corner. The plants grew fairly well the first two or three years, but later seem to be dying out.

13. *Lathyrus venosus*. BUSHY VETCH. One introduction by the roots. Did not establish itself. This should make a good plant for some places, but is rather coarse for a small bed. The flowers are quite large and are borne in large clusters.

14. *Viola rugulosa*. What shall this plant be called now that it is regarded as distinct from *V. canadensis*? Of all the native violets this is the only one which has survived under the conditions and it has been exceedingly successful, increasing to a considerable extent although occupying part of the most exposed side of the bed.

15. *Viola pubescens*. YELLOW VIOLET. Planted next to the preceding but did not survive.

16. *Viola papilionacea*. BLUE VIOLET. I was surprised to see that this also failed to appear the next year. It is possible that the edge of the bed was more exposed than usual that winter. Neither this nor the yellow one have had a second trial.

17. *Viola sororia*. Hairy Violet. A few plants of this
also were brought in but failed to reappear the next season.

18. *Viola conspersa*. This grows only in the aspen woods in the edge of the trees just beyond the low wet openings. One good sized plant was transplanted in 1922 when in full flower and continued to blossom as if unaffected by the change. I believe that another plant had been brought in a previous year but did not survive or at least reappear the next season.

19. *Viola pedatifida*. **PRAIRIE VIOLET.** A number of plants of this handsome species were placed near the Sieversia, and like it have declined slowly, perhaps due to attempts to weed out some undesirable plants among them.

20. *Steironema ciliatmn*. **FRINGED LOOSESTRIFE.** I have admired this flower ever since I first became acquainted with it. A good sod nearby a foot square was brought in early in the spring. When the stalks were about four inches high something broke them off and the plant seemed discouraged for the year, much to my disappointment. The next spring I was surprised to see it coming up a yard or more from the original place. However, it does not seem inclined to make a dense stand and so far has not been considered a weed. The past summer it was noticeable that all the stalks were in the outer half of the bed. It was originally planted next to the porch on account of its height.

21. *Hydrophyllum virginicum*. **WATERLEAF.** This handsome plant is one of our commonest woodland flowers. The illustration and description in "Wild Flowers of New York," and in "Nature's Garden," seem not to do justice to it, as the flowers are more often of a much deeper color, reminding one of *Geranium maculatum*. They do not last well, however, soon becoming rather ragged in appearance. My experience is that they are a failure as cut flowers as they seem to refuse to freshen. Two pieces of sod were brought in early spring. The plants have succeeded and have produced seedlings freely. Some came also by accident with Steironema.

22. *Lithospermum canescens*. **HOARY PUCCOON.** One plant of this was brought in during the flowering season. It was dug none too carefully as the root is deep. The top wilted
and new growth soon appeared but did not come the next year.

23. *Spiraea salicifolia*. MEADOW SWEET. A good sized piece of this was introduced in early spring, not in the bed but along the front of the porch. In its natural condition the little thickets of the plant seem quite pretty, but as a shrub it was not a success, due to the short life of the branches which gave it a ragged appearance most of the time. It was dug out after two or three years.

24. *Rosa blanda*. SMOOTH WILD ROSE. Whatever may be its proper name this is our common woodland rose of the eastern part of the state. It is tall and has practically no prickles on the upper branches although the new shoots from the roots are well covered with them. Two plants were transplanted in early spring to the front side of the porch. In spite of an attempt to dig them carefully the large roots came up with few branches and no dirt. The first year the bushes made very little growth, but did much better the second season. One of them has become entirely too tall, being now about seven feet high. Two new shoots from the roots have reached a height of seven feet the past summer. The bushes have not shown much inclination to spread from the roots until the past summer when new stems came up a yard or more from the original plants. The leaves have been infested badly with leaf miners, and this has detracted from the appearance of the plants.

II. PLANTS UNINTENTIONALLY INTRODUCED.

25. *Agropyron smithii*. WESTERN WHEATGRASS. This was in the *Sieversia* sods. The grass much resembles quack grass but is not so persistent in fields, although it often causes trouble among groves of trees. In the flower bed it began to spread to a considerable extent. The second attempt at removing it seemed to be successful, but it also may have been responsible for the decline of *Sieversia* and *Viola pedatifida*.

26. *Agropyron richardsonii*. BEARDED WHEATGRASS. A plant or two came in the same way as the preceding species.
27. *Carex sp.* **SEDAE.** An unidentified species, also with the *Sieversia.*

28. *Salomonia commutata.* **SOLOMON'S SEAL.** I do not remember for certain but believe this came with *Hydrophyllum.* One or two stalks have come up and persisted.

29. *Menispermum canadense.* **MOONSEED.** I think this was brought with the ostrich fern roots. If given more room it should make a good addition to such a collection.

30. *Thalictrum dioicum.* **EARLY MEADOW RUE.** This came with the *Spiraea.* It is worth growing if a suitable place is available.

31. *Thalictrum dasycarpum.* **TALL MEADOW RUE.** This came with the *Steironema.* It has thrived and keeps to its place next the porch.

32. *Anemone cylindrica.* **COTTON WEED.** This came in the *Sieversia* sods. It has persisted but has not made much growth nor proven of value.

33. *Ribes americanum.* **WILD BLACK CURRANT.** This apparently came with the ostrich fern. It has persisted but has not made very much growth so far.

34. *Vicia americana.* **WILD VETCH.** Introduced with the *Spiraea.* The plant is distinctly ornamental and worthy of consideration.

35. *Falcata comosa.* **HOG PEANUT.** Seeds of this were introduced with some woodland plant, probably *Hydrophyllum.* At first it seemed a valuable addition, as the foliage is pretty and the flowers somewhat ornamental. By the third year it had become so abundant that it quite overran the bed and the following season an attempt was made to eradicate it. The seeds are close to the surface and come up with the plant if it is pulled soon after it begins to grow. Reproduction has been at least chiefly from the subterranean fruits. The plants were much less numerous the past season and another year ought to complete its eradication, but it has required considerable time and labor. The leaves were used the past summer by a leaf cutter bee, those of no other species in the bed being cut so far as observed.

36. *Zizia aurea.* **MEADOW PARSNIP.** This came with the Large Bellwort and at once sprung up to such a height that
it overshadowed everything in its vicinity. It was dug out rather roughly and removed to a more exposed place at the northwest corner where it continues to grow but not with its original exuberance. To be "consistent" I should call this species "woodland meadow-parsnip." With us it grows abundantly in the woods or around their margins, in thickets and openings but not so much in the open away from the woods. *Zizia cordata* is a plant of the low places on the open prairie.

37. *Solidago serotina*. TALL SMOOTH GOLDENROD. This came perhaps with *Hydrophyllum*. It very soon attempted to take complete possession and was the first species to be taken to task for its pertinacity. The rootstocks were close to the surface and eradication was not difficult.

38. *Aster paniculatus*. TALL WHITE ASTER. This was a running mate of the preceding, but its roots were deeper and not easily pulled up. The plant is decidedly weedy in low ground in the fields.

III. PLANTS INTRODUCED BY NATURAL MEANS.

39. *Chaetochloa glauca*. YELLOW PIGEONGRASS. An occasional plant but it does not thrive under such conditions.

40. *Ulmus americana*. WHITE ELM. This may be called a weed of gardens and flower beds where the young plants spring up from seeds blown from trees of streets and yards.

41. *Kochia scoparia*. BURNING BUSH. Some of these came the past year probably from seeds scattered from plants with which the children were playing the preceding fall.

42. *Alsine media*. CHICKWEED. This makes itself quite at home as usual in shaded places.

43. *Bursa bursa-pastoris*. SHEPHERD'S PURSE. A few plants of this common weed.

44. *Potentilla monspeliensis*. ROUGH CINQUEFOIL. An occasional plant.

45. *Prunus virginiana*. CHOKECHERRY. One plant which probably came from seeds of fruits brought from the woods.

46. *Oxalis cymosa*. SMOOTH YELLOW SORREL. A few plants of this are usually present.
47. *Acer negundo*. **BOX ELDER.** This may be called one of the principal weeds of flower beds and backyard gardens. The trees have been planted extensively on account of their rapid growth. They seed freely and the young plants come up in great numbers in the nearby flower beds and gardens. The seedlings are produced more freely than those of the elm but are not so firmly rooted and more easily pulled out.


51. *Arctium minus*. **BURDOCK.** One seeding appeared the past summer. I often have thought that this plant has an unusually effective method of seed dispersal. The hooked bracts cling with unsurpassed tenacity, allowing the akenes to be shaken out at intervals. The dense bristles between the akenes probably act as a preventative of too rapid shattering and the marked tendency of the heads to remain in bunches would have a similar effect. I have found my shoe strings to be a favorite riding place and this plant may have arrived thus. However, the weed is not infrequent about the streets and some other carrier may have been host to that particular seed.

52. *Lactuca scariola integrata*. **PRICKLY LETTUCE.** Occasional.

53. *Taraxacum officinale*. **DANDELION.** No weed list of our locality would be complete without this plant. It has been one of the less important in the flower bed, however.
Birds of Watertown, Wisconsin.

BY BROTHER ALPHONSUS, C. S. C.

My vacation in the summer of 1922 was spent at Watertown, Wisconsin; where I arrived on August 8th and remained until September 7th. This town of about nine thousand people is some forty miles southeast of Madison, the capital of the state. Watertown, which is situated in the fertile Rock River Valley, I found to be a favorable locality for bird study. In all I obtained ninety-one records, the largest number I have ever got at that particular season of the year. In fact, I doubt whether I have ever secured, even in Spring, more satisfactory results from my observations.

Starting out every afternoon at 1:15 p. m. and remaining until 5 p. m., I found this time of day equally as good for observation as the morning. In one respect I think the early afternoon was better than the morning, for then there was a clearer light in the tree-tops, which made it easier to see the warblers. My list of warblers for this season of the year, I think, was remarkably large—twenty in all.

I confined my observations chiefly to two places—a wood with undergrowth and a small stream bordered by willows. Both localities proved very fruitful, but the grove gave me most of the warblers. Among the rare species were the following: Lark Sparrow, Yellow-throated Vireo, Acadian Fly-catcher, Blue Gray Gnatcatcher, Prothonatory Warbler, Black-billed Cuckoo, Blue-winged Warbler, and Titlark. The Lark Sparrow I had not seen in Indiana for many years. The Yellow-throated Vireo is rare also in northern Indiana. The Acadian Fly-catcher, a species of this family that is seldom seen, was very common in the grove I visited in Wisconsin. The Blue Gray Gnatcatcher was observed on two days in different localities. The Prothonatory Warbler was observed once. The Black-billed Cuckoo was perhaps more abundant than the Yellow-billed. The Lincoln Sparrow, in small numbers, was seen on two days. The Blue-winged Warbler was also found twice. The Rusty Black-bird, always very rare, was located near the stream on two days. The Golden-winged Warbler and a small flock of Titlarks were seen once.
The following is my bird list obtained in Watertown, Wisconsin:

MONTH OF AUGUST, 1922.

August 8, 1922.
1. Bobolink.
2. Crow.
3. Flicker.
4. Goldfinch.
5. Rose-breasted Grosbeak.
10. White-breasted Nuthatch.
12. Wood Pewee.
13. Robin.
15. Field Sparrow.
17. Savanna Sparrow.
18. Song Sparrow.
20. Barn Swallow.
22. Yellow Warbler.
23. Cedar Waxwing.
24. Hairy Woodpecker.
27. Mourning Dove.
28. Indigo Bird.
29. Spotted Sandpiper.

August 9, 1922.
31. Purple Martin.
32. Rough-winged Swallow.
34. Bronzed Grackle.

August 10, 1922.
35. Downy Woodpecker.
36. Little Green Heron.
37. Bluebird.
38. Catbird.
39. Chickadee.
40. Cowbird.
41. Crested Flycatcher.
42. Red-eyed Vireo.
43. Towhee.
44. Phoebe.

August 11, 1922.
45. Brown Thrasher.

August 13, 1922.
46. Warbling Vireo.
47. Bank Swallow.
48. Lark Sparrow.

August 14, 1922.
49. Yellow-throated Vireo.

August 16, 1922.
50. Acadian Flycatcher.
51. Bob-white.
52. Canadian Warbler.

August 17, 1922.
53. Blackburnian Warbler.
55. Black and White Warbler.
56. Tennessee Warbler.
57. Hummingbird.
58. Yellow-billed Cuckoo.
59. Maryland Yellowthroat.

August 18, 1922.
60. Red-shouldered Hawk.
61. Redstart.
62. Nighthawk.

August 19, 1922.
63. Pine Warbler.
64. Scarlet Tanager.

August 20, 1922.
65. Adler Flycatcher.
66. Water Thrush.
67. Long-billed Marsh Wren.
August 21, 1922.
68. Blue Gray Gnatcatcher.

August 22, 1922.
69. Wilson Warbler.

August 23, 1922.
70. Black-throated Green Warbler.
71. Nashville Warbler.
72. Magnolia Warbler.

August 24, 1922.
73. Tufted Titmouse.

August 26, 1922.
74. Bittern.

August 27, 1922.
75. Prothonary Warbler.
76. Least Flycatcher.

August 29, 1922.
77. Black-billed Cuckoo.
78. Oven-bird.

August 30, 1922.
79. Olive-backed Thrush.
80. Loggerhead Shrike.
81. Sparrow Hawk.

August 31, 1922.
82. Black-throated Blue Warbler.

MONTH OF SEPTEMBER, 1922.

September 1, 1922.
83. Blue-winged Warbler.

September 3, 1922.
84. Wood Thrush.
85. Lincoln Sparrow.
86. Rusty Blackbird.
87. Chestnut-sided Warbler.

September 5, 1922.
88. Screech Owl.

September 6, 1922.
89. Golden-winged Warbler.
90. Tree Swallow.
91. Titlark.
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Notes Relative to the Species of Gambusia in the United States.

S. W. Geiser,

Washington University, Saint Louis.

(From the Zoological Laboratory of the Johns Hopkins University.)*

Regan ('13) in his revisional paper on the viviparous Poeciliidae or top-minnows of the world has ascribed to the territorial limits of the United States three species of the genus Gambusia; holbrooki, patruelis, and affinis. He maintains that Gambusia holbrooki (Grd.) Guenth. is distributed from “Virginia to Alabama;” G. patruelis (B. & G.) Grd. from ‘Florida to Texas;” and G. affinis (B. & G.) Grd. from “Florida to Tampico; Mississippi.” Owing to the rarity of males in field-collections of Poeciliidae, he had no males of some of the different “species” for comparison; and hence the descriptions which he gives of the different “species” do not appear to really satisfactorily differentiate them from other “species.” Color-markings, for example, may vary widely; the ground-color, also may differ markedly in the different habitats. The characters which he used in differentiating species, in fine, vary so greatly that it is impossible to clearly discriminate between his species.

As a result of this, and in view of the remarkable diversity in the form and the color of Gambusia contemporary workers

* My heartiest thanks are due to Professor S. O. Mast and Mr. S. F. Hildebrand. The work was done under the direction of Professor Mast, and to him the writer is indebted for valuable suggestions and help. Mr. Hildebrand supplied much valuable material which otherwise was inaccessible, gave notes on distribution, and contributed otherwise. I am indebted to both Professor Mast and Mr. Hildebrand for criticizing the manuscript.
regard those of the United States as comprising a single species, *Gambusia affinis* and they look upon *G. holbrooki* and *G. patruelis* (along with other names long since gone into the synonymy) merely as varieties, or as entirely synonymous and without taxonomic standing.

In the course of studies on top-minnows the writer has found evidence that we have in these forms certain well-defined types. This evidence is here presented. It is drawn from the microscopic structure of the terminal portion of the copulatory organ, or gonopod, of the fish.

It will not be necessary to speak here of the general form and structure of the gonopod, and its origin, development, and microscopic structure in the different genera of Poeciliid fishes, for this has already been done in the admirable papers by Langer ('13), Regan ('13), Meek & Hildebrand ('16), and Henn ('16), and by Eigenmann ('07, '12). Suffice it to say that in the viviparous Poeciliids the anal fin is metamorphosed in the male into a complex, usually imperforate copulatory organ or gonopod, by means of which the male is able to transfer balls of sperm, the specialized *spermatozeugmata* (sing., spermatozeugma) from his own genital aperture to that of the female. The third, fourth and fifth anal-fin rays are modified in male Gambusia to form the distal portion

![Text-figure A](image-url)

*Text-figure A.* (a) Lateral dissection of a male *Gambusia holbrooki*, showing the general relations of gonopod to other organs, especially the internal organs of the body. (*I*, intestine; *T*, testis, *AF*, gonopod; *HS*, modified haemal spines; *M*, muscle controlling gonopod; *VP*, ventral process of abdominal vertebrae.) (b) Detail drawing of end of the gonopod. (After Kuntz, '14.)
of the copulatory organ (Fig A, a.) The anal fin, of course, is a fused, single, unpaired median organ. While the gonopod in Gambusia, and in most other Poeciliids, is

Text-figure B. Collection-localities for Gambusia used in this study. A number of other localities, very near other stations indicated, are not marked on the map. (E. g., Key West, near Big Pine Key, Fla.)
imperforate, it should be noted that the two sets of fin-rays in the fused median organ form on the anterior border of the gonopod a trough or furrow down which the sperm-ball, after being discharged, proceeds towards the genital pore. Copulation in these fish is only a momentary process, and is not an act of intromission.

On studying the microscopic structure of the terminal portion of the gonopod of an "Eastern form" of Gambusia it is found that the simple ossicles of the anal fin of the male have become most curiously and characteristically modified. (Fig. 1). Three rays, the third, fourth, and fifth, form the terminal portion of this organ. The third ray forms an unbranched series of relatively thin, broad, conspicuous trough-plates, frequently having in the "Eastern form" prominent angular, lateral, longitudinal ridges. The most distal ossicles of this fin-ray are progressively smaller and possess hooks directed distad ("serrae" of REGAN.) The fourth ray is divided into branches in the proximal portion of the gonopod. The anterior branch has on its anterior edge a prominent, slightly recurved hook, at the distance of eight or ten ossicles from the end of the gonopod (Fig. 1, ant. hook, IV. ant.) The posterior branch of the fourth ray ends in a prominent terminal recurved hook (Fig. 1, term. hook, IV post.), to form which several ossicles may be fused, followed after a short interspace of simple ossicles by a number usually five or six, which have posteriorly-directed hooks or spines. The fifth anal ray is relatively simple, and is terminated by a retrorse hook. This, in brief, outlines the morphology of the terminal portion of the fin in the "Eastern form" of Gambusia. The ossicles, of course, are bound together by connective tissue, and enclosed within the investing fin-membranes.

The accompanying Figures 1-18 are camera lucida drawings of gonopods of specimens collected in the following localities: Goldsboro, N. C., (Figs. 1-2); Savannah, Ga., (Fig. 3); Augusta, Ga. (Fig. 4); Big Pine Key, Fla., (Fig. 5); Little Rock, Ark., (Figs. 6-7); Austin, Tex., (Figs 8-9);
Camilla, Ga., in the Gulf Drainage, (Fig. 10); Huntsville, Ala., (Fig. 11); Memphis, Tenn. (Fig. 12); Greenwood, Miss., (Fig. 13); Jacksonville, Tex., (Fig. 14); San Marcos, Tex., (Figs. 15-18.) Material was obtained from various other localities in Maryland, Virginia, North Carolina, Illinois, Indiana, Missouri, Georgia, and Florida. The drawings are reproduced at the magnifications indicated in the legend.

It will thus be seen that the localities from which material was studied lie in three general sections of the United States: The Atlantic Coastal Plain, the Central Mississippi Valley region, and the Southwest.

Material collected at the Mexican Border shows itself upon examination to be typical Gambusia senilis, a Mexican form which shows in the type of its gonopod-structure very striking and extensive dissimilarity to the material from the rest of the United States. (Figs. 15-18.) On comparison of the figures mentioned with those of gonopods of fish from other localities, it will be seen that the Mexican Border form is completely different.

The material from the three general localities (with the exception just noted) also show differences, but not so striking, in the finer structure of the gonopod; differences that appear to be relatively constant. A comparison of Figures 1-5, 10 (Eastern form,) with Figures 6-7, 11-13 (Central form,) and Figures 8-9, 14 (Western form,) illustrates the differences. These differences are presented in tabular form in Table I:

This table shows that the structure of the third ray in the Eastern material is sharply different from that of both the Central and Southwest material, for in the former there is a prominent series of posterior teeth on the proximal ossicles—a characteristic that is lacking in both the Central and the Southwest forms. The prominent longitudinal lateral ridges present on the third rays of the Eastern form appear also to be entirely lacking in the Central and Southwestern forms.*

* Since the above was written, material has been obtained from the "Central" region which shows lateral ridges; but these ridges do not appear to be nearly so prominent as in the "Eastern form."
TABLE I.—Showing the differences in microscopic structure of the gonopods of *Gambusia* found in different parts of the United States.

<table>
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<th>EASTERN FORM</th>
<th>CENTRAL FORM</th>
<th>WESTERN FORM</th>
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<tr>
<td>III. Ray:</td>
<td>III. Ray:</td>
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<tr>
<td>11-14 end ossicles with antero-distally directed teeth.</td>
<td>8-10 end ossicles with antero-distally directed teeth.</td>
<td>12-14 end ossicles with antero-distally directed teeth.</td>
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<tr>
<td>Posterior teeth on the larger ossicles near the distal end.</td>
<td>No posterior teeth present on the larger ossicles near the distal end.</td>
<td>No posterior teeth present.</td>
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<tr>
<td>Ossicles in many of the rays with sharp lateral ridges.</td>
<td>No such ridges.</td>
<td>No such ridges.</td>
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<td>Usually 2 ossicles united to form terminal hook.</td>
<td>Usually 3 ossicles in terminal hook.</td>
<td>Usually 6 ossicles bearing posteriorally directed teeth.</td>
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<td>Usually 7 ossicles bearing each posteriorally-directed tooth, usually curved in outline, and the apices directed either proximad or distad. The angle slightly less than a right angle.</td>
<td>Usually 5 ossicles bearing posteriorally-directed teeth; their apices being directed proximad and at a sharp angle.</td>
<td>None.</td>
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Thus, the Central and Southwestern material appears to be much more nearly related to each other than they are to the Eastern material. However, the Central material is sharply different from the Southwestern in the number of ossicles forming the terminal hook of the fourth posterior ray, since the Central material has usually 3 ossicles, while the Southwestern has usually six. The Central material in this respect resembles the Eastern material which has usually 2 ossicles in the terminal hook of the fourth posterior ray.

In the number of ossicles of the fourth posterior ray which bear teeth on their posterior edge, the three forms show marked and distinguishing differences. In the Eastern form, there are 7 ossicles (mean number,) which bear a single tooth. Both the Central and Southwestern forms lack these ossicles bearing two teeth. The Central material also differs sharply from the Eastern form in the fact that the teeth in the former are often straight and are set at a very sharp angle to the longitudinal axis of the ray (Figs. 11-13) while in the Eastern material the teeth of the fourth posterior ray have usually a curved outline, and their apices are directed either proximad or distad, (the apices of the proximal teeth being usually directed distad.) The angle which these teeth make with the longitudinal axis of the ray is very much more nearly a right angle. The Southwestern form differs from the Central form in making a less acute angle with the ray-axis, as well as in possessing usually more posteriorly-directed teeth on the fourth posterior ray. These are the main similarities and differences of structure of the gonopod in individuals of Gambusia from the three regions.

It might be thought that the enumerated differences occurring between Central and Southwestern forms were due to differences in habitat. Difference in habitat will, however, account for very little of the variation found in the gonopods, for specimens from Maryland to Key West and from Illinois to Louisiana have a close adherence in all cases to the type characteristic of the Eastern and the Central form, respectively, and the habitat of different regions in each of these two districts differs fully as much as does that of the
other two districts. No cases of overlapping were found between Central and Southwestern forms, or between Eastern and Central forms.

All of the individuals studied were Gambusia. (Regan, '13, Figs. 168-169.) There is no possibility of males of other genera having without our knowledge gotten into our collections, for the microscopic structure of the gonopod in the other viviparous Poeciliids living in the United States are sharply dissimilar from it in form. The merest tyro could instantly distinguish them.

The Gambusia type which I have here called the "Eastern form" corresponds in its structure with the species figured by Regan (Fig. 169, A) as Gambusia holbrooki. None of his figured gonopods of other species of Gambusia resemble in a close way the structure of what I have called the "Central" and "Southwestern" forms of Gambusia. In Gambusia nicaraguensis (Fig. 168, A), G. wrayi (Fig. 168, B), and G. oligosticta (Fig. 169, B), there are small points of resemblance to our material, but with these points of resemblance there exist fundamental and glaring differences.

The Eastern form of Gambusia is the only one of the group in the United States which possesses denticulations on the posterior border of the ossicles of the third ray. In all other species, so far as I am aware, these borders are entire in outline.

The distribution of the Eastern form is from New Jersey to Key West, and it has invaded to a slight extent the Gulf drainage of western Georgia, being found in the Flint R. at Cammilla, Ga. The exact limits of its East-West range are, in the lack of material, not yet ascertained.

Practically all students of the Poeciliidae agree with Regan ('13) in the conclusion that the "differences in structure of the intromittent organ are of great systematic importance." Eigenmann ('07, '12), Langer ('13), and Henn ('16) have used them as a basis for ascertaining generic relationships and affiliations. These differences of structure have proved to be remarkably constant to a type. Species within the same genus (as, e. g., the various species of Gambusia whose gonopods
are figured by Regan, or of Mollienisia and Neoheterandria figured by Henn) also show a close adherence to a specific type of structure at the same time that they conform to a generic type. Just as it has been possible for Regan in his synoptic paper to diagnose for each genus the microscopic structure of the gonopod, so also does it appear possible to give diagnoses of the gonopod of each species. It appears conclusively to the writer as the result of an extensive examination of gonopods that by means of the structure of the gonopod alone it is possible to determine correctly the species to which a given top-minnow belongs.

It is easily seen from these studies that the so-called "species" Gambusia affinis, as at present understood, is not a single, unified species. The Atlantic Coastal Plain form would appear to be sharply distinct from the other two forms, and hence merits the status of a distinct species. It appears that it should be known as Gambusia holbrooki Grd. In the case of the two other forms the case is not so clear. The Central material obtained from Illinois, Arkansas, and Louisiana (as well as other states) shows certain fairly constant differences from the Southwest material, as has already been noted. Since the differences found in the gonopod-structure of fish from the two sections are not of so fundamental a sort as those noted as existing between the Central and Eastern material, I should merely class the two as varieties and not call them distinct species. And as Gambusia affinis, is described earlier than G. patruelis in Baird & Girard's 1854 paper, it appears that the former name has the priority.

SUMMARY.

(1.) The Gambusia of the United States are usually included in one species, Gambusia affinis.

(2.) Regan has held on general anatomical grounds that there are three species, G. affinis, G. patruelis, and G. holbrooki, within the territorial limits of the United States.

(3.) The microscopic structure of the gonopod in Poeciliid fishes has been proved by the work of a number of investigators to be a completely satisfactory criterion of generic and specific relationships.

(4.) Study of the finer structure of the gonopods of material
gathering from the Eastern, Central, and Southwestern sections of the United States shows constant differences between these forms.

(5.) The structure of the gonopod of the Eastern form is strikingly different in certain respects from that of the two other forms. This form deserves specific rank as Gambusia holbrooki Grd.

(6.) The evidence is, however, not clear for the Central and Southwestern forms that the differences indicate more than varietal relationships of these forms. The material may be tentatively grouped together as Gambusia affinis B. & G.

(7.) The Mexican species Gambusia senilis has invaded Southern Texas, and is now found at San Marcos and other localities.

LITERATURE CITED.


Figures 1-5. Gonopods of "Eastern form" of Gambusia (G. holbrooki) from various localities. 1-2 Goldsboro, N. C.; 3, Black race of males from Savannah, Ga.; 4; Augusta, Ga.; 5, Big Pine Key, Fla. (Ant. hook, IV. ant.-anterior hook of the anterior branch of the fourth ray; term. hook, IV Post.-terminal hook of the posterior branch of the fourth ray;
Figures 6-9. Gonopods of "Central form" (figs. 6-7) and "South-term, hook V-terminal hook of the fifth ray.
Little Rock, Ark.; 8-9, Austin, Texas. (Stock originally from Brazos R, in southcentral Texas.) x 40.)
Figures 10-14. Gonopods of Gambusia from various localities. 10, Camilla, Ga. ("Eastern form," in the Flint R. drainage); 11, Huntsville, Ala. ("Central form"); 12, Memphis, Tenn. ("Central form"); 13, Greenwood, Miss., ("Central form"); 14, Jacksonville, Texas ("Western form.") In Fig. 14 an immature, incompletely differentiated gonopod is shown. x 27.
Figures 15-18. Gonopods of Gambusia senilis (nobilis) from south central Texas, on the San Marcos R. at San Marcos. Note the radically different type of gonopod structure. x 27.
The Birds of Floyd County, Iowa.

BY CARROLL LANE FENTON.

I.—INTRODUCTION.

In 1916 I published, in the Wilson Bulletin (No. 96, pp. 130-138), a paper entitled "Preliminary List of the Birds of Floyd County, Iowa." This list extended through the Raptorese, and included ninety species and subspecies. Several of the references, however, were either questionable or erroneous. A combination of circumstances made it impossible to complete the list in the Wilson Bulletin. Instead, the entire paper has been re-written, much material has been added, and all data carefully checked. The resulting paper is considerably larger, more detailed, and it is hoped, more reliable, than that originally published in the Wilson Bulletin.

The sources of material and notes are varied. The principal one, of course, is my own field notebooks, made from 1914 to 1922. These have been supplemented by the field notes of Mr. H. Clarke Brown, now of Geneva, Ill., but formerly of Charles City, Ia. For several years Mr. Brown and I worked together, and his share in the list is larger than the acknowledgments indicate. Clement L. Webster, John R. Waller, and the late Mrs. Mary A. Dutton, all of Charles City, have furnished numerous notes, and have assisted in securing and verifying "early days" records. Through various other observers, brought together through the Bird Bureau of the Califor Naturalist Club, of Charles City, much data have been secured. Published material has been taken from the books and papers mentioned in the bibliography.

A final source of information is the Miles collection of birds, made by a former resident of Charles City, and now in the Charles City High School. The collection is in bad repair, and many of the labels appear to have been lost since Dr. Bailey assisted me in examining it; nevertheless the notes taken at that time, and the remaining specimens, have proved of much value,
For assistance in checking reports and records, and in editing of the manuscript, I am indebted to Mr. Ira N. Gabrielson, Dr. Lynds Jones, and Miss Althea M. Sherman. The late Dr. B. H. Bailey, of Coe College, Cedar Rapids, examined manuscript and specimens, checking virtually all the material in hand in 1916. Finally, the entire manuscript, in virtually its present form, has been read by Dr. T. C. Stephens, of Morningside College, who has made copious notes and valued suggestions.

II. — GEOGRAPHY OF FLOYD COUNTY.

A. — Topography.

Floyd County lies within the area covered by the Iowan drift sheet. In general its surface is gently rolling, with no very deep valleys or bold hills, and few to many undrained depressions, depending upon the exact spot under consideration. On the whole it may be considered as typical of what McGee has styled the "rolling Iowan" prairies.

The largest stream in the country is the Cedar (more properly, Red Cedar) River, which flows southeastward through the county. It is a broad, rather sluggish stream stopped by a large dam at Charles City, and a small, dilapidated one at Floyd. The Charles City dam causes a considerable widening of the stream, and assists somewhat in the formation of marshy "bayous" northwest of the town. North of Floyd the river banks are high, and in some places steep, with prominent limestone faces, but near and south of Charles City the banks are low and gently sloping.

Flood Creek, a small stream, flows roughly parallel with the Cedar River, but several miles west of it. Its banks are low, and very largely of drift.

The Shell Rock River parallels Flood Creek in the western part of the county. It is similar to, but considerably smaller than the Cedar River, and its banks are somewhat steeper. Its tributary, Lime Creek, flows through Cerro Gordo county, entering Floyd northwest of Rockford. For a considerable distance it flows through a broad, flat valley at the base of clay hills sixty to eighty feet in height. The most abrupt
of these is in Cerro Gordo County, and is known generally as the Hackberry Grove Clay Bank. There are no other large streams in the county.

Due to the relative youth of the glacial drift there are still many undrained depressions. Along the line of the Chicago, Milwaukee, and St. Paul railway, between Rudd and Charles City, there are considerable areas of slough land. This was at one time of little agricultural value, but drainage has now made it suitable for farming. East and southeast of Charles City, and northwest of Floyd there are numerous sloughs, not yet thoroughly drained. The balance of the land is high, rolling prairie.

B.—Forests.

The natural forests of the region are largely oak, with some lindens and other trees. Poplars, willows, etc., are not abundant among the natural forest trees. Thornapple, wild plum, hazel, and various bushy trees make up the scrub growth.

The principal areas of natural forest are along the streams, as shown in the map. The belt along the Cedar River is the largest of these, and despite continued cutting, covers some thousands of acres. The largest area of woodland away from streams is Wallers' Woods, northeast of Charles City.

The introduced woodlands are largely of fruit trees, evergreens, and elms. Soft and Manitoba maples are common. Along some of the roads there are rows of willow trees, but the custom is less prevalent in Floyd than in more central counties of Iowa. While the total of introduced forest probable about equals the cut-off of natural timber, it is less attractive to birds. This is due partly to the location and distribution of the planted trees, and partly to the fact that they do not offer particularly good nesting sites to the birds which build in low, shrubby trees.

C.—Roads, Transportation.

In the map there is no indication of the roads. They are, for the most part, unpaved, and with the exception of a few “pikes” only moderately traveled. Weeds and bushes are
allowed to grow along their sides, and by offering nesting sites they are probably of more value than harm to birds. The railways are all single track lines, with but few trains daily. So far as noticeable they have neither favorable nor unfavorable effect upon bird life.

D.—INDUSTRIES, POPULATION.

Floyd County is dominantly a region of grain farms. Corn is the principal grain raised, although there are large fields of oats. Pasture land is not extensive.

Rockford, with a population of about 1,400 and Charles City, with a population of about 7,200 are the largest towns in the county. Charles City is dependent for much of its prosperity upon the factory of the Hart-Parr Company, manufacturers of oil tractors. There are other minor factories, and a very large nursery. The city is attractively built, with plenty of trees, large lawns, and a large wooded park, Wildwood Park, to the southwest.

Rockford, Nora Springs, Floyd, and Marble Rock are farming towns. There are several small villages, of no particular consequence to the fauna, in the country.

Floyd County, therefore, is a typical section of the northern part of the Iowa corn belt. Its population is moderate, its industries mainly that of any farming community. Yet the effect of these industries and populations on animal life has been considerable. Generalizations on this subject would have little point; the specific examples are brought out in the various species noticed.

III.—LIST OF SPECIES AND SUBSPECIES.

1. *Colymbus holboelli* (Reinh.) Holboell's Grebe. Webster states that this species nested near Charles City in the 60's, but it is now a very rare migrant. Webster reports a flock of six birds, seen near Hackberry Grove, Cerro Gordo county on March 26, 1916. I have a questionable record for May 26, 1916, at Charles City.

2. *Columbus auritus* (Linn.) Horned Grebe. Common migrant in "early days" (Webster). Now a rare migrant and rarer summer resident. Mr. J. H. Waddell reports a pair as
having nested near Floyd in 1913; I know of no other nesting records in recent years.


4. *Gavia immer* (Gunn.) Loon. Rare migrant, though formerly common as a migrant, and not rare as summer resident (Webster). Last reported observation near Charles City, March 23, 1916, by W. T. Swartz.

5. *Gavia arctica* (Linn.) Black-throated loon. Webster states that this species had disappeared prior to 1897. John R. Waller tells me that as late as 1870 it was a not uncommon migrant, but decreased in numbers rapidly after that. I have no definite data.

6. *Larus argentatus* (Brünn.) Herring Gull. Fairly common migrant, being seen in middle to late March. The species is common about Clear Lake, in Cerro Gordo county.

7. *Larus franklini* (Sw. & Rich.) Franklin's Gull. Uncommon migrant, probably no longer to be found in the county. A specimen was taken near Floyd, in 1898, by W. C. Miles.


9. *Sterna hirundo* (Linn.). Common Tern. These two species, which cannot be distinguished with certainty in the field, appear to be rather common in Floyd and Cerro Gordo counties. One or the other—perhaps both—nests at Clear Lake.

10. *Sterna antillarum* (Less.) Least Tern. Formerly an uncommon migrant, occasionally rather common in Cerro Gordo County. (Webster). "... very plenty on Clear Lake, Iowa," (Krider, Forty Years' Notes, p. 82.). I have no records for the species.

11. *Hydrochelidon nigra surinamensis* (Gmel.) Black Tern. A common or tolerably common migrant, arriving in late March or early April. Howard Clarke Brown and others, as well as myself, have seen them in the neighborhood of Charles City, and at Willow Pond.
12. *Phalacrocorax auritus aureus* (Swainson.) Double-crested Cormorant. The data on this species are somewhat confusing. Webster states that he has never seen a specimen in Floyd County, but has seen them at various times near Clear Lake, in Cerro Gordo County. I have never observed the species, either in Floyd or adjoining counties, although there is a specimen in the Miles collection labelled "Floyd, 1891." On the other hand Mrs. W. I. Fredrickson and John R. Waller, both reliable observers, saw a flock of 10 of these birds near Charles City on April 14, 1919, and a week later Mr. Waller identified the species. This year (1921) comes an unsubstantiated though probably reliable record of the Cormorant from Mitchell County.

13. *Pelecanus erythrorhynchos* (Gmel.) White Pelican. This species was at one time a tolerably common migrant (Waller, Webster, Swartz). The Miles collection contains one specimen taken near Charles City in 1890. This is the latest record I have been able to find.

14. *Mergus americanus* (Cass.) Merganser. Rare migrant, there being no records of it since 1908 when specimens were shot by Mr. Waller. The Miles collection contains a specimen taken near Charles City in 1904.

15. *Lophodytes cucullatus* (Linn.) Hooded Merganser. Both Webster and Waller state that this species was never common in Floyd and adjoining counties. The Miles collection contains two specimens taken in 1894 "on the Cedar River."

16. *Anas platyrhynchos* (Linn.) Mallard. A common migrant, arriving in the latter part of March. Webster and Waller state that it once nested in Floyd, Cerro Gordo and Mitchell counties, but it does not do so at the present.

17. *Anas rubripes* (Breswter.) Black Duck. Very rare migrant. I have a questionable identification for April 18, 1918. One specimen, taken near Floyd in 1896, is in the Miles collection.

18. *Chaulasma strepterus* (Linn.) Gadwall. Uncommon or rare migrant. I saw three individuals on March 29,
19. *Nettion carolinense* (Gmel.) Green-winged Teal. A rather uncommon migrant in the past six years, although Webster, Waller and others class it as common. Certainly Anderson's reference to it as the commonest duck in Iowa will not hold for Floyd County, where it is exceeded in numbers both by the Pintail and Mallard. The species passes north in April; it has not been reported to breed in the county, though it may have done so.

20. *Querquedula discors* (Linn.) Blue-winged Teal. A rather uncommon migrant, seen in late March and early April, and middle to late November. Flocks of 6 and 11 birds, respectively, seen near Charles City on November 26, 1915 and March 27, 1917.

21. *Spatula clypeata* (Linn.) Shoveller. An uncommon migrant, seldom taken by hunters. One specimen taken near Nora Springs in May, 1914 (C. H. Belanski). Webster and Waller state that prior to 1900 the species might have been classed as common.

22. *Dafila acuta* (Linn.) Pintail. Fairly common migrant, arriving in late March or early April. In numbers it ranks second to the Mallard.

23. *Aix sponsa* (Linn.) Wood Duck. Very rare migrant; is not known to breed in Floyd or adjoining counties. Webster states that it was formerly common during migrating seasons, and probably nested in the county. He reports one specimen seen in March, 1915, and another in April, 1917.


25. *Marilla marilla* (Linn.) Greater Scaup Duck. Rare migrant, although Webster states that it was at one time common. Waller says that he has not infrequently taken specimens when hunting. My last observation was March 23, 1916.

26. *Marila affinis* (Eyt.) Lesser Scaup Duck. An uncommon migrant. (Waller). A small flock was seen by Mr.

1918. Waller and others state that they have occasionally shot specimens.
Waller near Floyd in March, 1915. I have no records of the species.


28. *Chen caerulescens* (Linn.) Blue Goose. At one time a common migrant; now rare (Waller). Mr. Waller's last date for the species is in March, 1915. I have never identified the species in Floyd county.

30. *Anser albifrons gambeli* (Hartl.) White-fronted Goose. Rare migrant. Last observed near Floyd, in October 1915, by Waller.

31. *Branta canadensis canadensis* (Linn.) Canada Goose. Common migrant. According to Webster it nested within the county in the late 60's. Its spring arrival is usually in late March.

32. *Branta bernicla glaucogastra* (Brehm.) Brant. There may be some question as to the reliability of various records of this rare migrant. I have what I think is a reliable record for March 17, 1916; five birds on the Cedar River, near Charles City.

33. *Olor colubianus* (Ord.) Whistling Swan. Rare migrant since 1890. Webster states that in "early days" the species was quite common. I have been unable to learn of any specimens seen or killed since 1900, and conclude that the species is no longer part of the county's avifauna.

34. *Olor buccinator* (Rich.) Trumpeter Swan. Webster states that the species was tolerably common in the late 50's. One was killed near Charles City in 1897, but I have been unable to find a later record.

25. *Botaurus lentiginosus* (Montag.) Bittern. A fairly common summer resident, regularly nesting within the county. I have frequently come upon them in the "bayous" of the Cedar River, near Charles City, in July, August and September, though have failed to locate nests.
36. *Ixobrychus exilis* (Gmel.) Least Bittern. A tolerably common migrant and summer resident, but less so that the preceding species. Nests regularly within the county, and probably within the limits of Charles City.

37. *Ardea herodias herodias* (Linn.) Great Blue Heron. A rather uncommon summer resident, though it seems to be increasing in numbers. They arrive in early April, and are most commonly seen along the river near Floyd.

38. *Egretta candidissima candidissima* (Gmel.) Snowy Egret. Casual visitor. “Has been taken at Des Moines and in Floyd County in August.” (Keyes and Williams, Proc. Dav. Acad, Nat, Sci., V, p. 120.

39. *Butorides virescens virescens* (Linn.) Little Green Heron. Common migrant and summer resident. Arrives about the last week of March or the first of April, or later.

40. *Nycticorax nycticorax naevius* (Bold.) Black-crowned Night Heron. Tolerably common migrant; perhaps a summer resident. Webster found it nesting near Floyd in 1897, and in the west part of the county for four years later. It is reported as nesting near Nora Springs in 1913. The species, in common with the Great Blue Heron seems to have increased since 1915.

41. *Grus americana* (Linn.) Whooping Crane. At one time a rather rare migrant (Webster); now probably but a memory in the county’s avifauna. The Miles collection contains one specimen, without date. So far as I know, there is no record of the species nesting within the county, although Cooke states that it had been known to nest at Clear Lake. (Bd. Migr. Miss. Valley, p. 85).

42. *Grus mexicana* (Müll.) Sandhill Crane. Webster, Waller, and others, state that this species once occurred in large flocks during the migrating seasons. At present it is, at best, a very rare migrant. I have no definite records.

43. *Rallus elegans* (Aud.) King Rail. An uncommon species during migrations, and a rare summer resident. It arrives in late April; on April 24, 1916, I saw a specimen well
within the limits of Charles City, near the Willow Pond Bird Preserve.

44. *Rallus virginianus* (Linn.) Virginia Rail. An uncommon migrant, probably not a summer resident. Arrives about the same time as the preceding species.

45. *Porzana carolina* (Linn.) Sora. Webster, in 1897, recorded the species as nesting commonly in Floyd county, and a pair probably nested near Floyd in 1917. The species is a common migrant.

46. *Porzana noveboracensis* (Gmel.) Yellow Rail. The Miles collection contains one specimen, collected in 1885. Attached to the specimen was a note: "Floyd, 1885. Crake, uncommon." I have no other record.

47. *Inornis martinicus* (Linn.) Purple Gallinule. An accidental visitor, reported only twice, J. R. Waller shot a specimen near Charles City in 1891. September 9, 1915, Mrs. Mary A. Dutton and Miss S. E. Wetherbee identified one of these birds on the Cedar River, about one-half mile west of the thickly settled part of Charles City. Mrs. Dutton carried glasses and approached within 15 feet of the bird, and her identification seems to me to be reliable. It was not questioned by Dr. Bailey.

48. *Gallinula galeata galeata* (Licht.) Florida Gallinule. This species varies from rare to tolerably common in different years. I have occasionally seen in at Willow Pond, in the north part of Charles City, but is more frequently to be found near Hackberry Grove, in the east part of Cerro Gordo County.

49. *Fulica americana* (Gmel.) Coot. A common migrant and a summer resident, nesting near and within the limits of Charles City, though not commonly. In swampy areas along the Cedar River, between Charles City and Floyd it is not uncommon as a summer resident. I saw three specimens on the Shell Rock River, in Rockford, on July 18, 1919. During the migrating season they are occasionally seen on the Cedar River, in the business district of Charles City.

50. *Steganopus tricolor* (Veill.) Wilson's Phalarope. A fairly common migrant and formerly a not uncommon summer
resident. I saw an immature bird near Charles City on August 12, 1915, and several times have seen young birds near Floyd; perhaps it still breeds there.

51. *Philohela minor* (Gmel.) Woodcock. Mr. J. R. Waller killed one specimen near Floyd in 1904, and on August 23, 1917, I made a sight identification in a swampy area north of Charles City. The latter may well be questioned. Mr. C. H. Belanski states that on several occasions he has made questionable identifications of the species in the neighborhood of Nora Springs. Other records have come in, but it is probable that they refer to the Wilson’s Snipe rather than to the Woodcock. In general, it may be said that the species is rare as a migrant and probably absent as a summer resident.

52. *Gallinago delicata* (Ord.) Wilson’s Snipe. This species is a fairly common migrant in both Floyd and Cerro Gordo counties, arriving in early April. March 31, 1918, I saw seven birds in a swampy area along Lime Creek, near Hackberry Grove in Cerro Gordo county. In the swamp, now drained, north of the Willow Pond sanctuary in Charles City there are frequently small flocks of these birds throughout April. One bird was observed at this locality on May 6, 1917.

Definite early records are lacking. Mr. Waller tells of having killed many of the birds in the now drained swamps and sloughs west of Charles City. Webster states that near Rockford, at the time of his childhood, the “Jack Snipe” was a common game bird. There are no nesting records.

53. *Micropalama himantopus* (Bonap.) Still Sandpiper. Keyes and Williams state: “Observed but once, and that in early autumn on the open prairie in Floyd County. There were four individuals wading about in a small pond; a single specimen only was secured.” (Bds. of Iowa, 1889, 122.) There are no other records for Floyd or adjoining counties, so far as I can discover.

54. *Pisobia maculata* (Vieill.) Pectoral Sandpiper. Although Anderson (Bds. of Iowa, 1909, 217) states that this species is “an abundant migrant in nearly all parts of the state” it is rare in Floyd County. In June, 1913, I observed two individuals near Patten’s Pond, southeast of Charles City.
On June 28, 1918, Mahlon Palmer and I identified five individuals at Willow Pond, and on June 29 I identified two at the same locality.

55. *Pisobia fusicollis* (Vieill.) White-rumped Sandpiper. According to Webster and J. R. Waller this species was a rather common migrant near Rockford and Charles City. The reference to it as a "rather common migrant, appearing the last of May about the quiet pools near watercourses" by Keyes and Williams (Bds. of Iowa, 1889, 122) is probably from Williams' observations in Floyd County. I have a very questionable record for May 12, 1917; one bird seen on the bank of Lime Creek, near Rockford.

56. *Pisobia minutilla* (Vieill.) Least Sandpiper. A common migrant in Floyd and adjoining counties. In both spring and late summer it is abundant along the bayous of the Cedar north and west of Charles City. It associates with both the Semipalmated Sandpiper and the Spotted Sandpiper. The spring migration begins about the first of May and lasts throughout the month. The birds reappear in late July or early August and may be seen well through September.

57. *Ereunetes pusillus* (Linn.) Semipalmated Sandpiper. A rather uncommon species associated with the foregoing in its migrations. I saw five specimens at Willow Pond on May 23, 1918. It is usually to be seen along the Cedar River.

58. *Limosa fedoa* (Linn.) Marbled Godwit. Rare migrant in Floyd County. (Webster.) Mr. J. W. Preston found it breeding at Clear Lake, in Cerro Gordo county. (Cooke, Bd. Migr. in Miss. Val., 1884-5, 94.) I have a questionable identification made at Hackberry Grove, Cerro Gordo county, on June 6, 1917.

59. *Totanus melanoleucus* (Gmel.) Greater Yellow-legs. A fairly common migrant, being seen mostly in sloughs and along the streams. It appears in the spring in late April. On June 12, 1917, I saw four individuals on Flood Creek. The autumn migration is irregular, beginning in mid-September and lasting into October.

60. *Totanus flavipes* (Gmel.) Yellow-legs. More common
than the preceding species. It is common along the streams and near ponds, appearing in late April. On June 12, 1917, I saw two individuals on Danforth Creek about two miles west of Charles City; on August 7, 1915, several birds were seen in a slough in the northwest part of the town.

61. Helodromus solitarius (Wils.) Solitary Sandpiper. Fairly common migrant, arriving about April 24 and remaining to the middle of May. My earliest summer record is August 3 (1918; four specimens near Willow Pond). My latest is September 28 (1916; two specimens along the river near Brackett's Woods).

62. Bartramia longicauda (Bechst.) Upland Plover. Webster states that he has identified the species, but can give me no dates. I have a questionable record for June 6, 1914. May 24, 1917, I identified three individuals about a mile north of Charles City. There is no indication that the species has ever nested in the county.

63. Tryngites subruficollis (Vieill.) Buff-breasted Sandpiper. Rare. I have one specimen, secured near Charles City on September 9, 1915. The specimen was identified by Dr. B. H. Bailey.

64. Actitis macularia (Linn.) Spotted Sandpiper. This little sandpiper is a very common migrant and a common summer resident in Floyd and adjoining counties. The species arrives as early as April 6 (1915; two individuals at Willow Pond). On April 15, 1917, I identified four of the birds on Danforth Creek, near Charles City. The spring migration seems to be at its height in the third week of May. The autumn migration begins about August 10, and birds have been seen as late as October 13.

65. Numenius americanus (Becht.) Long-billed Curlew. Messrs. Webster and Waller say that during the 60's and 70's this species was a fairly common summer resident. It is now a rare migrant. I have a questionable identification for April 11, 1915, near Charles City. On April 14, 1918, I saw two birds that were without doubt of this species at Wildwood Park. I have no other records.
66. *Charadrius dominicus* (Müll.) Golden Plover. A rare migrant, although Webster states that it was at one time common. There were two records for it near Charles City in 1915, and it is probable that the same individuals were seen in both cases. On August 31, 1916, Mrs. M. A. Dutton and I identified three individuals of this species near Oak Park, in the northern part of the town.

67. *Oxyechus vociferus* (Linn.) Killdeer. A common summer resident. It arrives March 13 to March 21, March 16—20 being the average. It nests both in stream beds and in pastures. On May 26, 1918, C. Herbert Belanski and I found the species nesting in the partially dry bed of Hackberry Creek. On June 3 I saw young Kildeers in the southeastern part of Charles City.

68. *Aegialitis semipalmata* (Bonap.) Semipalmated Plover. Webster states that this species is a rare migrant in Floyd County. Mrs. F. May Tuttle identified one near Osage, in Mitchell County on November 3, 1914. Mahlon Palmer and I saw three individuals in a pasture west of Charles City on October 3, 1916.

69. *Colinus virginianus virginianus* (Linn.) Bob-white. This species was at one time very common in Floyd County. Mr. Waller says he has seen them in large flocks on the prairies of the county. Mr. Will T. Swartz says that when unmolested they commonly came into the farmyards and fed with the poultry. In 1914 and 1915 the species was rare, and in 1916 I listed it so (Wilson Bull., no. 96, p. 136). Within the last five years, however, it has increased considerably in numbers. In 1913 a pair nested in Wildwood Park, near the buildings of the Sherman Nursery Co.

70. *Bonasa umbellus umbellus* (Linn.) Ruffed Grouse. The Ruffed, Grouse or "Partridge" as it is commonly called, is a rare bird in Floyd and adjoining counties. Webster, in 1897 (History of Floyd County) listed the species as rare except in the deep woods. A single individual was killed in December, 1917, by a huntsman from Charles City. Two specimens, taken some years ago at Big Springs, on the Cedar River, are in the Miles collection.
71. *Tymanuchus americanus americanus* (Reich.) Prairie Chicken. That this species was once very common in the region is stated by many hunters and observers. It is now rare. Mr. John R. Waller saw a small flock in January, 1916, and in November, 1918, a flock of about a half dozen individuals was seen near Orchard. Webster, in the Iowa Naturalist, describes two albino Prairie Chickens taken near Niles, in Chickasaw County, but gives no dates of collection.

72. *Meleagris gallopavo silvestris* (Vieill.) Wild Turkey. In 1897 Webster classed this species as rare; it was probably almost extinct so far as the county is concerned. Among some loose notes with the Miles collection is the record of one specimen having been shot near Bloody Run, south of Charles City, in 1898. The specimen is lacking.

73. *Ectopistes migratorius* (Linn.) Passenger Pigeon. Very common during the "early days." (Webster, Waller, Dutton, and others). Keyes and Williams state: "A nest with one egg was taken at Charles City, June 14, 1879." (Bds. of Iowa, 1889, 125.) The last authentic record is by Webster, in 1897. The species probably had disappeared from the county by 1900. There are occasionally alarms when someone thinks he has discovered a Passenger Pigeon, but the "Discovery" is always a Mourning Dove.

74. *Zenaidura macroura marginella* (Woodh.) Mourning Dove. An abundant summer resident. It arrives in March or early in April and nests in early May. I have found nests with eggs in them in May, June and July, and young but a few days old in the middle of August. The species departs in the second and third weeks of October, with a few individuals hanging on until the last of the month.

75. *Cathartes aura septentrionalis* (Wied.) Turkey Vulture. Listed as rare by Webster in 1897 (History of Floyd County.) Several farmers have told me of having seen "Buzzards," and John R. Waller states that he has on several occasions shot them. There are no records, however, within the last fifteen years, and the species is probably no longer to be found in the county unless accidental stragglers should appear.
76. *Elanoides forficatus* (Linn.) Swallow-tailed Kite. Mr. Webster tells me that this species was at one time tolerably common, but could furnish no further data. John R. Waller says that he has occasionally shot specimens. There is a single specimen, probably taken in the county, in the Miles collection. Considerably to my surprise C. H. Belanski and I identified a specimen of this bird at Hackberry Grove, in Cerro Gordo County, on May 28, 1916.

77. *Circus hudsonicus* (Linn.) Marsh Hawk. The Marsh Hawk is a common summer resident in Floyd and adjoining counties. The relative abundance seems to vary rather markedly from year to year. Spring arrival in late March of early April, and departure takes place in late October and early November. Due to the habits of the species it is less noticed, and therefore less persecuted than others of the hawks.

78. *Accipiter velox* (Wils.) Sharp-shinned Hawk. A common migrant and a less common summer resident. On May 4, 1917, I located a nest of this species, with two eggs in Waller's Woods, northeast of Charles City. In July of the following year young birds were observed in this same woodland.

79. *Accipiter cooperi* (Bonap.) Cooper's Hawk. This species is a common summer resident. Prior to 1916 I found no nests with eggs or young, but in 1916, 1917, 1918, and 1919 occupied nests were located in various parts of the county and near Hackberry Grove.

80. *Accipiter atricapillus atricapillus* (Wils.) Goshawk. A rather rare migrant and perhaps winter resident. Four individuals were seen in the northern part of Charles City on November 11, 1917, and there were several reports of the species in the third week of April, 1918. It is probable that all of these records applied to the same birds. I saw two individuals on April 16.

81. *Buteo borealis borealis* (Gmel. Red-tailed Hawk. A tolerably common summer resident, arriving in mid-March. Nests with eggs have been found in the second week of May,
and I have observed brooding birds as early as May 2 (1917). These birds breed in considerable numbers in the woods along the Cedar River between Charles City and Floyd, and also north of Floyd.

Since field determinations of the various Red-tailed Hawks are at best rather questionable it is quite probable that some of the records noted above apply to the following form.

82. Buteo borealis krideri (Hoopes.) Krider's Hawk. This paler phase of the Red-tail is probably not uncommon in the region but due to lack of distinction between it and the preceding species records are scarce. On September 3, 1917, I found a dead bird belonging to this variety. Dr. Bailey (Raptorial Bds. of Iowa, 1918, 109) records the species as occurring in Cerro Gordo County and nesting in Hancock.

83. Buteo lineatus lineatus (Gmel.) Red-shouldered Hawk. Apparently my statement (Wilson Bull. 96; 137) to the effect that this species was more common in Floyd County than the Red-tail was unjustified. I should by no means class the species as rare, as does Anderson (Bds. of Ia., 1907; 249), but its numbers are certainly less than those of the preceding. It nests throughout the county. I have seen nests near Charles City, Floyd, Nora Springs and Rockford in every year since 1914.

84. Buteo swainsoni (Bonap.) Swainson's Hawk. An uncommon species. Webster states that he has seen the species two or three times in the last five years. I saw one specimen in woods west of Charles City on April 30, 1918. Mrs. F. May Tuttle, of Osage, has a specimen taken in Mitchell County on May 13, 1914. I know of no nesting records.

85. Buteo platypterus (Vieill.) Broad-winged Hawk. A common species throughout the county. I have found it nesting in the neighborhood of Charles City in 1913, 1915, and 1918. September 24, 1917, a flock of 16 of these birds was seen in Brackett's woods, north of Charles City. In May, 1918, a pair was found nesting southeast of Nora Springs. In June of the same year a nest was found in the oak grove above the Hackberry Grove clay bank, in Cerro Gordo County.

-86. Archibuteo lagopus sancti-johannis (Gmel.) Rough-
legged Hawk. Seemingly an uncommon winter resident. Mrs. F. May Tuttle reports a specimen seen at Osage, in Mitchell County on Jan. 1, 1915. October 20, 1917, I saw two specimens in a large linden tree in Brackett’s woods. Webster states that he has seen it occasionally, and John R. Waller says that he has killed specimens in both light and dark phases.

87. *Aquila chrysaetos* (Linn.) Golden Eagle. An uncommon winter resident (Webster and Waller). Specimens were shot near Charles City on November 18, 1914, and near Nora Springs on November 5, 1915.

88. *Haliaeetes leucocephalus leucocephalus* (Linn.) Bald Eagle. Webster (Hist. Floyd Co., 1897) states that this species was not rare, and during “early days” had been quite common. Mrs. F. May Tuttle reports a specimen seen near Osage, Mitchell County, on March 26, 1914.

89. *Falco columbarius columbarius* (Linn.) Pigeon Hawk. An uncommon migrant. My only reliable records are: September 5, 1913, April 4, 1916, and April 12, 1917. A questionable nesting record was given me for 1915.

90. *Falco sparverius sparverius* (Linn.) Sparrow Hawk. A common species throughout the county, and probably the adjoining counties. It arrives in late March or early April. May 8, 1915, the species was found nesting in Oak Park, north of Charles City, the birds having occupied an old flicker hole in a dead linden. In 1917 nests were located in Brackett’s woods and Wildwood Park, Charles City, and in 1918 the species was found nesting near Rockford.

91. *Pandion haliaetos carolinensis* (Gmel.) Osprey. A rare migrant (Webster). My only record of the species is a single specimen seen near Hackberry Grove on May 28, 1916.

92. *Aluco pratincola* (Bonap.) Barn Owl. Rather plentiful as late as 1881, according to a note made by W. C. Miles, and found with his collection. Webster says that, so far as his observations show, the species was never more than uncommon, and disagrees with the Miles record. At present the Barn Owl is a rare resident. A pair nested in Charles City
in 1914, and Howard C. Brown and I had, for a short time, one of the young ones, fallen from the nest.

93. *Asio wilsonianus* (Lesson.) Long-eared Owl. This species is a more or less uncommon resident. In 1917 two pairs nested in Waller's Woods, about 2 miles northeast of Charles City. C. Herbert Belanski reports it from Nora Springs, and the Charles City High School possesses a specimen collected near Rockford in 1904.

94. *Asio flammeus* (Pontoppidan.) Short-eared Owl. A common owl, nesting in the sloughs north of Charles City and near Floyd, and west of Charles City. Specimens have been taken from Charles City, Floyd, Nora Springs, Rockford, and Devonia.

December 3, 1914, Howard Clarke Brown and myself examined the stomach of a specimen taken near Charles City. One mouse much digested, and another evidently recently swallowed, along with a quantity of hair, were found. On December 3, 1915, a specimen was examined, the stomach contents being a partly digested mouse. January 19, 1916, I examined the stomach of a specimen taken near Orchard, the only contents being some rodent bones and a ball of mouse hair. The first two specimens were females, the last, a male.

95. *Strix varia varia* (Barton.) Barred Owl. A common species in all seasons. I have observed it at Charles City, Floyd, Rockford, Nora Springs, and Nashua in Chickasaw County. They nest in woods near all of these towns. No examinations of stomach contents were made.

96. *Cryptoglaux acadica acadica* (Gmel.) Saw-whet Owl. A rare winter visitant. I saw one specimen on January 6, 1917, and another on November 27 of the same year. These are my only records.

97. *Otus asio asio* (Linn.) Screech Owl. The commonest owl of the region, the gray phase being the more common. I have found the species nesting at Charles City, Floyd, and Rockford. In 1915 and 1916 C. Herbert Balanski reported it as nesting at Nora Springs, and Webster reported in from Devonia (then Lithograph City) in 1915, 1916, and 1917.
98. *Bubo virginianus virginianus* (Gmel.) Great Horned Owl. This species is uncommon in Floyd County. On March 7, 1918, I located a nest with incubating bird in Brackett's woods; this is the only nest record that I have. C. Herbert Belanski reports the species from Nora Springs, and I saw a specimen killed near Rockford in 1918 (December). On the 24th of December, 1918, I received for mounting a large male shot between Charles City and Floyd. The stomach contained the flesh and feathers of a pigeon, along with some hair, probably of a rabbit.

99. *Nyctea nyctea* (Linn.) Snowy Owl. A rare winter resident. December 23, 1913, I saw a specimen near the Cedar River, about two miles south of Charles City. In May, 1917, I saw the remains of one of these birds nailed to a fence in Nora Springs, and on inquiry learned that the bird had been killed in the preceding February. The Charles City High School has two specimens, one without locality or date, the other taken near Carrville in 1908.
The First Robin.

Great pleasure is always experienced by everyone at the announcement of the arrival of the first robin. Newspapers will print any reliable report of this bird's appearance as being of general interest to their readers. To the average person the robin is the first of birds to return, and naturally its presence is hailed as one of the earliest signs of approaching spring. The arrival of the first robins usually occurs on one of the last days of winter, when the cold weather is relenting. While this is true, it does not necessarily follow that warm days will at once bring sunshine and cheer; for often after the robins have come there will be periods of inclement weather. In fact the robin seems to enjoy cold winds and rains, and will sing contentedly while gloom wraps earth and sky.

Not all of the robins leave us in winter. Any diligent bird lover who goes out regularly in December and January will be likely to see at least one robin in his walks. The writer had this good fortune on December 3, 1922, and acquaintance of his expressed surprise at finding a robin in January of the present year. In 1918, in mid-winter, during unusually cold weather, robins were seen almost daily for a month. The vigor of that season had probably driven all the robins which were wintering farther north to places where they could obtain food and water. The newspapers at that time had frequent reports of wandering flocks of robins in the northern states.

The robins that appear in the latter part of February are not winter residents, but are the vanguard of the mighty army of migrants which will soon spread over the northern states. The robin records obtained by the writer in February for eight years are as follows:—1911, Feb. 25; 1915, Feb. 13; 1916, Feb. 22; 1917, Feb. 23; 1919, Feb. 28; 1921, Feb. 27; 1922, Feb. 21; 1923, Feb. 28. The average date for the month of February, from these records, is the 23rd. The condition of the weather in February of these years may be judged by the dates of arrival of the robin. When the month
of February is very stormy and winter lingers into March, the first robin will not appear until there is a mitigation of the elements.

The March records which I have obtained in six years for the first robin are—1919, March 2; 1910, March 1; 1912, March 14; 1913, March 9; 1914, March 13; 1920, March 10. These dates give as an average, March 8. Between this date and the average for February then are fourteen days. As only four dates in March occur in the second week, we may conclude that normally the first robin will appear either in the last week of February or in the first week of March. Earlier or later dates are so rare that they may be regarded as exceptional or unreliable. As a matter of fact, when I have found the first robin later than March 8th, I have heard of other observers who made earlier records; and so I have concluded that my late dates for the first robin were not the correct ones.

Brother Alphonsus, C. S. C.,
Notre Dame, Indiana.
In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. All other books for review should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.

**Darwinism and Catholic Thought** by Canon Dorlodot, D. D., D. Sc.
Translated by the Rev. Ernest Messenger of
St. Edmund's College, Ware.

This is a 16 mo. of 184 pages, and 8 additional pages in the table of contents. On the title page we read, "Vol. One; The Origin of Species." There are two conferences in this volume dealing with the origin of species, and the author promises another conference, or, perhaps, several other conferences on the descent of man.

The first conference deals with "Darwinism and the Work of the Six Days." The second conference treats "Darwinism in the Light of Catholic Tradition and Catholic Philosophy." The book was written as a rejoinder to certain criticisms that were made on the address of the author, delivered as official delegate of Louvain before the University of Cambridge on the occasion of the Darwinian centenary. The conferences were "delivered during the war before the professors of the University of Louvain at the invitation of the rector." (From the foreword to the French edition.)

The general question that is treated in the two conferences is,—"What judgment must we pass upon the Darwinian theory from the point of view of Catholic orthodoxy, if we leave out the special subject of the origin of man?" (p. 3). The fundamental teaching of Darwin is summed up in two propositions;—

1) The primary origin of living things is the result of a special influence on the part of the Creator, Who infused life into one or a few elementary organisms.

2) These organisms, by evolving in the course of ages, have given rise to all organic species which exist at the present time, as well as those that have come down to us only in the fossil state. (p. 4).

Dorlodot calls this a "fairly moderate system of Natural Evolution" and says that opposed to it are two "extremist opinions, Absolute Evolution and Creationism or Fixism."

"Absolute Evolution denies the special intervention of God, even in the origin of life; it attributes the first origin of living beings to a natural evolution of inorganic matter, which became organized and
ultimately living matter by the simple action of forces, or, better still, of powers inherent in matter, or which at least were inherent in it in days gone by."

"The creationist theory admits a special intervention of God at the beginning of each of the groups which we now call species."

Between these two extremes there are many theories.

The guiding principles of the Catholic interpretation of the Sacred Scriptures are, according to Dorlodot,

1) The Encyclical Providentissimus Deus of Nov. 18, 1893, and,
2) The decrees of the Biblical Commission.

The author examines the general question in the light of the two guiding principles just mentioned, and arrives at the following conclusion,—

"We cannot find in Holy Scripture, interpreted according to the rules of Catholic exegesis, any convincing argument against the theory of natural evolution—even that of absolute evolution, for the sacred text does not justify the conclusion that the appearance of species was due to a special intervention on the part of God."

A number of statements in the first Conference seem to call for comment. On page 11, for instance, we read,—"And, speaking generally, we must reject a priori any interpretation which would make a text of Holy Writ a divine instruction upon a subject belonging to the physical or natural sciences." The translator seems to have foreseen that this statement would not go unchallenged. To forestall criticism, he quotes two propositions from the encyclical of Leo XIII., which, he says, warrant the author's conclusion. The propositions are;—

"1) The Holy Ghost so moved the sacred writers that they wrote all those things and only those things which He Himself ordained, and
2) The Holy Ghost, who spoke through the sacred writers, did not wish to teach men those things which He Himself ordained."

On page 39, we read,—"the term reptile does not mean for a naturalist a crawling animal, and this is especially true of the reptiles of the secondary epoch."

This statement is, at least, inexact. Snakes, lizards, etc., are certainly "crawling animals" in the sense of the author. But the naturalist comprehends all of them under the term "reptile."

Again, on page 40 there is this statement,—"the birds of to-day no longer possess teeth." This is true of adult birds. But the embryo has, if not actual teeth, at least the dental ridges. (Kingsley, p. 231).

The second conference,—"Darwinism in the Light of Tradition and Catholic Philosophy"—contains four propositions. These are;—

1) The teaching of the Fathers is very favorable to the theory of absolute natural evolution;
2) Aristotelian scholastics generally limited the theory of absolute natural evolution to a section of living beings for scientific reasons (spontaneous generation) but still, all the doctors remained faithful to
the spirit of Christian naturalism. Provided we remain faithful to this spirit, we are free to accept, at least provisionally, a less radical solution than that of absolute natural evolution, if the present state of science makes it advisable;

3) The application of the principles of Catholic Theology and Philosophy—principles themselves certain—to the concrete data of the sciences of observation, elevated into an absolute certainty the conviction of the simple naturalist who holds a very radical system of transformism. Such application leads us to accept at least as eminently probable the theory which derives all living beings from one or a few very simple types of organisms, which is Darwin's own view. On the other hand, since there are scientific difficulties against the theory of absolute evolution, Darwin's special hypothesis of a special intervention on the part of God at the origin of life seems legitimate, at least for the time being.

4) The Catholic theory concerning the natural activity of secondary causes is capable of explaining a natural transformist evolution as Darwin understood it, and entitles us to reject as entirely superfluous the additional special intervention postulated by those who hold the fixity of specie or by the moderate creationists. (pp. 5-6).

In his proof from tradition, Dorlodot mentions that "the Fathers who dealt with this matter, up to the 8th century, are unanimous in holding that there was no special divine intervention in the formation of the world beyond the creative act by which God called forth the universe from nothing at the beginning of time." (p. 66). The Fathers mentioned are Origin, Gregory of Nyssa and Augustine. Dorlodot seems to have some doubts about the authority of Origin because this Father "while holding the creation of the world from nothing, thought that this creation was eternal." Now there can be no question of a "natural evolution of the world, for if everything was made simultaneously there is no room for evolution." But "neither is there room for special divine interventions chronologically distinct from the creative act at the beginning of things." (p. 70).

Gregory's theory is called a "theory of absolute evolution in the case of living things as well as the organic world. It formally denies any special intervention on the part of God other than the unique impulse, the mia hrope, of the original creation." (p. 79).

The works of St. Augustine on which Dorlodot bases his conclusions as to that Father's opinions on this question are;—De Genesi contra Manichaeos, Confessions, De Genesi ad litteram, Chapters XI., XII., XIII., of the Civitate Dei. The teaching on evolution is in the twelve books De Genesi ad litteram. There is only a parenthetical reference to the Retractationes. The author's conclusion in regard to St. Augustine is that this Father was the firmest believer in absolute natural evolution, and, if "inaccurately translated texts had not stopped him, we should be able to place St. Augustine side by side with St. Gregory of Nyssa as
one of the upholders of the evolutionary origin of the inorganic world as well as the organic world."

Dorlodot thinks that Darwin did not go far enough and that if we follow the Fathers of the Church, we must go further and accept absolute natural evolution. He himself is not quite ready to go that far. In fact, after reading this book, one is not quite clear as to the exact position of the author.

A final example of the author's method will not be out of place. On page 89 there is a statement to the effect that it is unreasonable to say that the ovum of a given species cannot develop without fertilization because to-day, the eggs of sea urchins are hatched parthenogenetically. The fact of the parthenogenetic development of sea urchin eggs, as also the eggs of other animals, will not be denied by any present-day biologist. But from the hatching of an ovum to the origin of an animal from no ovum at all is a pretty far cry. It is also suggested—page 90—that "conditions for spontaneous generation of certain animals may have been present in the first ages of the world which are no longer present to-day." The author seems here to forget entirely that the one point which is stressed throughout the whole book is that the same natural laws are operative now as were operative in the beginning.

It seems to us that, on the whole, this book is not deserving of the importance that some press notices attach to it. The entire ground covered in the book has been covered,—and in our opinion much more thoroughly,—thirty years ago by the Rev. Dr. John A. Zahm, C. S. C., in his "Evolution and Dogma." Dorlodot's book is brief and concise. But it contains merely the old materials worked over. We discovered nothing new.

Francis J. Wenninger, C. S. C., M. S.
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Nortonechinus, a Devonian Echinoid.

CARROLL LANE FENTON AND MILDRED ADAMS FENTON.

Among the fossils of the Hackberry Stage of the Upper Devonian of Iowa there occur numerous fragmentary remains of echinoderms. The most common of these consist of the plates and spines of an echinoid, called by Mr. A. O. Thomas, of the University of Iowa, *Nortonechinus*. So far as we are aware, the name has been used in print only in papers by the senior author,¹ who was under the impression that Mr. Thomas had described the genus, since he used the name. Since, after six years of waiting, no diagnosis has appeared, we publish the accompanying description of the fossil indicated by Thomas's nomen nudum.

Phylum ECHINODERMATA
Class ECHINOIDEA Bronn.
Genus NORTONECHINUS Thomas (nom. nud.)

Genotype: *Nortonechinus primus* n. sp.

_Description._—The general form of the genus is not determinable; probably it very closely resembled that of the modern *Colobocentrotus*,² except that the outer spines are long and sharp instead of flattened. The spines are short and heavy over most of the body, with flat, polygonal outer surfaces, that evidently fit together so as to form a natural armor-plate. The flat surfaces are variously patterned, with rows of granules and bosses. There are variations in the spines, some of them

²See Lankester's *Treatise on Zoology*, part 3, Echinoderma, by F. A. Bather, pp. 313-314, fig. 34.
being irregularly conical, and others rounded, with sharp points fringing the distal ends, and are without definite pattern on the outer portion, with an excentric elevated central portion, generally roughly polygonal, which bears in the center an elevated boss for the attachment of the spine, and near the periphery a series of small knobs or granulae.

Remarks.—This genus is based on a single species, *N. primus*, of which remains are common in the Hackberry stage. It is distinguished by the shape of the plates and their ornamentation, and the distally enlarged spines.

**NORTONECHINUS PRIMUS** n. sp.

Plate, Figs. 1-8.

*Description.*—This species has been fully described in the genus diagnosis. The commonest spines are the broad, flattened ones, which evidently covered the general surface of the body. Other types are the elongate-polygonal ones, and the heavy, club-shaped forms, which are marked by fine vertical lining, and in the latter case, are without granulose ornamentation on the distal surfaces. These two types of spine are uncommon, but may be found associated with the flattened ones. The third type is that shown in Fig. 6: an elongate spine, heavier at the proximal end than at the distal. The length of one of these, which is incomplete, is 16 mm.; diameter at base 2.7 mm.; diameter about midway of the length 2.8 mm. Probably these spines correspond in position to the long, flattened ones of *Colobocentrotus*.

 Remarks.—The writers are particularly indebted to Dr. Stuart Weller for assistance in working out this, the most characteristic of the Hackberry echinoderms.

*Distribution.*—Throughout the Spirifer zone of the Hackberry, near the base of that division.
Nortonechinus, a Devonian Echinoid.

EXPLANATION OF PLATE.

Nortonechinus primus n. sp.

Figs. 1-2.—Obverse and reverse of a plate. x 2.
3-4.—Distal and lateral views of a typical spine. x 2.
5.—Drawing to illustrate the attachment of spine to plate. x 2.
6.—Mass of plates and spines. The spines probably are those of the periphery. x 1.
7-8.—Distal and lateral views of another type of spine, which is marked by vertical striae. x 4.
The Marchantiaceae of Sinsinawa Mound.

Sister M. Ellen.

This family is represented by three species: Marchantia polymorpha, Conocephalum conicum, and Preissia commutata, all of which grow in abundance and fruit luxuriantly year after year in the locality of Sinsinawa Mound, Grant County, Wisconsin. The writer has been interested in observing and noting the seasons for the discharge of the spermatozoids, reduction division, and the subsequent development of the sporophyte and spore dissemination in each of the three species. All three plants are found in great profusion on the north side of a rock-bound, spring creek, Marchantia polymorpha on the lower level, just at the water’s edge, and, in the rainy weather, sometimes almost submerged; while Conocephalum conicum and Preissia commutata are often very closely associated in dense mats a little higher up on the rocky bank. Preissia commutata is also found far away from water, fruiting most luxuriantly on quite dry rocks.

The spermatozoids of Marchantia polymorpha are often ready for dispersal about May first. However, there is some variation in all of the activities of this plant. This is due not only to differences in the seasons but also to differences in the individual plants. The variations in the time of fertilization are easily noted in Marchantia polymorpha by the unevenness in the elongation of the stalks of the archegonial heads as these stalks begin to lengthen only after fertilization has occurred. The formation of the tetrads occurs as early as June fifteenth and the spores are ripe about the first of July. It is quite possible sometimes to collect plants that are much less mature at this time.

In Conocephalum conicum, the spermatozoids are discharged about June fifteenth and there is considerable uniformity in

---

the time of the fertilization process of this species. Probably most of the zygotes are formed by the first of July. Reduction division takes place in the spore mother cells of Conocephalum conicum in the early part of September and the fully developed spores begin to germinate within the capsules late in September or early in October, and continue cell division until the eight-celled stage is reached. Here they rest until spring, when cell division is resumed and continues until the thirty-to forty-celled stage is reached. Simultaneous with the last of the intra-capsular divisions of the young sporelings, the stalk of the carpocephalum and the foot and seta of the sporophyte elongate rapidly by the growth of their cells. The sporelings are disseminated about the twentieth of April. One usually can not find sporophytes intact after the first of May.

The discharge of the spermatozoids of Preissia commutata, quite unlike those of Marchantia polymorpha and Conocephalum conicum, does not occur until October. There is some development of the sporophytes in the fall, but there is little differentiation of sporogenous cells until the following spring. With the opening of spring, the sporophytes develop rapidly, so that the tetrads and, sometimes even the mature spores and elaters, are dispersed as early as April twentieth. Spore dispersal is usually complete by May tenth. The present year, is, nevertheless, a notable exception to the general rule, as the season has been usually late, particularly so in that locality. The tetrads were not formed earlier than May tenth this year. Since the principal part of the development of the sporophyte of Preissia commutata occurs in the early spring, this plant is particularly affected by a late season. The spring activities of Conocephalum conicum and Marchantia polymorpha appear to be less retarded, although fertilization in the latter form will probably be considerably later this year.

It is somewhat interesting to note the rather short period between fertilization and spore dispersal in Marchantia polymorpha as compared with the corresponding, very long periods, almost ten months, in Conocephalum conicum and, between seven and eight months, in Preissia commutata. The season for collecting spores and elaters in each of the three plants is
also interesting. Spores of Conocephalum conicum, in some stage of development, from the tetraspore stage to the multicellular sporelings, are available any time between the first of September and the latter part of April. The opportunity for collecting spores is reduced in Preissia commutata to less than a month in any season, and this period, though more variable, is probably not much longer in Marchantia polymorpha.

Rosary College,
River Forest, Illinois.

Birds in the Vicinity of Rosary College, River Forest, Illinois.

ROSE E. KERBER.

River Forest is located about ten miles west of Chicago on the Des Plaines River. Situated as it is, in the midst of the expansive Forest Preserves of Cook County, bird life is abundant. The birds here noted were observed between October fifteenth and June fifteenth. The list, by no means, includes all of the species which may be found in this vicinity, for those named were seen on weekly botany excursions of a few hours each and were more or less casual observations, as the writer's chief attention on these field trips was directed to the study of plants. The birds listed below, with few exceptions, seemed to be very common. This is especially true of the ring-necked pheasants, of which as many as thirty were seen at one time in an old corn field adjacent to the college campus.

The list is as follows:

Order Passeres:

1.—Turdus mustelina—Wood Thrush.
First observation was April 14. This bird was seen on almost every trip thereafter.

2.—Merula migratoria—American Robin.
Very common after the latter part of March. Few were observed before March 23, and were never seen in groups.

Arrived in early spring. A flock of eight were seen on March 27. After that several were observed, but always singly or in pairs.


Found hopping from branch to branch in the bushes along the Des Plaines River on April 14.


Observed only a few times along the Des Plaines River. First observation was on May 10. Was not seen after June 1.


A resident. Found chiefly in low bushes along the river. Observed on almost every trip.


Is a winter resident. Quite common in Forest Preserves. Observed the first time on October 28.


A summer resident. Seen as early as April 14.


Very common. A summer resident, observed almost daily after April 14.


Very numerous. Heard or seen daily after May 28.


Not very common. Observed on and after April 14.


Very common. Summer resident. First observation was on April 14. Often seen after that.


Observed only once, May 23, on College Campus.


Common summer resident. First observed May 10.
15.—*Vireo olivaceus*—Red-eyed Vireo.  
Observed May 21, and several times after that.

16.—*Lanius ludovicianus*—Loggerhead Shrike.  
Two were seen fighting a blue jay on June 21.

17.—*Ampelis Cederorum*—Cedar Waxwing.  
Observed frequently in Forest Preserves after March 3.

18.—*Chelidon erythrogaster*—Barn Swallow.  
Not very common. A group of three were seen on May 26.

19.—*Clivicola reparia*—Bank Swallow.  
Several were seen along the Des Plaines River May 21.

20.—*Piranga erythromelas*—Scarlet Tanager.  
Observed May 23 on College Campus. Heard a couple of times after that.

21.—*Passer domesticus*—English Sparrow.  
Numerous and very common, winter and summer.

22.—*Spinus tristis*—American Goldfinch.  
Several observed in group near Lemont May 21.

23.—*Spizella pusilla*—Field Sparrow.  
Not very common. Observed May 10 in field along the Des Plaines River.

24.—*Junco hyemalis*—Slate-colored Junco.  
Very common throughout winter. Last ones observed April 1.

25.—*Melospiza georgiana*—Swamp Song Sparrow.  
Observed only once on May 21, running through the high grass.

26.—*Cardinalis cardinalis*—Cardinal.  
Observed several times. First observation was April 14.

27.—*Habia ludoviciana*—Rose-breasted Grosbeak.  
Common summer resident. First observed May 10.

28.—*Passerina cyanea*—Indigo Bunting.  
Not very common. First observation was May 21. Seen a few times after that.
29.—*Molothrus ater*—Cowbird.
   Observed a group of six in a vacant lot June 17.

30.—*Sturnella magna*—Meadowlark.
   Summer resident. Observed April 2 for first time. Very common.

31.—*Dolichonyx oryzivorus*—Bobolink.
   Common summer resident. Seen many times after May 26.

32.—*Chondestes grammacus*—Lark Sparrow.
   Observed a few times in fall after October 21. Not very numerous.

33.—*Icterus spurius*—Orchard Oriole.
   Not common in this region. Observed only once on June 16.

34.—*Icterus galbula*—Baltimore Oriole.
   Not common. Observed June 13 on College Campus.

35.—*Scolecophagus carolinus*—Rusty Blackbird.
   Observed in groups, often with purple grackles. First observation was March 24.

36.—*Agelaius phoeniceus*—Red-winged Blackbird.
   Common in swamps near Forest Preserves. Several observed in group October 28.

37.—*Quiscalus quiscula*—Purple Grackle.
   Usually seen in large flocks. Observed October 21, and many times in the spring.

38.—*Cyanocitta cristata*—Blue Jay.
   Very common and numerous. Few observed now and then throughout winter. Marked increase in number after May 6.

39.—*Corvus Americanus*—American Crow.
   Very common. Resident.

40.—*Tyrannus Tyrannus*—Kingbird.
   Common summer resident. Several observed May 21.
41. — *Myiarchus crinitus* — Crested Flycatcher.
   Pair observed on College Campus several times.

42. — *Sayornis phoebe* — Phoebe.
   Common summer resident. Observed October 28 and May 27. Heard call several times.

43. — *Contopus virens* — Wood Pewee.
   Summer resident. Observed June 13 on Campus.

Order Macrochires:

44. — *Antrostomus vociferus* — Whip-poor-Will.
   Rare. Heard only once on May 2.

45. — *Chordeiles virginianus* — Nighthawk.
   Heard and seen almost every evening at dusk. Rather numerous.

46. — *Chaetura pelagica* — Chimney Swift.
   Very common and numerous since May 1. Can be seen every evening.

47. — *Picus pubescens* — Downy Woodpecker.
   Common resident. Observed frequently in Forest Preserves.

   Very common and numerous. Present throughout year.

49. — *Colaptes auratus* — Flicker.
   Present all year, but more numerous during summer. Common after May 1.

50. — *Coccyzus americanus* — Yellow-billed Cuckoo.
   Observed several times since June 1 on or near Campus.

Order Raptores:

51. — *Megascops asio* — Screech Owl.
   Heard only once in Forest Preserves on October 31.

52. — *Accipiter cooperi* — Chicken Hawk.
   Common resident. Seen October, November, and several times since March.
53.—*Zenaidura macroura*—Mourning Dove.
Numerous and common in Preserves. Common after April 19.

Order Gallinae:
54.—*Colinus virginianus*—Quail.
Not very common. Observed May 26, and once after that.
55.—*Phasianus torquatus*—Ring-necked Pheasant.
Very numerous and common. Seen daily in flocks of twenty or thirty all winter. Call heard frequently every day this spring.

Order Anseres:
56.—*Anas Boschas*—Mallard.
A flock of fourteen was seen flying over the Des Plaines River March 27.
57.—*Branta canadensis*—Canada Goose.
Three were observed near the Des Plaines River April 18.

Order Longipennes:
58.—*Larus argentatus smithsonianis*—American Herring Gull.
Commonly seen near river or flying over the College Campus. A large flock observed January 13.
59.—*Sterna hirundo*—Common Tern.
Observed near river several times after April 17.
60.—*Sterna* Black Tern.
Seen with Common Tern. Usually present in numbers.

Order Limicolae:
61.—*Oxyechus vociferus*—Kildeer.
Heard once along the road on May 26.
62.—*Gallinago delicata*—Wilson Snipe.
Heard only once on April 2.

*Rosary College.*
*River Forest, Illinois.*
100. *Coccyzus americanus americanus* (Linn.) Yellow-billed Cuckoo. This species is a common summer resident, arriving from May 28 to June 10, depending somewhat upon the season. Nests are built shortly after the birds arrive, and eggs are laid in late June or early July. In the woods along the Cedar River both north and south of Charles City, and in the town itself, the species is very common.

101. *Coccyzus erythropthalmus* (Wils.) Black-billed Cuckoo. A species about as common as the preceding and closely associated with it. It arrives somewhat earlier, my earliest record being May 13, 1914. By the last of May it is present in considerable numbers and nesting begins before that of the Yellow-bill. In general this species frequents towns less than the preceding, though this conclusion may be open to question.

I have found Brewster's (Chapman, Handbk. Bds. of Eastern N. A., 1916, 320) a very reliable means of identification. In cases where the bird was not seen, or was seen indistinctly, I have relied upon it. All important records, however, are based on sight.

102. *Ceryle alcyon* (Linn.) Belted Kingfisher. A common summer resident, occasionally remaining throughout the winter. It arrives in the second or third week of March and remains until late October or early November. In 1920-21, a light winter, the Kingfisher stayed throughout the year, being seen on December 27 and 30 by Howard Clarke Brown. In both cases the birds were near Cedar River.

Nesting takes place in May, along the banks of streams and to a lesser extent in the walls of sandpits and other cuts. The birds are commonly seen about Willow Pond, but have not been found to nest there. They show little fear of man,
commonly perching on cables crossing the river at Main street in Charles City, and they seem in no way annoyed by the people, vehicles and street cars.

103. *Dryobates villosus villosus* (Linn.) Hairy Woodpecker. A common species in autumn, winter and spring; less common in the summer. I have found them throughout the summer at Rudd, Nora Springs, Rockford, Marble Rock and Charles City, as well as at various localities throughout the county. On August 28, 1918, I identified three individuals at Hackberry Grove.

104. *Dryobates pubescens medianus* (Swains.) Northern Downy Woodpecker. A common resident, particularly in the winter. It is more common in the towns than is the Hairy Woodpecker, nesting even in the closely settled portions of Charles City. In the country woodlands its nests are not at all uncommon, and I have found them in various parts of the county.

105. *Sphyrapicus varius varius* (Linn.) Yellow-bellied Sapsucker. A common migrant and summer resident, most common in April. February 12, 1916, I saw two specimens in the northern part of Charles City. Most of my records fall between April 8 and April 20. It has nested in Charles City in all of the last seven years. In 1917 and 1918 it was found nesting at Hackberry Grove. In the summer of 1919 a pair nested near the bridge over the Shell Rock at Rockford.

106. *Melanerpes erythrocephalus* (Linn.) Red-headed Woodpecker. A common summer resident and uncommon winter resident. H. C. Brown and I have identified them on January 2 and 5, 1917; I have records for January 16, February 10 and December 26, 1918. There are several other winter records, indicating that it is by no means unusual for the species to remain throughout the year. The spring migration begins with a few scattered individuals in late March or early April. Numbers of arrivals gradually increase until the height of the migration is reached in the last week of April and the first of May. Mr. Webster and I have on two occasions noted these birds catching insects on the wing.

107. *Centurus carolinus* (Linn.) Red-bellied Woodpecker. Rare visitant. I have one sight record for May 8, 1915. I
was able to examine the bird closely, and think the identification reliable.

108. *Colaptus auratus luteus* Bangs. Northern Flicker. The commonest woodpecker in the region. It arrives as early as March 4, while in 1915 we did not see any of the birds until April 8. The species seems to take kindly to suitable nestboxes where they are provided. I have been told of the birds nesting in a deep railway cut along the C. C. W. tracks in the east part of Charles City, but did not see the nest. They occasionally attempt to place nests in the gables of barns if a foothold is afforded. I have observed two such cases.

109. *Antrostomus vociferus vociferus* (Wils.) Whip-poorwill. A rare summer resident in the region. My only records are: August 21, 1916, one specimen north of Charles City; September 5, 1920, one (or two?) specimens in Brackett's Woods. Webster, Waller, Mrs. M. A. Dutton, and others state that twenty years ago the species was quite common.

110. *Chordeiles virginianus virginianus* (Gmel.) Night-hawk. This species makes up in numbers what the Whip-poor-will lacks, being very common. It arrives about May 15, and nests early in June. In the early evenings it is seen in considerable numbers both in the country and in the towns. On the evening of August 23, 1918, I counted sixteen of these birds in the air at one time near Rockford.

111. *Chaetura pelagica* (Linn.) Chimney Swift. An abundant summer resident. The earliest arrivals are in mid-April, but the bulk of the migration arrives in the first week of May. They depart in the first two weeks of September. Mr. Webster states that he has found the birds nesting in hollow trees, but no such cases have come under my observation.

The autumn congregation begins in the second or third week of August. At that time great flocks may be found about various favorite chimneys in the towns, and small flocks at some farm-houses. A favorite resort of these birds at Charles City is the old main building of the one-time Charles City College. There are probably thousands of birds
to be found in the several huge chimneys, the deserted attic, and the tower of the building.

112. *Archilochus colubris* (Linn.) Ruby-throated Hummingbird. This species appears as early as May 6 (1913 two specimens, Charles City,) the bulk of the birds appearing in the third week of the month. They nest commonly, though irregularly, throughout the county and seem to vary in numbers from year to year. They usually leave in the second and third weeks of September.

They are popularly confused with the large Tomato Sphinx moth (*S. maculatus*) when on the wing. Strangely enough, a distinction is not always made between the two when dead specimens (mostly of the moth) are found. This is, to my mind, an extreme example of the carelessness with which the average person observes the animals about him. I have several times been called on to explain the differences between a Sphinx and a bird!

113. *Tyrannus tyrannus* (Linn.) Kingbird. This species is a very common summer resident of Floyd and adjoining counties. It arrives in early May, with the bulk of the migration appearing between May 15 and May 24. Numbers decrease in late August, and by the middle of September most of the birds are gone. On September 21, 1920, I saw two Kingbirds at Willow Pond, the latest date I have for the species.

114. *Myiarchus crinitus* (Linn.) Crested Flycatcher. An uncommon migrant and rare summer resident. In the summer of 1916 a pair nested near St. Charles church, and in 1918 I found two nests along the Cedar River southeast of Charles City. On August 4, 1916, two individuals were seen at Rockford.

115. *Sayornis phoebe* (Lath.) Phoebe. The commonest flycatcher in the region is this species, which arrives in late March and early April. In 1915 the species was observed in Charles City by H. C. Brown and myself on March 21, the earliest date of which I have record.

117. *Octoris alpetris praticola* Henshaw. Prairie Horned Lark. A common summer resident, perhaps remaining all winter. Reports have come to me that these birds were seen in February and very early March of 1918; in 1916 Howard Clarke Brown saw a flock on March 12, in Oak Park. Breeding apparently does not begin until early April. The species is more common in the western and northern portions of the county than about Charles City.

118. *Cyanocitta cristata cristata* (Linn.) Blue Jay. A common resident throughout the year, although a partial migration is noticeable in middle or late October. The return migration is so gradual that it cannot be recorded. The first eggs are laid in late April, the second set at various times in June. The species is particularly abundant in brushy areas in Wildwood Park, southwest of Charles City, and in the Waller Woods.

119. *Corvus corax sinuatus* (Wagl.) Raven. Anderson states: Mr. George H. Berry reports that a correspondent observed a specimen near Rockford, Iowa, in 1900, feeding with crows. It was also observed to be much larger than the crows, which makes the record appear probable.” There are questionable reports of the species from W. T. Swartz, now of Elkader, Iowa, but for many years a resident of Charles City, and from John R. Waller. Webster says that in 1914 he saw what he took to be a Raven with a flock of crows at Devonia.

120. *Corvus brachyrhynchos brachyrhynchos* C. L. Brehm. Crow. An abundant resident in all parts of the county, and in adjoining counties. Nests are built in rather small trees, the eggs being laid in April. I have found nests near Charles City, Rudd, Nora Springs, Rockford, Marble Rock and Carrville; also in the neighborhood of Devonia and in the woods north of Floyd.

The only roost that has come under my observation is located in a woodland near Devonia. Webster, who watched this roost for several years, reports that the number of birds varies widely, from less than 200 to approximately 3000. In mid-August, 1915, the flock numbered about 250 birds; in September 1916 at least 500 were seen in one flock. The
average number during winter, according to Webster, is about 1000 birds, or somewhat less.

121. *Dolichonyx oryzivorus* (Linn.) Bobolink. Common migrant and summer resident. My arrival dates range between April 29 and May 8, most of the birds arriving in mid-May. The nests are placed in grassy meadows and slightly used pastures; they are common in the Oak Park "addition" to Charles City, as may be seen by referring to the map of that region. Eggs are laid about the first week of June. Departure takes place in mid-September.

122. *Molothrus ater ater* (Bodd.) Cowbird. The Cowbird is an abundant summer resident throughout the county, arriving in late March (earliest March 25, 1917) to middle April, and remaining until the latter part of October, with an occasional straggler holding over into the first week of November.

The parasitic habits of this bird are notorious, and the slight objection of the foster parents rather remarkable. I have seen young Cowbirds in the nests of Warblers, Vireos, and even Goldfinches. I have two nests, one that of a Yellow Warbler, the other that of a Goldfinch, in which intruded Cowbird eggs have been covered over, and the nest literally made into a two-story affair. Both of these nests secured in Wildwood Park in 1914.

123. *Xanthocephalus xanthocephalus* (Bonap.) Yellow-headed Blackbird. The Yellow-headed Blackbird occurs in Floyd and adjoining counties only as a straggler, and a rare one at that. In most cases the records are for migrating birds, but in the summer of 1914 one was seen at Clear Lake. In the spring of 1913 H. C. Brown and I saw one specimen at Charles City. Webster states that in the 80's the species irregularly nested near Rockford and in the sloughs near Rudd.

124. *Angelaius phoeniceus phoeniceus* (Linn.) Red-winged Blackbird. This Blackbird is a common or abundant

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1 Dr. Stevens Comments:

"I think you are correct in calling it *phoeniceus*, since that is the only thing that has been authorized by the A. O. U. Check-list. Of course if you desired to recognize the more recent proposals for sub-
summer resident throughout the region. My earliest arrival date in March 11, (1918); the greatest numbers arrive in the last week of March and the first week of April. Departure is rather irregular, depending upon the clemency of the autumn, but few remain after the third week of November. Keyes and Williams mention it at Charles City in December.

Few large flocks of these birds are seen, the average being from 150 to 300 individuals. On March 17, 1918, I saw a flock that probably contained about 800 birds—the largest I have seen in northern Iowa.

The birds nest along the swampy borders of the Cedar River, in heavy sloughs, and about ponds. On June 25, 1915, I counted 87 nests in Willow Pond and 14 in the ponds across the Illinois Central tracks. In 1916 a total of 123 nests were counted in these ponds. Nesting is common in the "Cemetery Bayou," and the nests may be reached easily by a person in a canoe. I made no attempt to count the nests in the bayou, however.

16. *Sturnella neglecta* Aud. Western Meadow Lark. A common summer resident, reported in winter by various observers. It arrives March 14th to March 20, nesting in late April and early May. This species is found mostly on the open prairies, the western form occupying the open woodlands and regions about towns.

126. *Sturnella neglecta* (Aud.) Western Meadow Lark. Keyes and Williams state: "In Floyd County it [the Western Meadow Lark] is more common than *S. magna*, and frequents the outskirts of the towns, while *S. magna* is usually found on the prairies" (Bds. of Ia., 1889, 138.) I have not been able to determine that one species is more common than the other, but the distinction as to habitation holds quite well. It is not uncommon, however, to find *S. magna* and *S. neglecta* together, and I consider it probable that they interbreed.

species it would then probably be found that the breeding red-wing in northern Iowa is *A. p. predatorius*, while *A. p. arctolegus* undoubtedly occurs in migration. (In case of adoption of these subspecies by the A. O. U. committee the name phoeniceus will become obsolete. While they have not as yet been officially adopted they have been recognized in various published writings.)"
127. *Icterus spurius* (Linn.) Orchard Oriole. A fairly common summer resident, arriving in the first or second week of May and departing in early September. Eggs are laid in early to middle June; I have found the species nesting near Charles City, Floyd, Rockford and Nora Springs, as well as at various points along the Cedar River.

128. *Icterus galbula* (Linn.) Baltimore Oriole. A common summer resident, arriving May 3 to 12 and departing in early September. It nests abundantly along the road and in towns, but is less commonly found in the heavier woods. Eggs are laid about the first of June. The Baltimore Oriole is much more common than the Orchard, and due to its habits and coloring is more commonly seen.

129. *Euphagus carolinus* (Müller.) Rusty Blackbird. A common migrant from the first week in April to the first of May, and from mid-October to the middle of November. They are quite commonly seen in flocks with red-winged Blackbirds and Bronzed Grackles.

130. *Quiscalus quiscula aeneus* Ridgway Bronzed Grackle. The Bronzed Grackle is an abundant summer resident, arriving in early March and departing in late November. The earliest arrival date recorded in March 2 (1920) by Mrs. W. I. Frederickson of Charles City; my own dates range from March 16 to 24. Nesting takes place in May.

Grackle roosts are quite common throughout the county. In a grove of evergreens on St. Charles Street, in the northern part of Charles City, 243 nests were counted in 1916, 249 in 1917, and 162 in 1918. In 1919 and 1920 there was a great falling off in the number of nests, as well as the number of birds frequenting the roost after the nesting period, only 84 nests being counted in 1920.

About the first of August the birds begin to come in to this roost from distances of more than two miles. The paths of flocks flying above Charles City have been watched by several observers, notably the late Mrs. M. A. Dutton, and fairly definite routes of approach are discernible. From about 500 birds in the nesting season the number swells until in middle August the entire grove is filled with Grackles. On August 15, 1916, I estimated the number of birds at the
roost at about 5000; within a week it increased by at least half. August 17, 1917, I counted 230 birds in one tree, and there were more than forty trees apparently as crowded. Exactly two years later (August 17, 1919) 3000 would have been a liberal estimate of the number at this roost.

Coincident with the partial desertion of the St. Charles Street roost, one was established on East Clark Street, apparently taking up the majority of the birds that had been coming from the southwest to the St. Charles roost. This inference is substantiated by the fact that the southwest route to the latter roost became almost deserted. In middle August, 1919, there were some 1200 birds in the Clark Street roost; within a week the number was about doubled. In 1920 the birds were so numerous, and occupied trees so close to sidewalks that they were decided nuisances. Oddly enough, as the colony increased in size it shifted its location westward toward the business section of town. In 11 days it covered four blocks, and reached a maximum of about 2000 birds.

In an evergreen grove on the grounds of C. G. Patton on the southern outskirts of Charles City is a nesting colony that averages about 125 pairs, with a maximum of about 1200 birds during August. Near Rockford, Nora Springs and Rudd, and in the woods north of Floyd are small roosts, accommodating about 1000 birds each.

131. Hesperiphona vespertina vespertina (Cooper.) Evening Grosbeak. The only data for Floyd County for this species is taken from Keyes and Williams. "It is ... reported from Charles City in March" (Bds. of Ia., 1889, 140.) The record is probably to be attributed to Mr. Williams.

132. Pinicula enucleator leucura (Müller.) Pine Grosbeak. Rare winter visitant; "a few small flocks appeared in the vicinity of Charles City in winter of 1878-79" Keyes and Williams, Bds. of Ia., 1889, 140.) Webster says that he has occasionally seen the species near Rockford in winter. January 5, 1918, a flock of 8 of these birds was seen near my home on east Clark street, Charles City.

133. Carpodacus purpureus purpureus (Gmel.) Purple Finch. The Purple Finch is an uncommon migrant. Howard Clarke Brown saw 3 individuals on Hawkins ave., Charles
City, on March 22, 1912, and several southeast of Charles City on March 28, 1920. September 15, 1916, I saw five of these birds near Charles City, and on November 1, 1917, I saw two near my home on east Clark Street.

134. *Loxia curvirostra minor* (Brehm.) Crossbill. The Crossbill is an irregular and rather uncommon winter visitant, and occasionally a summer visitor. Keyes and Williams state: "Generally seen from the middle of October to the first week in May. At Charles City, during the spring of 1878, it appeared in large numbers, remaining until the end of the first week in May. In July of the same year, a flock was also noticed in Floyd County." (Bds. of Ia., 1889, 141.) Eight of these birds were seen by Howard Clarke Brown at a farm southwest of Charles City on December 30, 1920.

135. *Acanthis linaria linaria* (Linn.) Redpoll. An uncommon and irregular winter visitant, arriving in early November. On November 5, 1916, I saw a flock of 7 near St. Charles Church, on two days later saw a single individual in the northern part of Charles City.

136. *Astragalinus tristis tristis* (Linn.) Goldfinch. A common summer resident; rare or uncommon in winter. The spring arrival begins about the middle of March or first of April, apparently in accordance with the temperature. The early spring flocks commonly number from 100 to 400 birds; on April 30, 1915, I saw, in Wildwood Park, a flock that probably numbered 650 individuals. Nesting begins in early July and continues into middle September. About the last of September small sized flocks appear. On November 20, 1916, a flock of some 20 individuals, in summer plumage, was seen just north of Willow Pond, Charles City.

In view of the fact that Keyes and Williams, Anderson and others, have reported the species as a "common resident throughout the year in all parts of Iowa." (Anderson, p. 312), I have carefully gone over my own records and those submitted to me. As a result I fail to find any evidence that these statements hold good for Floyd County, at least at the present time. Webster classes the species as "uncommon in winter, both near Charles City and Rockford." The Bird Bureau records fail to show it as more than uncommon. My
own winter records, while covering 5 successive years, are only 17 in number. Mr. Brown's are even less.

On the other hand, there is a distinct migration arrival in the spring, with a less distinct one in the fall. Thus the sudden appearance of about 400 of these near my home on March 17, 1918, where not a single individual of the species had been seen within a radius of a mile and a half during winter, and only 43 in a radius of some 5 miles, looks decidedly like migration. In this connection, reference may be made to the migration records given in Table I.


138. *Plectrophenax nivalis* (Linn.) Snow Bunting. An irregular winter visitant. Typical records are: March 12, 1916, Wildwood Park, 1 individual, with Goldfinches; November 3, flock of 21, St. Charles St., Charles City; March 1, 1917, small flock, north of Charles City. (H. Newton.)

139. *Calcarius lapponicus lapponicus* (Linn.) Lapland Longspur. An irregular and uncommon winter visitant, arriving in November. Large flocks are seldom seen.

140. *Calcarius ornat us* (Towns.) Chestnut-collared Longspur. My only reliable record for this species is a specimen from the Miles collection, identified by Dr. Bailey. The specimen was taken at Charles City; no date given.

141. *Pooçoetes gramineus gramineus* (Gmel.) Vesper Sparrow. An abundant migrant and common summer resident. The first arrivals appear in late March, and the species is most abundant about April 15. Departure takes place in early October. Nesting takes place in June.

142. *Passerherculus sandwichensis savanna* (Wils.) Savannah Sparrow. A common migrant, arriving in early April and becoming common in the middle of that month. I have one record, made by Howard Clarke Brown and myself for March 12, (1916.) Some 12 individuals were seen in Wildwood Park. One individual was seen in the vicinity of Willow Pond on July 13, 1917. There are no records of nests having been found.

143. *Ammodramus savannarum austalis* Mayn. Grass-
hopper Sparrow. A common summer resident, arriving in early April and departing about the middle of October. The nests, which are in fields or little-used pastures are built in early June.

144. *Passerherbulus henslowi henslowi* (Aud.) Henslow's Sparrow. A tolerably common summer resident throughout the county, arriving in the first week of April and departing in October. Nesting dates not ascertained.

145. *Passerherbulus lecontei* (Aud.) Leconte's Sparrow. This species seems to be a rather uncommon migrant, arriving in early April. It has been observed near Charles City by Howard Clarke Brown, Mrs. May Tuttle and myself.

146. *Chondestes grammacus grammacus* (Say.) Lark Sparrow. A rather uncommon migrant and an uncommon summer resident. The species arrives in late April or early May, and Mrs. F. May Tuttle, of Osage, Mitchell County, records it for that county in early May.

147. *Zonotrichia querula* (Nutt.) Harris's Sparrow. A rather irregular but common migrant. It arrives from March 24 to April 15, the latter being an exceptionally late date. It passes south about the middle of October.


149. *Zonotrochia albicollis* (Gmel.) White-throated Sparrow. The White-throated Sparrow is a common migrant in Floyd and adjoining counties. The first arrivals are about April 12, and the species becomes common in the course of 3 or 4 days. The height of the migration comes in the last week of April. Autumn records range from September 16 to October 21. In contrast with the White-crowned Sparrow, this species frequents thickets, particularly along streams.

150. *Spizella monticola monticola* (Gmel.) Tree Sparrow. The Tree Sparrow is a common migrant and winter resident, associating with juncos in the winter. It arrives in early or middle October, and is common throughout the winter, departure taking place in early April.

151. *Spizella passerina passerina* (Bechst.) Chipping
Sparrow. Abundant summer resident, arriving in middle or late March, and becoming abundant in the first week of May. Its nests are built in bushes, shade trees, shrubs, vines about houses, and in low bushes in semi-open woods. Eggs are laid about the second week in May. The species seems to prefer nesting near houses, and is very common in Charles City.

152. *Spizella pusilla pusilla* (Wils.) Field Sparrow. A common summer resident in Floyd and adjoining counties. It arrives from April 4 to 19, and remains until the second or third week of October. The first eggs are laid about May 8. The species, along with the preceding, seems to be increasing in numbers rather rapidly.

153. *Junco hyemalis hyemalis* (Linn.) Slate-colored Junco. Abundant migrant and winter resident. It arrives in the first or second week of October and remains until about April 20. The spring migration is at its height in the third week of March, when flocks of from 40 to 400 of these birds may be commonly seen.

154. *Melospiza melodia melodia* (Wils.) Song Sparrow. A common summer resident, arriving from March 17 to April 1. It nests in May, June, and the first part of July, remaining until mid-October. It nests on the ground, usually in or near thickets, particularly near the streams.

155. *Melospiza lincolni lincolni* (Aud.) Lincoln's Sparrow. An irregular and rather uncommon migrant. It usually arrives in the spring about April 25. On March 17, 1918, during an uncommonly warm period, Miss L. E. Kelley and myself saw a flock of 6 of these birds in Oak Park, northeast of the cemetery at Charles City. This is my earliest record for the species.

156. *Melospiza georgiana* (Lath.) Swamp Sparrow. A tolerably common migrant, but seldom seen because of its habits. It arrives April 2 to 10, reaching its maximum in 8 to 14 days later than the first arrival. Passes south during October. Is not known to breed in the county.

157. *Passerella iliaca iliaca* (Merrem.) Fox Sparrow. A rather irregular migrant, common some years and uncommon in others. Spring arrival dates range from March 27 (1916)

158. *Pipilio erythrophthalmus erythrophthalmus* (Linn.) Towhee. The Towhee is a very uncommon or rare summer resident in Floyd, and apparently in adjoining counties. The first record available was made at Osage, in Mitchell County, April 16, 1914, by Mrs. F. May Tuttle. They were reported at Charles City in 1915 and 1916. Howard Clarke Brown recorded the species at the "Cemetery Bayou" bridge, in Charles City, on May 12, 1917, his first record. I saw a single individual near Willow Pond on June 17, 1918, my only record.

159. *Cardinalis cardinalis cardinalis* (Linn.) Cardinal. The history of the Cardinal in Floyd County had been given in some detail by Brown in the Wilson Bulletin [No. 113; pp. 123-132.) The first authentic report of the Cardinal in Floyd County was turned in by Harold Frederickson, of Charles City, who saw a male in Wildwood Park on April 3, 1916. In late June of 1917 a report came from the south part of Charles City, and on July 4 I saw my first Cardinal in Wildwood Park. Since that time the species has been seen with increasing frequency in the neighborhood of Charles City. On January 3, 1920, Clement L. Webster found a pair of Cardinals in his orchard, in the southeast part of Charles City, and several people watched these same birds.

In Mitchell County the Cardinal appeared in 1918, and was seen by Mrs. F. May Tuttle, at Osage, on March 20, 1919, and there are authentic records, supplied to Mrs. Tuttle, for January 4, 1919. It is a rather remarkable fact, to which Mr. Brown calls special attention, that, while the Cardinal was evidently extending its range by following the Cedar River, it appeared in greater numbers at Osage than at Charles City. The species is still to be classed as 'rare' on Floyd County lists, but it is doubtful if it will long remain so.

160. *Zamelodia ludoviciana* (Linn.) Rose-breasted Grosbeak. A common summer resident, arriving from April 15 to May 12. Eggs are laid in early June, and departure takes place in the latter part of September.

161. *Passerina cyanea* (Linn.) Indigo Bunting. A rather
uncommon summer resident, apparently more common in the western portions of the county than in the eastern and central. It arrives about May 10, and probably begins to nest in late June. Departure takes place in middle September. Mr. Brown supplies me with two unusual records: April 7, 1921, seen at Charles City by a Mrs. Page; November 3, 1918, Charles City, by Howard Clarke Brown.

162. *Spiza americana* (Gmel.) Dickcissel. An abundant summer resident, arriving as early as March 17, but ordinarily not before March 25. These dates, it will be noted, are at least a month earlier than those given by Anderson (Bds. of Ia., 330), but are substantiated by a considerable number of observers. Nests are usually in low, bushy trees, and eggs are laid in late June. The species departs in the latter part of September.

163. *Piranga erythromelas* (Vieillot.) Scarlet Tanager. The Scarlet Tanager is a rather unevenly distributed and uncommon summer resident. It arrives in the middle of September. Nests are built in open woods, most of the nesting birds having been seen near the Cedar River, between Floyd and Charles City.

164. *Progne subis subis* (Linn.) Purple Martin. This species is a common summer resident in Floyd County. It arrives from the last of March to the 10th of April. In 1918 the Martins arrived late, my first record being for April 29. Departure begins about September 12, and continues irregularly for ten or fifteen days. In 1914 the Purple Martins were very abundant in Charles City in early to middle May. They built nests in eaves, above awnings on store fronts, and at many other unlikely places. In a walk of three blocks along Main Street, May 13, I counted 18 nests torn from above awning rolls. Since that year the species has never been so abundant about Charles City, but on September 8, 1920, I observed a flock of at least 1500 individuals at Rockford.

165. *Petrochelidon lunifrons lunifrons* (Say.) Cliff Swallow. The Cliff Swallow is common as a migrant and tolerably common as a summer resident in Floyd and Cerro Gordo counties; probably also in Mitchell. It arrives May 14 to 20,
remaining until early or middle September. Nests are built under the eaves of barns and other outbuildings, and very rarely against some cut bank. This original nesting habitat, however, seems to have been virtually abandoned.

166. *Hirundo erythrogaster* (Bodd.) Barn Swallow. This Swallow is the commonest bird of its family in the region. My earliest arrival date is April 26 (1917,) and Mr. Brown did not supply me with any earlier. The date of departure varies from September 4 to 12.

167. *Iridoprocne bicolor* (Vieillot.) Tree Swallow. A tolerably common migrant, and uncommon summer resident. Arrival is from April 26 to May 8 so far as available records show.

168. *Riparia riparia* (Linn.) Bank Swallow. A common summer resident, arriving April 14 to 26 and departing in the second week of September. It nests abundantly in gravel pits, cut banks, and steep hillsides. A colony of from 25 to 40 pairs regularly nests at Hackberry Grove, in Cerro Gordo County.

169. *Stelgidopteryx serripennis* [Aud.] Rough-winged Swallow. A tolerably common migrant but an uncommon summer resident. Arrival is in late April, departure in September. Nests not observed.

170. *Bombycilla garrula* (Linn.) Bohemian Waxwing. The Bohemian Waxwing is a rather irregular and uncommon migrant; so far it has not been observed during the winter. On April 2, 1915, I observed about fifteen of these birds in some evergreens near the center of Charles City. Mrs. Tuttle reports the species at Osage as late as May 22, but Mr. Gabrielson questions the record. On June 8, 1917, Mr. Brown and I saw four birds in Wildwood Park, and think we were accurate in identifying them as *B. garrula*. We were within ten feet of the birds, and the 'chestnut-rufous' tail coverts, emphasized by Chapman, were seen very plainly.

171. *Bombycilla cedrorum* (Vieill.) Cedar Waxwing. An irregular but common migrant; rare summer resident. It appears in the spring in early April, and on into May; in the autumn is seen from about October 20 to the middle of November and occasionally later. I have found no nests, but the
Miles collection contained one of eggs, labelled 'Floyd' but without date. Keyes and Williams (Bds. of Ia., 1899, 149) mention that eggs have been taken at Charles City.

172. Lanius borealis (Vieill.) Northern Shrike. A tolerably common winter resident, arriving in October or early November, and remaining into April. Mrs. Tuttle records it at Osage on October 24, 1914. I have records at Charles City for April 13, 1915, and April 23, 1917. The last is the latest date I have been able to secure.

173. Lanius ludovicianus migrans (Palmer.) Migrant Shrike. A common summer resident, nesting in various parts of the county. Arrives in very late March or early April; nests about the first week of May, raising two broods. It is not uncommon to see a family of six or seven of these birds perched on a telegraph wire or a fence. They seem particularly common east of Charles City.

174. Vireosylva olivacea (Linn.) Red-eyed Vireo. The Red-eyed Vireo is a common summer resident, arriving in early May and remaining until October. Eggs are laid in the first or second week of June. This species is the commonest of the Vireos of Floyd County.


176. Vireosylva gilva gilva (Vieill.) Warbling Vireo. A common summer resident, ranking second to the Red-eyed Vireo. Arrives May 6 to 20; remains until early September.

177. Lanivireo flavifrons (Vieill.) Yellow-throated Vireo. A tolerably common migrant; probably does not nest either in Floyd or adjoining counties. Passes north in late May.

178. Lanivireo solitarius solitarius (Wils.) Blue-headed Vireo. A rare migrant. Howard Clarke Brown and Mrs. F. May Tuttle saw it near Osage on March 29, 1917. I have a record, for Willow Pond, on September 18, 1920.

179. Vireo griseus griseus (Bodd.) White-eyed Vireo. The White-eyed Vireo is a common migrant, perhaps a summer resident. Arrival dates range from April 21 to May 20, with May 12 to 15 as the average.

180. Mniotilta varia (Linn.) Black and White Warbler.
Uncommon migrant. My spring records range from April 11 to May 20; the species passes south in late September. Mrs. W. I. Frederickson records it in Charles City on September 28, 1919. There is no indication that the species nests in Floyd County.

181. *Protonaria citrea* (Bodd.) Prothnotary Warbler. An uncommon migrant which is apparently increasing in numbers. My arrival dates range from May 15 to 22, with the height of the migration between May 16 and 20. I have seen the species in all portions of the county, at Hackberry Grove and at Orchard, in Mitchell County.

182. *Vermivora rubricapilla rubricapilla* (Wilson.) Nashville Warbler. A rare or uncommon migrant. Reported in May, at Osage, by Mrs. Tuttle, and at Charles City on September 28, 1919, by Mrs. W. I. Frederickson. I have not identified the species in the county.

183. *Vermivora celata celata* (Say.) Orange-Crowned Warbler. Recorded at Osage in late May by Mrs. Tuttle; I saw three individuals at Willow Pond on September 23, 1920, and two the following day. The species seems to be a rare migrant.

184. *Vermivora peregrina* (Wilson.) Tennessee Warbler. The Tennessee Warbler is a tolerably common migrant. It arrives in the second and third week of May, or a little earlier, and reappears about the middle of September. It was more common in 1917 than in any of the years since.

185. *Compsothlypis americana usnea* Brewster. Northern Parula Warbler. An uncommon or rare migrant. Brown gives a record for Willow Pond on May 12, 1917. I have no records for the species.

186. *Dendroica tigrina* (Gmel.) Cape May Warbler. The Cape May Warbler is a species which seems to be growing more common in the county, although it is still a rare migrant. Mrs. Tuttle records it at Osage, in Mitchell County, on May 19, 1916.

187. *Dendroica aestiva aestiva* (Gmel.) Yellow Warbler. A tolerably common summer resident. My arrival dates range between May 12 and 15; Mr. Brown furnishes me with a record for May 16; in 1917 it arrived in large flocks. It
nests commonly in the vicinities of Charles City, Rockford, Nora Springs and Osage, the eggs being laid in late May or the first week in June. It is commonly selected by the cowbird as a host.

188. *Dendroica caerulescens caerulescens* (Gmel.) Black-throated Blue Warbler. A rare migrant in Floyd County, and so reported by Mrs. Tuttle for Mitchell. A flock of three, two males and the third probably a female, were seen at "Big Springs," north of Floyd, on May 20, 1918.

189. *Dendroica coronata* (Linn.) Myrtle Warbler. An abundant migrant, arriving as early as April 10. It reaches its height about a week after the first arrival, and remains until about May 15. The southward migration takes place in October.

During the spring these birds are to be met with almost everywhere, both in town and in the country woodlands. They flock about door-yards, in the parks, and along the streams. Flocks of some hundreds (estimated 400 to 600) have been seen at Willow Pond and in the immediate neighborhood. During the autumn migration they are less conspicuous, and travel in smaller flocks.

190. *Dendroica magnolia* Wilson. Magnolia Warbler. The Magnolia Warbler is a common migrant in Floyd, Mitchell and Cerro Gordo counties. The earliest arrival date recorded is for Charles City, April 23, 1916, when Howard Clark Brown and I saw a small flock. The height of the migration follows about a week after the first arrivals are noted. In 1918 the migration of these Warblers was delayed, my first record being for May 3.

191. *Dendroica cerulea* (Wilson.) Cerulean Warbler. A common migrant about Charles City and Nora Springs, probably throughout the county. Arrives May 2 to 12, and associates in flocks with the two preceding species.

192. *Dendroica pensylvanica* (Linn.) Chestnut-sided Warbler. An uncommon migrant. I noted seven individuals north of Floyd on May 20, 1918. Brown lists it as rare, giving as the only Willow Pond record one for May 16, 1917. I have not seen the species during its autumn migration.

193. *Dendroica striata* (Forster.) Black-poll Warbler.
A fairly common migrant. Mrs. Tuttle reports it at Osage on August 23. As Mr. Gabrielson did not question this record, the specie may be regarded as a possible summer resident for Mitchell County.

194. *Dendroica fusca* (Müller.) Blackburnian Warbler. An irregular and rather uncommon migrant. I saw seven in the southern part of Charles City on May 22, 1917, and members of the little flock remained about the locality until the 30th.


196. *Dendroica palmarum* (Gmel.) Palm Warbler. An uncommon migrant, the only record for the county being by Mr. Brown, who saw the species in Charles City on May 22, 1917.

197. *Seiurus aurocapillus* (Linnaeus) Oven-bird. In some years this species is a common migrant, in others it is almost rare. Its status in summer is rather a question. Spring arrival is in the first week of May; the autumn migration takes place mid-September. I have never found nests, and have rarely seen the birds in summer, from which I conclude that it is an uncommon summer resident.

198. *Seiurus noveboracencis notabilis.* (Grinn.) Grinnell's Water-thrush. A tolerably common migrant, arriving May 6 to 15. It probably does not occur as a summer resident.

199. *Seiurus motacilla* (Vieill.) Louisiana Water-thrush. The Louisiana Water-thrush is a common migrant, arriving May 5 to 12, and reaching its height in numbers May 12 to 15. No nests have been found, but Mrs. Tuttle has seen the species in Mitchell County as late as August 15, and I have seen it near Charles City in August, and near Floyd on July 19, 1916, July 30, 1918, and in August. From these records it appears that the species is an uncommon summer resident.

200. *Oporornis agilis* (Wilson) Connecticut Warbler. A rare or decidedly uncommon migrant. Brown records it for Willow Pond on May 20, 1917; I have it at the same
locality on May 24. Mrs. Tuttle records it at Osage on October 1, 1914.


202. **Geothlypis trichas trichas** (Linn.) Maryland Yellowthroat. The Maryland Yellowthroat is a common summer resident in Floyd and bounding counties. It arrives in the last week of April or the first ten or twelve days of May, and becomes common almost as soon as it arrives. It builds its nest on the ground, near clumps of high grass or low bushes, particularly in sloughs and near marshy streams. The eggs are laid in the first week of June. The species departs in the second or third week of September, with a few stragglers hanging over into October.

203. **Icteria virens virens** (Linn.) Yellow-breasted Chat. The Yellow-breasted Chat is a rare species in Floyd, Cerro Gordo, and Mitchell Counties. I saw two individuals north of Floyd on May 20, 1918, my only record. Anderson says: “I . . . . . have a specimen in my collection taken in Cerro Gordo county by J. E. Law, May 30, 1891.” (Bds. of Ia., 1907, 363).


205. **Wilsonia canadensis** Linn.) Canada Warbler. An uncommon or rare migrant, spring arrival dates ranging from May 19 to 23. I have only one autumn record, that for September 2, 1920.

206. **Setophaga ruticilla** (Tunstall) Redstart. An abundant migrant and tolerably common summer resident. Spring arrival dates range from April 28 to May 12. The birds remain until late August, and I have occasionally seen them in the first week of September.

207. **Anthus rubescens** (Tunstall) Pipit. So far as I have been able to determine, this species called “a tolerably common migrant in Iowa” by Dr. Anderson, is a rare migrant
in Floyd County. I have one record, of three individuals seen in the eastern part of Charles City on April 17, 1917.

208. *Mimus polyglottos polyglottos* (Linn.) Mockingbird. The only record of the Mockingbird in Floyd County is taken from Keyes and Williams (Bds. of Ia., p. 156.): "A single specimen was taken at Charles City." The record was probably made by Mr. Williams, as Charles City was his early home.

208. *Dumetella carolinensis* (Linn.) Catbird. The Catbird is an abundant summer resident in Floyd and adjoining counties. Arrival dates range from April 22 to 28, with the species becoming common in the first week of May. Most of the birds depart before October 10, but on October 19, 1917, I saw a single individual in Wildwood Park, Charles City. Eggs are laid in the last week of May or the first week of June. I have found nests throughout the county, as well as near Orchard and Osage in Mitchell County, Nashua in Chickasaw, and Portland in Cerro Gordo.

210. *Toxostoma rufum* (Linn.) Brown Thrasher. An abundant migrant and summer resident. It arrives about the same time as the Catbird, and remains until late September. Eggs are laid in the first week of June, the nesting localities recorded corresponding with those given for the Catbird. In one case, about one-fourth mile west of Rockford, I found two catbird nests and one thrasher nest in a single large thorn-apple tree. W. Rhinesmith, of Charles City, found a Thrasher nest with eggs on May 11, 1919, a remarkably early record. My latest record for the species is October 4, 1917, when I saw three individuals in the northern part of Charles City.

In 1918 the autumn migration took place very early. I found the species to be very common in the vicinity about Nora Springs, Rockford, and Hackberry Grove on August 24 to 31. On September 4 I took a half-mile walk through a region southeast of Charles City in which Thrashers are ordinarily abundant, and failed to see one. My latest record was for September 11. The records of other observers substantiate my own observations.

211. *Thryomanes bewicki bewicki* (Aud.) Bewick's Wren. The Bewick Wren has been observed at Charles City and vicinity by Mr. Brown, Mr. Webster, Mrs. Webster, and my-
self, and we feel confident in classing it as an uncommon summer resident. What I consider to be my most reliable records are for May 22, 1916, and May 15, 1917, both near the Webster home in the southeastern part of Charles City. Mr. Gabrielson's comment is: "Don't know about this species, although it is possible. The species is rather southern." Unfortunately, specimens are lacking.

212. Troglodytes aëdon parkmani (Aud.) Western House Wren. An abundant summer resident, arriving in the first week of May and becoming common three or four days after its first appearance. Departure occurs in middle September. Eggs are laid as early as May 20, and two broods (perhaps three) are raised in a season.

213. Nannus hiemalis hiemalis (Vieill.) Winter Wren. The Winter Wren is a rare migrant in Floyd and Mitchell Counties. Mrs. Tuttle reports it at Osage in April. I have records, made at or near Charles City, for April 26, 1915, April 28, 1917, and April 15, 1917.

214. Cistothorus stellaris (Licht.) Short-billed Marsh Wren. A tolerably common migrant and rare summer resident. My records are April 30, 1916, west of Charles City; May 20, 1917, Willow Pond; July 15-18, 1918, nest in slough some three miles north of Charles City. There were three eggs in the nest. Mr. Brown records it for October 3, 1916, at Charles City.

215. Telmatodytes palustris iliacus Ridgway Prairie Marsh Wren. This subspecies of the Marsh Wren is an uncommon migrant and summer resident in Floyd County, and seemingly in Mitchell and Cerro Gordo counties. Arrival dates range from April 26 to May 8. Nesting takes place in early June. In June, 1918, I located three nests in a slough north of Charles City, and one in Willow Pond.

216. Certhia familiaaris americana (Bonaparte) Brown Creeper. The Brown Creeper is a common migrant and winter resident in Floyd County. It is common as a summer resident. I have seen it in Mason City, Cerro Gordo County, in January, and in June, July and August at Charles City, Marble Rock, Rockford, Rudd, Nora Springs, and Bevonia, in Floyd County, and at Hackberry Grove in Cerro Gordo.
THE BIRDS OF FLOYD COUNTY, IOWA.
summer resident. It arrives as early as the first of April, but usually about April 10. Nests have not been observed, but the species is regularly seen throughout the summer.

224. *Hylochichla alicae alicae* (Baird.) Gray-cheeked Thrush. An uncommon or rare migrant, arriving in the first week of May.

225. *Hylochichla astulata swainsoni* (Cab.) Olive-Backed Thrush. Tolerably common to uncommon migrant, arriving April 2 to 12.

226. *Hylochichla guttata pallasi* (Cab.) Hermit Thrush. This is the commonest of the Thrushes of the district, particularly during migration. Arrival ranges from March 24 to April 11, with the migration reaching its maximum about the middle of April. It is very common along the Cedar River, both north and south of Charles City, and follows the stream for some miles.

227. *Plaesticus migratorius migratorius* (Linn.) Robin. The Robin is an abundant summer resident throughout the region, and an occasional winter resident in Floyd County. It arrives in late February or early March, and remains until late October or early November. Webster states that he has several times known it to remain throughout the winter. December 23, 1918, Mrs. J. M. Ferguson reported it from Caldwell, a station some four miles north of Charles City, and on December 27 of the same year I saw two individuals east of Charles City. W. T. Swartz states that in January, 1916, he saw a flock of six birds in the grounds of the McKinley school, Charles City.

228. *Sialia sialis* (Linn.) Bluebird. Abundant migrant and summer resident, arriving in late February or early March, and remaining until the first week of November. Nests are usually built in old woodpecker holes, and eggs laid in the first week of June.

INTRODUCED SPECIES.

229. *Phasianus torquatus* (Gmel.) Ring-necked Pheasant. Several pairs of these birds have been placed in the Waller Woods, which is leased by the state as a game preserve. They
are doing moderately well, but are killed to such an extent that their number cannot increase.

Several pairs of the Hungarian Partridge, *Perdix perdix*, were placed in the same preserve, but seem to have died out.

230. *Passer domesticus* (Linn.) House or English Sparrow. The most abundant bird of the region, particularly about towns. It is less common in the country, particularly in the open fields and woodlands.

**HYPOTHETICAL LIST.**

On this list are placed species that I do not feel justified in including in the first part of this section. Mr Gabrielson is of the opinion that the Brant (List No. 32) should be placed here, but I hardly agree on this point.

1. *Florida caerulea caerulea* (Linn.) Little Blue Heron. I have several times seen birds that I identified as belonging to this species, but do not regard the identification as unquestionable. My most reliable record was secured north of Charles City, June 12, 1917.

2. *Dryobates villosus villosus* (Linn.) Northern Hairy Woodpecker. Mr. Brown and I have various sight records for this species, and Mrs. Tuttle reports it from Osage. Positive identifications are lacking.

3. *Sturnus vulgaris* (Linn.) Starling. Mr. Brown and I have at various times seen birds which we felt certain of as Starlings, but secured no specimens. The most reliable of my dates are: April 25, 1914; July 24, 1914; May 3, 1915. Mr Gabrielson considers these records as positive errors, Dr. Bailey accepted them as hypothetical, and Miss Sherman accepts them. In a letter to me she expressed the opinion that the species had been introduced into the Mississippi Valley from the east. She mentioned a record for Rockford, Illinois, by Mr. Paul B. Riis.

4. *Nuttalornis borealis* (Swains.) Olive-sided Flycatcher. There is little doubt that this species is found in Floyd County, but pending the solution of our Flycatcher problem, it is listed here.

5. *Empidonax flaviventris* Baird. Yellow-bellied Fly-
catcher. Mr. Brown and I have seen birds which we referred to this species, and Mrs. Tuttle reports it from Osage. Mr. Gabrielson strongly questions all the records.

6. *Empidonax virescens* (Vieill.) Acadian Flycatcher. Same data as above.¹

7. *Octocoris alpestris hoyti* Bishop. Hoyt's Horned Lark. Both Mr. Brown and I have seen birds which we assigned to this subspecies. See migration record for 1917. Mr. Gabrielson's comment is: "Possible, but ought to be collected."

8. *Sialia currocoides* (Bechst.) Mountain Bluebird. A pair of birds that I feel certain belonged to this species nested in the extreme southern part of Charles City in 1914. I watched them for considerable lengths of time, and was able sketch the male. Both birds correspond to descriptions and figures of the Mountain Bluebird, and to specimens which I have examined later at the Field Museum and the Chicago Academy of Sciences. The nest was in an old woodpecker hole, about three and one-half feet from the ground. It was deserted by the birds when a flock of sheep were let into the pasture in which it was located, and before I could secure the eggs all but one of them were damaged by a Red Squirrel. The first egg was laid the 26th of April; the fourth, five days later. The nest, one egg, and fragments of two others are in my collection.

Regarding this record Miss Sherman says: "I do not see how you can possibly be mistaken in the Mountain Bluebird," and I am quite sure that I am not. But Mr. Gabrielson comments: "This is almost certainly a case of mistaken identification, as the species has never been known to nest east of the Black Hills." Unfortunately, the eggs, which I showed to Dr. Bailey, do not seem to settle the question.

¹ Dr. Stevens thinks one should have no trouble identifying the Acadian Flycatcher when he has "become sufficiently acquainted with it." But there's the rub.
Birds of Notre Dame, Indiana.
BROTHER ALPHONSUS, C. S. C.

I.—WINTER RESIDENTS, 1922-23.

1.—Chickadee.
2.—Tufted Titmouse.
3.—White-breasted Nut-hatch
4.—Brown Creeper.
5.—Cardinal.
6.—Pine Grosbeak.
7.—Song Sparrow.
8.—Tree Sparrow.
9.—Pine Siskin.
10.—Goldfinch.
11.—Crow.
12.—Blue Jay.
13.—Slate-colored Junco.
14.—Downy Woodpecker.
15.—Hairy Woodpecker.
16.—Red-headed Woodpecker.
17.—Sparrow Hawk.
18.—Red-shouldered Hawk.
19.—Golden-eye.
20.—Herring Gull.
21.—Screech Owl.

II.—SPRING MIGRANTS, 1923.

February 28th.

1.—Bluebird.
2.—Robin.

March 1st.
3.—Killdeer.

March 3rd.
4.—Bronzed Grackle.
5.—Meadowlark.

March 11th.
6.—Red-winged Blackbird.
7.—Mourning Dove.
8.—Cedarbird.

March 25th.
9.—Phoebe.

April 1st.
10.—Golden-crowned Kinglet.
11.—Purple Finch.
12.—Cowbird.
13.—Loon.

April 4th.
14.—Sapsucker.

April 7th.
15.—Towhee.

April 8th.
16.—Vesper Sparrow.
17.—White-winged Scoter.

April 10th.
18.—Flicker.

April 11th.
19.—Field Sparrow.
20.—Myrtle Warbler.
21.—Kingfisher.

April 12th.
22.—Hermit Thrush.
23.—Fox Sparrow.

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April 13th.
24.—Ovenbird. 
April 17th.
25.—Barn Swallow. 
April 19th.
26.—Chipping Sparrow. 
April 20th.
27.—Ruby-crowned Kinglet. 
28.—White-throated Sparrow. 
April 21st.
29.—House Wren. 
30.—Chimney Swift. 
April 22nd.
31.—Prairie Horned Lark. 
32.—Brown Thrasher. 
April 23rd.
33.—Wilson Snipe. 
34.—Rough-winged Swallow. 
April 24th.
35.—Grasshopper Sparrow. 
April 25th.
36.—Blue-winged Teal. 
37.—Carolina Wren. 
April 26th.
38.—Pied-billed Grebe. 
April 27th.
39.—Purple Martin. 
April 28th.
40.—Spotted Sandpiper. 
April 29th.
41.—Palm Warbler. 
April 30th.
42.—Catbird. 
43.—Yellow Warbler. 
44.—Barn Swallow. 
May 1st.
45.—Wilson Thrush. 
46.—Warbling Vireo. 
47.—Lark Sparrow. 
May 2nd. 
48.—Baltimore Oriole. 
49.—Black and White Warbler 
50.—Yellow-throated Vireo. 
51.—Crested Flycatcher. 
May 3rd. 
52.—Rose-breasted Grosbeak. 
53.—Black-throated Green Warbler. 
54.—Bobwhite. 
May 4th. 
55.—Maryland Yellow-throat. 
56.—Green Heron. 
May 5th. 
57.—Least Flycatcher. 
58.—Alder Flycatcher. 
May 6th. 
59.—White-crowned Sparrow. 
May 7th. 
60.—Bobolink. 
61.—Kingbird. 
May 10th. 
62.—Nashville Warbler. 
63.—Cape May Warbler. 
64.—Lincoln Sparrow. 
65.—Blue-headed Vireo. 
May 12th. 
66.—Parula Warbler. 
67.—Dickcissell. 
68.—Grinnell's Water Thrush. 
May 13th. 
69.—Redstart. 
70.—Solitary Sandpiper. 
May 14th. 
71.—Magnolia Warbler. 
72.—Orchard Oriole. 
73.—Tenessee Warbler. 
74.—Savannah Sparrow. 
75.—Semipalmated Plover.
76.—Gray-checked Thrush.
77.—Swamp Sparrow.
    May 17th.
78.—Olive-backed Thrush.
79.—Blackburnian Warbler.
    May 18th.
80.—Red-eyed Vireo.
81.—Chesnut-sided Warbler.
82.—Cerulean Warbler.
83.—Virginia Rail.
84.—Indigo Bird.
    May 19th.
85.—Scarlet Tanager.
86.—Wood Pewee.
87.—Canadian Warbler.
88.—Yellow-bellied Flycatcher
89.—Nighthawk.
90.—Black-throated Blue Warbler.
91.—Wilson Warbler.
92.—Black-billed Cuckoo.
    May 20th.
93.—Tree Swallow.
    May 21st.
94.—Black-poll Warbler.
95.—Yellow-billed Cuckoo.
    May 22nd.
96.—Cliff Swallow.
    May 24th.
97.—Hummingbird.
    May 25th.
98.—Bittern.
99.—Migrant Shrike.
100.—Gnatcatcher.
101.—Acadian Flycatcher.

III. Summer Residents, 1923.

May 27th.
1.—Crow
2.—Goldfinch
3.—Song Sparrow
4.—Vesper Sparrow
5.—Field Sparrow
6.—Chipping Sparrow
7.—Red-headed Woodpecker
8.—Flicker
9.—Tufted Titmouse
10.—Bronzed Grackle
11.—Robin
12.—Bluebird
13.—Kingfisher
14.—Meadowlark
15.—Killdeer
16.—Red-winged Blackbird
17.—Mourning Dove
18.—Cowbird
19.—Towhee
20.—Alder Flycatcher
21.—House Wren
22.—Chimney Swift
23.—Brown Thrasher
24.—Purple Martin
25.—Catbird
26.—Spotted Sandpiper
27.—Red-eyed Vireo
28.—Warbling Vireo
29.—Indigo Bird
30.—Bobolink
31.—Dickcissel
32.—Crested Flycatcher
33.—Kingbird
34.—Baltimore Oriole
35.—Orchard Oriole
36.—Wood Pewee
37.—Green Heron
May 27th.
38.—Bob-white
39.—Phoebe

May 28th.
40.—Cardinal
41.—Blue Jay
42.—Downy Woodpecker
43.—Cedar Waxwing
44.—Yellow Warbler
45.—Hummingbird
46.—Migrant Shrike
47.—Grasshopper Sparrow

May 29th.
48.—Prairie Horned Lark.
49.—Maryland Yellowthroat

May 31st.
50.—Carolina Wren

June 1st.
51.—Hairy Woodpecker
52.—Yellow-billed Cuckoo

June 2nd.
53.—Rose-breasted Grosbeak

June 4th.
54.—White-breasted Nut-hatch

June 5th.
55.—Virginia Rail

June 9th.
56.—Screech Owl
57.—Rough-winged Swallow

June 11th.
58.—Cliff Swallow

June 13th.
59.—Sparrow Hawk
60.—Acadian Flycatcher
61.—Blue Gray Gnatcatcher

June 14th.
62.—Red-shouldered Hawk
63.—Chickadee
64.—Nighthawk

June 15th.
65.—Great Blue Heron

June 29th.
66.—Barn Swallow

June 30th.
67.—Bittern
68.—Yellow-throated Vireo

Birds of Bankson Lake, Michigan.

BROTHER ALPHONSUS, C. S. C.

August 6th.
1.—Goldfinch
2.—White-breasted Nuthatch
3.—Song Sparrow
4.—Field Sparrow
5.—Downy Woodpecker
6.—Red-headed Woodpecker
7.—Flicker
8.—Tufted Titmouse
9.—Screech Owl

10.—Robin
11.—Bluebird
12.—Kildeer
13.—Mourning Dove
14.—Cedar Waxwing
15.—Wood Pewee
16.—Acadian Flycatcher
17.—Cliff Swallow
18.—Tree Swallow
19.—House Wren
20.—Catbird
21.—Scarlet Tanager
     August 6th.
22.—Red-eyed Vireo
23.—Yellow-throated Vireo
24.—Indigo Bird
25.—Yellow-billed Cuckoo
26.—Kingbird
27.—Baltimore Oriole
28.—Bob-white
     August 7th.
29.—Vesper Sparrow
30.—Chipping Sparrow
31.—Hairy Woodpecker
32.—Maryland Yellow-throat
33.—Yellow Warbler
34.—Warbling Vireo
     August 8th.
35.—Kingfisher
36.—Towhee
37.—Brown Thrasher
38.—Spotted Sandpiper
39.—Cardinal
40.—Green Heron
41.—Solitary Sandpiper
42.—Crow
     August 9th.
43.—Grasshopper Sparrow
44.—Long-billed Marsh Wren
45.—Bobolink
46.—Great Blue Heron
47.—Bittern
48.—Chickadee
49.—Blue Gray Gnatcatcher
50.—Alder Flycatcher
51.—Chimney Swift
     August 10th.
52.—Purple Martin
53.—Whip-poor-will
     August 11th.
54.—Bronzed Grackle
     August 12th.
55.—Blue Jay
56.—Cowbird
     August 13th.
57.—Crested Flycatcher
     August 18th.
58.—Nighthawk
     August 19th.
59.—Cerulean Warbler
     August 20th.
60.—Canadian Warbler
     August 22nd.
61.—Oven-bird
     August 24th.
62.—Black and White Warbler
63.—Pine Warbler
64.—Redstart
65.—Bonaparte Gull
     August 27th.
66.—Red-tailed Hawk
     August 28th.
67.—Barn Swallow
     August 29th.
68.—Red-shouldered Hawk
     August 30th.
69.—Sparrow Hawk
70.—Black-throated Green Warbler
     September 1st.
71.—Pied-billed Grebe
     September 3rd.
72.—Red-breasted Nuthatch
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Botanical Gleanings in Michigan.

OLIVER ATKINS FARWELL

The collecting season of 1923 was inaugurated May 2nd, by a trip to Washington, with the purpose of collecting the flowers of *Tussilago Farfara*; no evidence of them was discovered. The floral season was some three or four weeks later than usual due to a cold and lingering winter, made prominent by a downfall of "the beautiful" to an extent of six inches on May the ninth. A trip to the Ohio border on May 30th was disappointing in its results; but on the Ohio side, near Alexis, were found the following:—*Floerkea proserpinoides, Rubus pergratus, Geum vernum, Uraspermum aristatum var. villicaeule, Thaspium barbinode* and its var angustifolium. Mr. Billington, of Detroit, and I were the guests of Prof. B. A. Walpole, of East Lansing, early in June and a very pleasant and profitable trip was made to Grand Ledge. Among the interesting plants found there may be mentioned: *Panicum Werneri, P. barbulatum, Poa sylvestris, Moehringia lateriflora, Isopyrum bibernatum, and Primula Mistassinica*.

The Lotus, *Nelumbo lutea*, was found in abundance at Halfway Creek and the Michigan sector of Maumee Bay, a station not cited by Beal in the Michigan Flora. Not far away from this station Mr. Gladewitz gathered the only orchid *Blephariglottis leucophea*, seen on that trip (July 11).

In what follows, where both the year and the name of the collector are not given, it is to be understood that Farwell and Gladewitz are the collectors for the year 1923.

Juniperus Virginiana, L. The Red Cedar is scarce but well distributed; Ypsilanti, No. 86a, June 11, 1912; Rochester, No. 86b, May 12, 1909; Parkedale, No. 3222, Oct. 27, 1912; Redford, No. 4741a, Oct. 14, 1917.

Juniperus Virginiana, L., var. reptans, Beissn. A procumbent variety indistinguishable from J. horizontalis except by its flowers and fruits. Rocky shores of Keweenaw Co., No. 86, May 15, 1884.

Potamogeton alpinus, Balbis. Found on the shores of St. Clair River, at Marine City, No. 6751, Aug. 29.

P. Americanus, C. & S. In Bell River at Marine City, No. 6743, Aug. 29. Also nearby, the variety with thick, broadly elliptic, obtuse, floating leaves which has been called var. Novaeboracensis (Morong) Benn. No. 6744, Aug. 29.

P. gramineus, L., var. lacustris (Fries) Farwell. In St. Clair River at Marine City, No. 6746, Aug. 29. Nearby was the var. parvifolius (Nolte) Farwell which is distinguished by its small, coriaceous floating leaves. No. 6748, Aug. 29.

Potamogeton amplifolius, Tuckerm. Along the shores of lakes in shallow water near Linden, No. 6668, Aug. 1; Lake Orion, No. 6838, Sept. 26, (no coriaceous floating leaves).

Potamogeton angustifolius, Berchtold & Presl. In deep water, Lake Orion, No. 900, Aug. 29, 1895 and Lakeville Lake, Billington, Farwell and Gladewitz, No. 6653, July 26, 1923 (no coriaceous floating leaves, but upper leaves subcoriaceous); Hamburg, No. 6765, Sept. 5.

Potamogeton lucens, Linn. Similar to the preceding but with longer and narrower leaves none of which is subcoriaceous. In deep water Lake Orion, No. 905, Aug. 29, 1895, and in Lakeville Lake, Billington, Farwell and Gladewitz, No. 5333, July 20, 1919, and July 26, 1923.

Potamogeton perfoliatus, L. In the St. Clair River at Marine City, No. 6752, Aug. 29.

Potamogeton perfoliatus, L., var. Richardsonii, Benn. In the St. Clair River at Marine City, No. 6753, Aug. 29.

Potamogeton perfoliatus, L., var. bupleuroides (Fernald) n. comb. P. bupleuroides Fernald, Rhodora X (1908) 46. In the St. Clair River at Marine City. No. 6754, Aug. 29. P. Richardsonii and P. bupleuroides pass insensibly into P. perfoliatus
and can scarcely be considered as distinct species. Britton and Brown reduce them to synonymy.

Potamogeton foliosus, Raf., var. Niagarensis (Tuckerm.) Morong. In the Bell River at Marine City, No. 6736, Aug. 29.

Najas flexilis (Willd.) Rostk. & Schmidt., var. robusta, Morong. This stout, elongated form with flat leaves was found in Lakeville Lake, Billington, Farwell and Gladewitz, No. 6654, July 26, 1923.


Muhlenbergia racemosa (Michx.) BSP., var. ramosa (Vasey) Beal. On the wet marshy covering of a submerged lake near Hamburg, No. 6763, Sept. 5. The typical form of the species also was found there, No. 6762, Aug. 29.

Deschampsia caespitosa (L.) Beauv. A very beautiful grass growing in the crevices of rocks on the lake shore. Associated with Solidago racemosa, Artemisia Canadensis and Campanula rotundifolia var. Langsdorffiana. Eagle Harbor, No. 6620, June 29, 1920; sand dunes northwest of Clifton, No. 717, August 20, 1889.

Eragrostis Eragrostis (L.) Karst. This grass seen last year for the first time, was found in abundance this year at Imlay City; No. 6682, Aug. 15; Ann Arbor, No. 6780, Sept. 12, 1923.

Poa sylvestris, Gray. Somewhat similar to P. debilis but it has much broader leaves and the lemmas have pubescent nerves. Grand Ledge No. 6569, June 10, 1923.

Bromus inermis, Leyss. In waste grounds at Linden, No. 6664, August 1.

Eleocharis rostellata, Torr. Beal records this from the Lower Peninsula only. In peat bogs associated with Carex gynocrates and C. exilis. Eagle Harbor, No. 6631, June 29, 1923.

Eriophorum Virginicum, L., var. album, A. Gr. This variety was found in abundance in an extensive peat bog near Oxford. Some of the plants had scales that were only 1 nerved instead of the usual 3-5 ribs. No. 6831, Sept. 26.
Carex gynocrates, Wormsk. Beal records this from the Lower Peninsula only, as *C. Redowskyana*. In peat bogs under tamaracks. Eagle Harbor, No. 6630, June 29, 1923.

Carex exilis, Dew. Superficially, this looks like a tall, coarse state of the preceding; but the perigynia are of a different shape and the spikes are gynecandrous while those of the above are androgynous. Both are frequently dioecious. In peat bogs under tamaracks. Eagle Harbor, No. 6630, June 29, 1923; Calumet No. 389, June 20, 1886.

Carex echinata, Murr., var. angustata (Carey) Bailey. This is a slender variety with long, narrow perigynia. In wet grounds or in bogs. Eagle Harbor, No. 6622, June 29, 1923; Clifton, No. 1792, August, 1902.

Carex sterilis, Willd. Rigid, often a meter high; perigynia with 10-15 nerves on the inner face. Reported as *C. rosea* as the spikes are often staminate at the top, generally dioecious. Mr. Mackenzie considers this to be typical *C. sterilis*, Willd. Washington, *Gladewitz and Farwell*, No. 5895, June 21, 1921 and No. 6203, June 21, 1922; Oxford, No. 6681, Aug. 8, 1923.

Carex hirta, L. On a vacant lot where it covers perhaps 150 square feet of ground to the exclusion of everything else. Probably the first Michigan station put on record. Shelbyville, No. 6584, June 21, 1923.

Carex aristata, R. Br. In a bog. Shelbyville, No. 6574, June 21, 1923.

Carex aristata, R. Br., var. imberbis (A. Gr.) n. comb. *C. trichocarpa* var. *imberbis* A. Gr. *Manual*, (1867) 597. This has the sheaths glabrous but it passes into the species with hirsute sheaths and leaves and is associated with it. Shelbyville, No. 6573, June 21, 1923.

Arisaema triphyllum (L.) Schott, var. pusillum, Peck. A low plant with the under side of the leaves green, not glaucous, nor paler than the upper surface. Under maples near Washington, No. 6482, May 23.

Lilium philadelphicum, Y., var. andinum (Nutt.) Ker. In riding through the State from Houghton to Bay City over the D., S. S. & A. and the M. C., I saw from the car window, probably several thousand plants of this lily; of this number per-
haps a score had yellow flowers; the others had flowers of a deep red color. About 90 per cent of the plants were terminated by a single flower and the other ten per cent bore an umbel of from two to six flowers, mostly three or four. It prefers wet meadows but is frequently found in rich woods or in dry, rocky situations and even in peat bogs. Eagle Harbor, No. 6606, June 29, 1923; Copper Harbor, No. 382, June 20, 1886; Birmingham, No. 382a, Sept. 7, 1903; Rochester, No. 382b, August 15, 1909; Wiard, No. 382c, June 25, 1910; Parkedale Farm, No. 2807, July 4, 1912, and No. 3457, June 15, 1913.

Disporum Cahnae, Farwell. The fruit is an obovoid, pubescent capsule, obtusely three-angled, in size and shape, much resembling that of Uvularia grandiflora.

Blephariglottis cilaris (L.) Rydb. The Yellow-fringed Orchis is a rare plant in Michigan. Three or four plants were found in a bed of sphagnum on the shores of what is called the "Hidden Lake," near Lakeville. Billington, Farwell and Glade-witz, No. 6659, July 26, 1923.


Salix alba, L., var. calva, G. F. W. Meyer [var. coerulea (Sm.) Koch.] Only leaves were collected at this season of the year and neither these nor the color of the branches were characteristic of S. alba, S. vittelina or S. fragilis; the latter two grew in the vicinity and it may be a hybrid of these two species or what Beal lists as S. fragilis alba Wimmer. Banks of the Clinton River at Rochester, No. 6845, October 3.

Salix pedicellaris, Pursh, var. hypoglaucua, Fernald. On the shaky and very pliable sod overlaying a submerged lake near Hamburg. No. 6768, August 20.

Salix candida, Flugge. With the last, No. 6769, Aug. 29.

Alnus crispa (Ait.) Pursh. The Mountain Alder; it has been the subject of revision by Mr. Fernald who has come to the conclusion that it is not identical with the European species, hence the old names A. viridis and A. Alnobotula are to be discarded. Rocky shores at Eagle Harbor, No. 6599, June 29, 1923; sandy shores northwest of Clifton, No. 19, June 18, 1883.
Alnus mollis, Fernald. River banks, etc., at Lake Linden, No. 3083, August 24, 1912; Grosse Isle, No. 3364, Sept. 18, 1913.


Humulus Lupulus, L., var. neo-mexicanus, Nels. & Cockr. H. Americanus, Nutt. Railroad banks near Whitmore Lake, No. 6772, September 5. This is plentiful along the shores of St. Clair River at Marine City. West of Ypsilanti, No. 6804, Sept. 12, 1923.

Humulus Americanus, Nutt. Railroad banks near Whitmore Lake, No. 6772, September 5. This is plentiful along the shores of St. Clair River at Marine City. West of Ypsilanti, No. 6804, Sept. 12, 1923.

Rumex Patientia, L., var. Kurdicus, Boiss. This looked very much like R. crispus but the leaves were too large, their margins were even, and their bases were acute. Ypsilanti, No. 6807, September 19.

Atriplex argentea, Nutt. This species of the western regions was found along the railway at Imlay City. An evident introduction by means of the railroad. No. 6688, August 15.

Allionia Nyctaginia, Michx. Becoming frequent and widely spread through southeastern Michigan. Leaves broad, cordate or deltoid. Ypsilanti, No. 5252, June 15, 1919 and No. 6805, Sept. 12, 1923; Rochester, Farwell and Walpole, No. 5391, Sept. 4, 1919; Romulus, Gladewitz and Farwell, No. 6170, June 7, 1922; Oxford, Gladewitz and Farwell, Oct. 4, 1922 and Farwell, No 6680, Aug. 8, 1923; Imlay City, No. 6683a, Aug. 15; Ann Arbor, No. 6785, Sept. 12, 1923; Geddes, No. 6805, Sept. 12, 1923.

Var. minor (Choisy) Farwell. Leaves much smaller, ovate-lanceolate to lanceolate, rounded to acute at base. Imlay City, No. 6683, Aug. 15; Ypsilanti, No. 6808, Sept. 19; Ann Arbor, No. 6787, Sept. 12, 1923; Pontiac, Farwell and Gladewitz, No. 6356, Aug. 16, 1922.

Allionia Gladewitzii, n. sp. Similar to the preceding but stem, branches, and inflorescence hirsute as in the next, the pubescence on the upper parts sometimes very glandular, sometimes glandless. Leaves varying from broadly obovate to broadly ovate, ovate-lanceolate, and oblong (2 to 7 cm long by 2 to 5 cm wide), obtuse, glabrous, thick and fleshy, entire or nearly so and more or less ciliate, subcordate, rounded or nar-
rowed at the base, the lower on broad margined petioles 1 cm long the upper subsessile or sessile; inflorescence axillary and terminal; calyx rose, on pedicels 7 or 8 mm; fruiting involucre 1 cm high and 2 cm across when expanded, on pedicels often 12 mm long; fruit narrowly or broadly obovoid 4 or 5 mm long, bearing 5 prominent ribs, the faces tuberculate, hirsute. It looks as though it might be a hybrid between the preceding and the following species, both of which are found in southeastern Michigan in their typical forms as well as in the varietal forms herewith mentioned. Apparently, this is closely related to the A. polytricha Standley but that is said to have strigose fruit and long petioled leaves.

Allionia aggregata (Ortega) Spreng. Stem and inflorescence hirsute, the latter also glandular; leaves ovate-lanceolate to lanceolate, sessile or subsessile, the lower more or less pilose, especially on the mid rib beneath, upper ones often glabrous; inflorescence single in the axils or cymose at the ends of the branches. Ypsilanti, No. 5253, June 15, 1819; French Landing, Farwell and Gladewitz, No. 6175, June 7, 1922.

Var. hirsuta (Pursh) Farwell. Leaves elongated-oblong or linear-lanceolate, hirsute; inflorescence a terminal panicle. Fenton, No. 6671, August 1.

Alsine rubra (L.) Crantz. Two stations are listed in the Michigan Flora, Litchfield and Rochester. Another is now added. Geddess, No. 6801, Sept. 12, 1923.

Sagina procumbens, L. Pearlwort. Usually found on wet rocks, etc.; but also on dry rocky or gravelly hillsides. The following collections were made near Lake Linden. Brink of Douglas Houghton Falls, No. 3914, October 11, 1914; foot of Douglas Houghton Falls, No. 6595, June 25, 1923; dry hillsides, No. 6594, June 25, 1923.


Cerastium longepedunculatum, Muhl. In an old abandoned corn field where it was quite plentiful. Easily differentiated from C. vulgatum which it closely resembles, by its longer peduncles with their pods at right angles thereto. Erie, No. 6492,
May 30. Also on wet sandstone ledges at Grand Ledge, No. 6561, June 10, 1923.

Silene latifolia (Mill.) Britten and Rendle, var. pubescens (DC) n. comb. (Silene inflata var. pubescens DC. Fl. Fr. IV. p. 747; 1805). A variation of the species in which the leaves are conspicuously ciliate and whole plant more or less short hirsute. Banks near Whiteford Center, No. 6495, July 11.

Nymphozanthus variegatus (Engelm.) Fernald. Mr. G. S. Miller, Proc. Biol. Soc. Wash. XV. (1902) 11-13, pointed out very characteristic differences between this species and the closely related N. advena (Ait.) Fernald. The most important distinction lies in the petioles which in this species are flat, causing the leaves to lie flat on the water or when that recedes to lie flat on the ground; in N. advena the petioles are subterete and sooner or later raise their blades above the water. As this species occurs in Michigan, the blades are round-ovate or broadly oval usually around 16 to 22 cm long by 13 to 16 wide; the calyx is yellow with a reddish-purple base and the fruit is more or less purple. Keweenaw Co., No. 139, July 20, 1884; Detroit, No. 139a, Sept. 3, 1892; Orion, No. 139b, May 30, 1895; Billington, Farwell and Gladewitz, Lakeville Lake, No. 6655, July 26, 1923.

Var. lutescens, n. var. Blades of leaves oblong-oval, 30 to 34 cm in length by 19 to 21 wide; calyx yellow throughout or greenish at the base within; otherwise like the species. This evidently is intermediate between the typical form of the species and N. advena, being similar to the latter in the color of its flowers and in the large size of its leaves, but it has the large flowers, the purplish fruit and flat petioles of N. variegatus. Lakeville Lake, No. 6663, July 26, 1923.

Nymphozanthus advena (Ait.) Fernald. This species is said to occur at Detroit and various other places in southern Michigan. While I haven’t found it at the places cited, it occurs in abundance both east and west of Pontiac. The only specimens collected were late in the season when the larger and better leaves had disintegrated. A few small leaves were gathered and a small, green flower bud and a larger, yellow one two-thirds or three-quarters grown; the subterete petioles are suf-
ficient to distinguish it at any season of the year; the leaves are apt to be raised above the surface of the water. Southwestern corner of Avon township, Oakland Co., No. 6871, Oct. 17.

Ranunculus acris, L., var. Steveni (Andrz.) Lange. This variety is distinguished by its broad leaf segments. Imlay City near the railway tracks, No. 6692, August 15.

Isopyrum biternatum (Raf.) Torr. and Gr. The flowering season had long passed but the plants were in perfect fruiting condition. Grand Ledge, No. 6549, June 10, 1923.

Nigella Damascena, L. Roadsides at Marine City; No. 6755, August 29.

Sassafras Sassafras (L.) Karst. Britton and Brown give the maximum height of this tree as 125 feet with a diameter of 7 feet. I had never heard of any Sassafras, nor seen any, that had a larger diameter than 8 or 10 inches in the region from Michigan to Alabama. It was, therefore, with much surprise that on May 23, Mr. Gladewitz and I found a tree of this species along the roadside not far from Washington, that measured 11 feet in girth about 5 feet from the ground. The trunk was about 12 feet in height and split through the middle and spread apart as though it had at some time been struck with lightning; the trunk gave rise to 5 large branches all springing from about the same point, each about one foot in diameter. Compared with the above quoted dimensions this would be a small tree. It was in full flower and we borrowed a ladder from a nearby farmer to procure specimens; No. 6487.

Sinapis alba, L. The White Mustard is not often encountered in southeastern Michigan; but it is quite frequent along the railways near Mt. Clemens; No. 6859, October 10.

Erucastrum Gallicum (Willd.) O. E. Schulz. Monroe, No. 6698, August 22; Whitmore Lake, No. 6775, September 29; Rochester, No. 6849, October 3.

Diplotaxis tenuifolia (L.) DC. Banks of the Grand Trunk railroad near Linden. New to Michigan, so far as I can tell; No. 6667, August 1.

Radicula sylvestris (L.) Druce. Mr. Walpole showed us a
yellow-flowered cress growing on the College grounds which proved to be this species. East Lansing, No. 6523, June 9, 1916.

Drosera linearis, Goldie. The plants were just beginning to flower. Peat bogs at Eagle Harbor, No. 6610, June 29, 1923; Clifton, No. 168, Aug. 10, 1884; Shores of Mark Lake, July 9, 1916.

Geum Canadense, Jacq. In open woods near Monroe, No. 6704, August 22. Nearby was found var. camporum (Rydb.) Fernald and Weath.; No. 6705, August 22.

Geum Virginianum, L., var. Murrayanum, Fernald. Differs from the species in having the fruit glabrous on its faces, while those of the type are bristly. With the preceding; No. 6706, August 22.

Poterium Sanguisorba, L. Not enumerated by Beal. First found here by Mr. Walpole. Railway banks at East Lansing, No. 6538, June 9, 1923.

Sanguisorba Canadensis, L. This is abundant in places along the railway tracks near Wiards Siding in Washtenaw Co.; No. 6813, September 19. Also near Sheldon, Wayne Co.; No. 6825, September 19.

Prunus Avium, L. The Sweet Cherry or Massard is found to be frequent along roadsides in the vicinity of Washington; No. 6488, May 23.

Amygdalus Persica, L. The Peach was observed along roadsides in the vicinity of Washington. Generally, the trees had been broken down and badly injured but young branches springing up gave them the appearance of small shrubs, 4 or 5 feet high; well covered with flowers; No. 6489, May 23.


Vicia sparsiflora, Nutt. Not cited in Beal’s Michigan Flora. Found along the railways near Mt. Clemens, No. 6861a, October 10; in similar situations at Amy, No. 6875, October 17.

Falcata Pitcheri (T. & G.) OK. Shores of the Bell River at Marine City, No. 6742, August 29.
Polygala ambiguа, Nutt. Plentiful in southwestern part of Avon township, Oakland Co.; No. 6867, October 17.

Euphorbia corollata, L., var. viridiflora, n. var. Hairy throughout, 2 to 8 dm high; stems erect, leafless below; leaves oblong, spatulate-oblong, oval, ovate-oblong or the uppermost linear-oblong, 1.5 cm to 4.6 cm long, 0.5 cm to 2.2 cm wide, sub-petiolate or sessile, retuse, rounded or tapering at base, scattered except for the terminal verticil of 3 to 5 leaves; inflorescence an oblong panicle composed of the terminal 3 to 5 rayed umbel and short axillary branches from the upper leaves, these leafless except for the small floral bracts; rays and branches 2 to 4 times dichotomously branched, the ultimate ramifications terminated by a single peduncle or rarely by an umbellet; no peduncle in the axils of the bifurcations; peduncle and pedicel, each about 3 mm long, fleshy, strict or arcuate; gland appendages light green, broadly oval 2 mm broad by 1.5 mm long, or smaller, when fully spread out 5 mm across or less. Oxford No. 6675, August 8, 1923.

Euphorbia dentata, Michx. Leaves ovate to lanceolate; seeds brownish-gray or ash colored. Geddes, No. 6797, Sept. 12, 1923.


Viola pallens (Banks) Brainerd. The leaves in this species are said to be glabrous on both sides. As it grows with *Tussilago Farfara* under tamaracks near Washington, the upper surfaces of the leaves vary from sparsely pubescent all over to entirely glabrous, at flowering time. No. 6485, May 23.


*Centhera* cruciata, Nutt. Stems reddish, strigose; petals linear, 12 mm long, 2 mm wide. This species is given a range of from Maine to N. Y. and Mass., by our local manuals. Our plant exactly fits the description in Gray's New Manual. Marine City, No. 6735, August 29.

*Centhera* parviflora, L. *C. biennis* var. *parviflora* T. and G.; *C. muricata* var. *parviflora* Gates. Stem simple or
branched, appressed pubescent, spreading or muricate hairs few or none; leaves narrow, under a dm. in length and less than 16 mm in width, repand denticulate; inflorescence compact, leafy; ovary 4-7 mm long, calyx-tube 2 cm long, bud club-shaped, red, 5 mm long, appendages separate; petals small, cuneate obcordate, slightly broader than long, 9 mm long by 10 mm broad at the apex; casule subfusiform cylindric, about 2 cm long, appressed pubescent, 4 valved, each valve 2-lobed. These plants undoubtedly are the Linnaean *OE. parviflora*; the small size of the flowers is not an accidental condition due to the lateness of the season in which they appear or to any other cause; but a fixed status. I have observed these plants over a period of 10 years and the small flower is a constant character whether the plants flower early or late, or whether they appear on normal plants or on second growth due to cutting down, etc. Reported in the 19th Report of the Michigan Acad. Sci. as *OE. muricata* var. *parviflora* Gates. Additional locations are: Banks of the Clinton River near Rochester, No. 6851, October 3; Marquette, No. 195b, July 6, 1895; Detroit, No. 1992, July 23, 1906.


Var. muricata (L.) n. comb. *OE. muricata* L. Syst., Ed. 12, (1767) 263. Stems copiously and muricately hirsute. These probably are but varying phases of one species the oldest name for which is *OE. parviflora* L. common throughout the State. Keweenaw Co., No. 195, Sept. 18, 1884; Marquette, No. 195c, July 6, 1895; Detroit, No. 195d, Aug. 3, 1905; Rochester, No. 2959, July 28, 1912, and No. 2972, Aug. 4, 1912; Parkedale, No. 2914, July 29, 1912; Stony Creek, No. 3828, Aug. 9, 1914; Dearborn No. 5596, Aug. 15, 1920.

*OE*another biennis, L. Stems simple or branched, appressed pubescent, muricate hairs none, spike compact and leafless.
Small plants with simple stems usually growing in pure sand, by some authors have been confused with OE. Oakesiana and with OE. parviflora var. canescens. Common throughout the state. Keweenaw Co., No. 721, Sept. 1, 1889; Woodville, No. 5957, Aug. 4, 1921; Slocum's Island, No. 5986, Aug. 31, 1921.

Var. rubricaulis (Farwell) n. comb. OE. muricata var. rubricaulis Farwell, Papers, Mich. Acad. Sci. Arts and Lets. I (1923) 95, 96. Appears to be hybrid between OE. biennis and OE. muricata with the leafless spikes of the former and the muricate pubescence of the latter. Stems purplish-red, leaves more or less suffused with red.


Primula Mistassinica Mx. Similar to P. farinosa but easily distinguished by its thin, veiny leaves, with little or no trace of mealiiness, its longer pedicles and corolla tubes. Sandstone ledges at Grand Ledge, No. 6563, June 10, 1923.


Asclepias Sullivantii, Engelm. Similar to A. Syriaca but smooth throughout, its flower buds twice as large and the flowers larger, usually darker purple but varying to almost white. Occasionally, the upper part of the stem is fasciated and bears the leaves in whorls of four. Erie, No. 6639, July 11.

Asclepias verticillata, L. This species usually is said to be from a fibrous root. It is from a slender, horizontal rhizome, 1.5 mm thick or less, from 4 to 19 cm under the surface; it is not shown on plants that have been pulled up; in order to obtain it, it must be dug up. Stems arise singly at one or more nodes of the rhizome; the aerial portion of the stem dies down to the surface of the earth at the close of each floral season and the subterranean part sends up one or more branches from one or more of its nodes at the beginning of the following season; also from the same nodes, fascicles of fibrous roots of about the same size as the rhizome arise. I have seen as many as 25 branches arising in this way from the original stem which had become 8 mm thick at the point of contact with the
rhizome, its thickest part. Sandy banks along the railroad. Metamora, No. 6648, July 18 and August 8.

Isanthus brachiatus (L.) BSP. This mint is known as False Pennyroyal. It is not listed in Beal’s Michigan Flora. Found along the railway tracks west of Ypsilanti. Scarce. No. 6803, Sept. 12, 1923.

Scutellaria parvula, Michx., var. ambiguа (Nutt.) Fernald. Beal lists the typical form of the species but not the variety. First found here by Mr. Walpole. Railway banks at East Lansing, No. 6541, June 9, 1923.

Monarda fistulosa, L., forma albescens, n. f. Flowers white. A rare color form of the species, the typical form of which is not at all common in southeastern Michigan. Metamora, No. 6650, July 18.

Mentha Cardiaca, Gerarde. Not cited in Beal’s Michigan Flora. A large patch of it was found in Mt. Clemens township near Fraser; No. 6860, Oct. 10. Also at Fraser, No. 6862, October 10.


Castilleja coccinea (L.) Spreng. The Indiana Paint Brush is found throughout the State, in meadows or moist thickets, but is less frequent in the Upper Peninsula than in the Lower. Goodison, No. 6503, June 6. Also, Keweenaw Co., No. 220, June 16, 1885; Detroit, No. 220a, May 17, 1898; Birmingham, No. 220b, Sept. 16, 1903; Parkedale, No. 3398, May 25, 1913. This species often shows two color variations; one in which the calyx and bracts are yellow and another in which they are white. I have not been able to find that these color variations have been named; they may be known respectively as forma lutescens and forma alba.


Plantago lanceolata, L., var. capitata, Presl. Spikes very short, mostly globular or oblong; in dry, sterile ground near Monroe; No. 6707, August 22.
Vernonia interior. Small. After many years this again has been collected. Monroe, No. 6700, August 22.

Solidago graminifolia (L.) Salisb. In low grounds near Orion. These plants are minutely scabrous but are to be referred here rather than to the hirtellus var. Nuttallii which is everywhere common. This is the first time I have seen the typical species in southeastern Michigan. No. 6832, September 26.

Aster leavis, L., var. falcatus, Farwell. Ypsilanti, No. 6809, Sept. 19. Here also was found a very handsome form with violet-purple rays which as a color variation may be put on record as Aster laevis, var. falcatus, forma purpurascens, n. f. No. 6811, September 19.

Aster ericoides, L., var. villosus, T. and G. Waste grounds along the shores of St. Clair River at Marine City, No. 6740, August 29.

Aster ericoides, L., var. platyphyllus, T. and G. Open fields near the Bell River at Marine City, No. 6739, August 29.


Erigeron Canadense, L., var. strictum (DC.) n. comb. Erigeron strictum DC. Prodr. V (1836) 289. Stem simple, strict; leaves densely crowded, those at the middle of the stem being the longest; inflorescence dense, spiciform 3 to 9 cm long by 1 to 3 cm wide. The spike or thrys is as dense as that of Solidago bicolor to which it bears a superficial resemblance; this is a variation that is well worth recognition. Although De Candolle based his species on Berlandier’s plants from around Bejar, Mexico, there can be no doubt that our plants belong here as they agree in every particular with De Candolle’s description. Growing with the species on waste grounds at Marine City, No. 6722, August 29; Oxford No. 6828, September 26; Avon, No. 6847, October 3. The Marine City plants are typical in every way; but the Oxford and Avon plants are less so as the panicles though spiciform are less dense and the leaves are not congested.
Silphium laciniatum, L. On the railway right of way near Sheldon. Only basal leaves were found, these being elliptical or elliptical-lanceolate in outline, acute at both ends, entire to pinnatifid with oblong lanceolate, acute, entire lobes, the larger leaves often a meter or more in length with a blade about 26 cm wide and a petiole equalling its own length. No. 6824, September 19.


Heliopsis scabra, Dunal, var. intermedia, Farwell. This is the commonest Heliopsis in southeastern Michigan. Oxford, No. 6673, August 8, 1923.

Rudbeckia laciniata, L. Near Denton, No. 6819, September 19. Nearby we also found as an escape from cultivation the double-flowered form called Golden Glow; No. 6820, September 19.

Rudbeckia triloba, L. Plentiful along the banks of the Bell River at Marine City; No. 6737, August 29.


Cosmos bipinnatus, Cav. An escape from cultivation. Waste grounds at Marine City, No. 6727, August 29; barnyards at Avon, No. 6856, October 3.

Tussilago Farfara, L. As reported in my last paper, this species was found in a tamarack swamp near Washington; there were two patches of it; one, near the edge underneath the tamaracks and another in the heart of the swamp, underneath cedars. On May 23, 1923, a half mile distant from the swamp, southerly, toward Washington, another patch was
found along the banks of the electric railway; it was plentiful, bearing both flowers and fruit, and gave indications of continuing to bloom for a number of days longer. Flowers bright yellow fading to reddish. No. 6490.

Arctium Lappa, L. This is the first time it has been seen in many years, the all but universal species in southeastern Michigan being *A. minus*. Near Monroe, No. 6720, August 22; Keweenaw Co., No. 452, August 20, 1886; Ypsilanti, No. 452a, August 12, 1891; Detroit, No. 452b, July 1, 1894.

Tragopogon porrifolius, L. Salsify; Oyster Plant. Cultivated for its esculent root which has an oyster-like flavor. Naturalized throughout the state. It has been observed in many places from the Ohio line to Lake Superior. Involucral bracts 8, twice longer than the purple flowers, the peduncles much swollen under the heads. Clifton, No. 309, August 6, 1885; Detroit, No. 309a, June 27, 1909.

Tragopogon pratensis, L. Goat’s Beard. Involucral bracts 8, equal to or shorter than the yellow flowers; leaves wavy margined but with straight tips; peduncles not swollen. Ypsilanti, No. 1247, June 21, 1892; Keweenaw Co., No. 1247a, July 2, 1895.

Var. tortilis, Mey. The tips of the leaves are twisted like a corkscrew. Involucral bracts 8 usually overlapping, obtuse. Seed 10-14 mm. long, tuberculately scabrous, tapering into a filiform beak 7-10 mm. long. Head of fruit, spherical, about 9 cm. in diameter, Rochester, No. 2062. September 29, 1912; Parkedale, No. 3337, May 25, 1913; Shelbyville, No. 6483, June 21, 1923; Lake Linden, No. 6589, June 25, 1923; Calumet, No. 6598a, June 25, 1923.

Tragopogon major, Jacq. Leaves linear-lanceolate, entire, acuminate as in *T. porrifolius*; bracts of the involucre 12 to 15, acuminate and twice longer than the yellow flowers; peduncles much swollen under the heads; seed roughened by coarse scales, about 15 mm. long and tapering into a filiform beak of about its own length; head of fruit spherical, about 14 cm. in diameter. Shelbyville, No. 5560, July 22, 1920, and June 21, 1923. The flowers of the species of Tragopogon often have closed as early as 8 or 9 o’clock in the morning. The large
feathery fruiting heads are both conspicuous and beautiful. Shelbyville probably is the only station in North America where T. major is known to occur; its involucral bracts are about 3 cm long at time of flowering and 6 at full maturity of the fruiting head.

Sonchus arvensis, L., var. maritimus, Wahl. Fl. Suec. (1824) 483. S. intermedius Bruckn. ex Koch. Syn. (1937) 434; S. avensis var. laevipes Koch. l. c., Ed. 2, 11 (1884) 482 and Reichb. l. c. Fl. Germ. XIX (1858) 29, table 61. MCCCCXII. Figure 11. S. arvensis var. intermedius (Bruckn) Nyman Fl. Euro. (1878-1882) 433. This variety differs from the species only in not being glandular. In a preceding paper I united it with var. glabrescens Gunth., Grab. and Wimm.; but at that time I hadn’t seen any living plants of it. The flower heads are 3.5 to 5 cm wide, flowers orange, achene linear, about 2.5 mm long, involucre 13-20 mm high. Imlay City, No. 6684½, August 15; Wiard, No. 6813, September 19; Geddes, No. 6790, September 12, 1923.

The var. glabrescens has a smaller head, not over 3.5 cm wide, flowers lemon yellow, seeds elliptic, about 1.75 mm. long, involucre smaller, not over 12 mm high.

The typical, glandular form of the species is quite common and widely distributed in southeastern Michigan.

Hieracium Florentinum, All. This species, commonly called King Devil, covers the sandy or gravelly hillsides near Lake Linden in great profusion. No. 6590, June 25, 1923. It has also spread into rich muck lands of drained swamps near Calumet where it is of gigantic size, 10-15 dm. high; No. 6598b, June 21, 1923.

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The following species are cited as occurring in this region: *Elliptio complanatus* Dillwyn (1). Described as being moderately abundant at Riverhead; *Anodonta implicata* Say (2, 3). Found in lake at Prospect Park, Brooklyn, and at Baisley's Lake, Jamaica South; *Anodonta cataracta* Say (3), from Kissena Park lake, Flushing. The writer notes the occurrence of this species at Lake Ronkonkama, a glacial kettle hole lake near the center of the island, where it seems fairly common. This species is widely distributed over the Atlantic slope. A number of specimens were transferred to St. John's lake, Cold Spring Harbor, in August, 1923, where their further progress may be noted.

Ortmann remarks of the close relationship of *cataracta* and *implicata*, the latter differing from the former only by a thickening of the shell along its lower margin, a distinction hardly noticeable in young shells. *Anodonta* sp. are usually thin-shelled under any condition of environment. Their ready adaptation to the lime-free waters of Long Island is thus easily understood. *E. complanatus* is a puzzling species due to the large number of variants representing it. While it is described as having a moderately thick shell, yet a form of it with shell so soft as to be easily indented with the finger, has been reported from a soft-water lake in New York (4). This would seem to indicate similar adaptability as the *Anodontas*. All are members of the depauperate Atlantic Coast Fauna, having been reported from New England by Johnson (5), and being found further south. The fair probability is their introduction on Long Island, one way or another through the agency of birds.

A similarly curious distribution is reported for *A. cataracta* from the Tennessee drainage. This shell is not found in the Upper Tennessee drainage above Chattanooga except at a
small pond near Knoxville, and at Wartburg on the Emory river. Yet it is abundant in the adjacent Cumberland river. Here again transportation by birds is the most plausible factor to invoke to account for its presence in the pond at Knoxville, inasmuch as it is absent from the main river. Finally with regard to Long Island shells, it is undoubtedly true that other species can be transported similarly, but it is possible that the chemical composition of the water has favored the species cited.

Dartmouth College.

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2.—Red-headed Woodpecker.

September 15.
3.—Palm Warbler.

September 18.
4.—Warbling Vireo.

September 19.
5.—White-throated Sparrow.

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6.—Brown Creeper.

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9.—Ruby-crowned Kinglet.

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2.—Kingbird.
3.—Redstart.

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4.—Wood Pewee.
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35.—Rose-breasted Grosbeak.

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43.—Bluebird.
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