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SOME FRESH-WATER NEMATODES OF THE DOUGLAS LAKE REGION OF MICHIGAN, U. S. A.*

MARGARET V. COBB. (Descriptions by N. A. COBB).

I. Introduction.

This account of the fresh-water nematodes of the Douglas Lake region is based on work made possible by a research fellowship from the University of Michigan for work at the Biological Station at Douglas Lake. The work was carried on in the summer of 1913, under the supervision of Professor Frank Smith of the University of Illinois. Most of the specific determinations have been made by Dr. N. A. Cobb, Department of Agriculture, Washington, D. C., and all have received his confirmation. I wish to acknowledge also the hospitality of the Bureau of Plant Industry, of the Department of Agriculture, during a part of the work.

II. The Region.

Douglas Lake lies in the sandy country of the northern end of the lower peninsula of Michigan, about halfway between Petosky and Mackinaw. It is about four miles long by one to two miles wide, and is one of many small lakes in the region. Collections were made from the waters of the lake itself; from its beach-pools of various ages; from its inlet, Bessey Creek; its outlet, Maple River; from a sphagnum bog cut off from the lake; and from three neighboring lakes. Of these, Monroe Lake lies about a mile north of Douglas Lake. Lancaster Lake, also to the north, is connected with Douglas Lake by Bessey Creek, which flows from the former into the latter. Dead Lake, close to Douglas Lake, has dwindled to a mere series of marshy pools. Collections were made in the following situations:

1. Maple River, entrance. Sand and mud near bank. About eighty-five specimens.
2. Maple River, short distance from entrance. Sand and mud near bank. About eighteen specimens.
3. Fairy Island, south shore. Detritus on sand, among rushes. Eight specimens.

* Publication No. 30 from the Biological Station of the University of Michigan.

4. Beach pool, south end of North Fish Tail Bay. Sand and mud, near crayfish burrows. Eight hundred specimens.
5. Large beach pool, Pine Point. Among moss. Two hundred fifty specimens.
6. Large beach pool, Pine Point, east end. Sand and mud. Thirty-three specimens.
7. Old beach pool, Pine Point. Mud, among rushes. One hundred specimens.
8. New beach pool, Pine Point. Sand and mud. One hundred seventy-five specimens.
9. Bessey Creek, middle bridge. Sand and mud near bank. Very small collection. About one hundred specimens.
10. Lancaster Lake, north shore. Two specimens.
11. Inlet of Lancaster Lake. Four specimens.
12. Monroe Lake. Among smartweed growing in water along shore. Eighteen specimens.
13. Dead Lake. Pool near roadside bridge, among moss and algæ. One hundred fifty specimens.
14. Bryant's Bog, east end. Among sphagnum. Thirteen hundred specimens.
15. Bryant's Bog, west end. Among sphagnum. Six hundred specimens.

III. Preparation of Material.

Free-living nematodes are abundant in this region, as elsewhere. They were collected by taking samples of the sand or mud and water of the pool or stream bottom, and of the aquatic vegetation. These were washed through a series of graded sieves, from coarse to fine, which removed the coarser debris, until examination with a lens showed that nematodes also were caught on the sieve. The collection was then allowed to settle for five minutes or more, and the superfluous water poured off. The nematodes were killed and fixed by adding to this watery mud an equal quantity of boiling hot saturated solution of corrosive sublimate.

Staining and mounting these small specimens is a less summary matter. Each sample was treated as follows. The sediment was examined, a little at a time, in a Syracuse watch-glass under a dissecting lens; the nematodes were picked out one at a time with a bamboo

splinter, and placed in water in the object-box of a differentiator¹, in which they were gradually passed up through the grades of alcohol to 80% alcohol. At this point they were treated with acid alcohol to dissolve out impurities (10 drops conc. HCl to 100 cc. 80% alc.) and overstained with Mayer's acid carmine according to the following formula :

Carmine..... 4 grams
 H₂O..... 15 cc.
 HCl..... 30 drops
 Add 95 cc. of 85% alcohol, boil until carmine is dissolved,
 neutralize with ammonia until carmine begins to precipitate,
 filter through glass wool.

For differentiation of the tissues acid alcohol was used (4 drops conc. HCl to 100 cc. 80% alc.). The specimens, still in the object-box, were then passed up to and through absolute alcohol and turpentine to thin balsam. This was done without removing the object-box from the differentiator, except to remove it to another type of differentiator when the change to heavier fluids began. The object-box was now opened in thin balsam in a Syracuse watch-glass, and the nematodes mounted in balsam.² From ten to one hundred, according to size, can be arranged in one drop of balsam without much crossing of specimens. This also is best done under magnification; it is convenient to have two dissecting microscopes, keeping the watch-glass of specimens under one, and the slide which is being prepared under the other. These methods were developed by Dr. N. A. Cobb.

IV. Results.

These collections from the Douglas Lake region have yielded thirty-six species, two-thirds of which are new species. They belong to twenty-seven genera; two, *Dolichodoros* and *Tylencholaimellus*, are new, and eight others have not previously been

¹For description, see New South Wales Dep't Agriculture Miscellaneous Publication No. 215. "Nematode Parasites; Their Relation to Man and Domesticated Animals". (N. A. Cobb.)

²The mounts were made on extra thin coverglasses held in perforated aluminum frame of regulation size, and covered by a smaller thin coverglass. The specimens may then be examined from either side under short focus oil immersion lens. This procedure is necessary for determining the finer histological details. Aluminum slides may be obtained from F. Cobb, Falls Church, Virginia.

recorded from North America. There is little doubt that further collections will add to this list; for while certain ubiquitous species were common to most of the collections, and many were taken from more than one situation, each of the larger collections yielded some forms found in none of the others. For some time to come each new collection may be expected to yield new forms.

The present species are as follows:

- A. Known species (see bibliography for descriptions)
 1. *Aphelenchus microlaimus* Cobb. (1).
 2. *Diplogaster fector*, Bastian (3).
 3. *Achromadora minina*, Cobb (1).
 4. *Cryptonchus nudus*, Cobb (2).
 5. *Plectus tenuis*, Bastian (4).
 6. *Chronogaster gracilis*, Cobb (2).
 7. *Mononchus longicaudatus*, Cobb (1).
 8. *Diploscapter coronata*, Cobb (2, 1).
 9. *Monhystera filiformis*, Bastian (4).
 10. *Tripyla affinis*, de Man (4).
 11. *Trilobus longus* (Leidy) Bastian (3).
 12. *Anonchus monhystera*, Cobb (2).
- B. New species, described in Trans. American Micr. Soc., for April, 1914 (3).
 1. *Dolichodorus* n. g. *heterocephalus*.
 2. *Microlaimus fluviatilis*.
 3. *Rhabdolaimus minor*.
 4. *Cephalobus sub-elongatus*.
 5. *Teratocephalus cornutus*.
 6. *Prismatolaimus stenurus*.
- C. New species here described.
 1. *Tylencholaimellus* n. g. *diplodorus* n. sp.
 2. *Actinolaimus propinquus*, n. sp.
 3. *Dorylaimus sulcatus*, n. sp.
 4. *Ironus minor*, n. sp.
 5. *Mononchus lacustris*, n. sp.
 6. *Cyatholaimus fluviatilis*, n. sp.
 7. *Chromadora inornata*, n. sp.
 8. *Ethmolaimus gracilicaudatus* n. sp.
 9. *Aphanolaimus viviparus*, n. sp.
 10. *Aphanolaimus communis*, n. sp.
 11. *Prismatolaimus digitatus*, n. sp.

D. Undetermined species.

- | | |
|--------------------------|--------------------------|
| 1. <i>Dorylaimus</i> sp. | 5. <i>Plectus</i> sp. |
| 2. <i>Dorylaimus</i> sp. | 6. <i>Rhabditis</i> sp. |
| 3. <i>Dorylaimus</i> sp. | 7. <i>Monhystera</i> sp. |
| 4. <i>Dorylaimus</i> sp. | |

TABLE SHOWING LOCAL DISTRIBUTION OF THE SPECIES

	Monroe Lake	Lancaster Lake	Inlet to Lancaster Lake	Fairy Island	Maple River	Bessey Creek	New Beach pool	Beach pool North Fish Tail Bay	Beach pool Pine Pt. sand and mud	Old Beach pool rushes	Beach pool Pine Pt. moss	Dead Lake	Bryant's Bog
<i>Aphelenchus micro-laimus</i>	×
<i>Tylencholaimellus dip-lodorus</i>	×
<i>Dolichodorus hetero-cephalus</i>	×
<i>Dorylaimus sulcatus</i>	×	..	×	×	..	×	×
<i>Dorylaimus spp.</i>	×	×	×	×	..	×	×	×	×	×	×
<i>Actinolaimus propin-quus</i>	×	×	?	×	×
<i>Ironus minor</i>	×	..	×	×	..	×	..	×
<i>Mononchus longicauda-tus</i>	×
<i>Mononchus lacustris</i>	×	..	×	×	..	×	..	×
<i>Diplogaster fictor</i>	×	×	×
<i>Cyatholaimus fluviatilis</i>	×
<i>Achromadora minima</i>	×
<i>Chromadora inornata</i>	×	×
<i>Ethmolaimus gracili-caudatus</i>	×	×
<i>Microlaimus fluviatilis</i>	×	×	×	×	×	×	×	×	..	×
<i>Cryptonchus nudus</i>	×	×	..	×	×	×	×
<i>Plectus tenuis</i>	×	×	..	×	×	×	×	..	×
<i>Plectus sp.</i>	×	..
<i>Chronogaster gracilis</i>	..	×	×	×	×	×	×	×	..	×

	Munroe Lake	Lancaster Lake	Inlet to Lancaster Lake	Fairy Island	Maple River	Bessey Creek	New Beach pool	Beach pool North Fish Tail Bay	Beach pool Pine Pt. sand and mud	Old Beach pool rushes	Beach pool Pint Pt. moss	Dead Lake	Bryant's Bog
<i>Rhabditis</i> sp.	×
<i>Rhabdolaimus minor</i>	×	×	×	×	×	×	..	×
<i>Cephalobus sub-elongatus</i>	×
<i>Teratocephalus cornutus</i>	×	×	×	..	×	..	×
<i>Aphanolaimus viviparus</i>	×	?	×	..	×	×	×	×	×	×	×
<i>Aphanolaimus communis</i>	×	?	..	×	×	×	..	×	?	×	..	×	..
<i>Prismatolaimus stenus</i>	×	?	×	×
<i>Prismatolaimus digitatus</i>	×	?	×	×	..	×
<i>Monhystera filiformis</i>	×	?	×	×	×	×	×	×	×	..	×
<i>Monhystera</i> sp.	×	?	×	?	..	×	..	×
<i>Trilobus longus</i>	×	×	..	×	×	×	×	×	×	..	×
<i>Tripyla affinis</i>	×	..	×	×
<i>Anonchus monhystera</i>	×	×	×	?	×
<i>Diploscapter coronata</i>	×

V. Key to the Genera Found in These Collections.

1. (10) Oral end armed with protrusile spear or sting..... 2
2. (5) Spear with bulbous base..... 3
3. (4) Oesophagus with median bulb only..... *Aphelenchus*, Bastian
4. (3) Oesophagus with median bulb only..... *Tylencholaimellus*, Cobb
5. (2) Spear without a bulbous base..... 6
6. (7) Oesophagus with median bulb; males with bursa.....
..... *Dolichodorus*, Cobb
7. (6) Oesophagus with only an elongated posterior swelling..... 8
8. (9) Pharynx simple, male supplementary organs not in fascicles
..... *Dorylaimus*, Dujardin
9. (8) Pharynx with complicated radiate framework, male supplementary organs in fascicles..... *Actinolaimus*, Cobb

10. (1) Oral end without protrusile spear or sting..... 11
11. (28) Pharynx armed with one or more refractive chitinous teeth 12
12. (13) Number of teeth three; equal, small, mobile, well forward near the mouth Ironus, Bastian
13. (12) Number of teeth one; or more and unequal..... 14
14. (15) Teeth, especially dorsal tooth, usually massive; thick, more or less prominently papillate lips closing over the pharynx Mononchus, Bastian
15. (14) Teeth small, often only one, then dorsal; lips with inconspicuous papillæ; pharynx moderate..... 16
16. (27) Œsophagus usually with one or two bulbs..... 17
17. (18) Bulbs two, spinneret absent..... Diplogaster, M. Schultze
18. (17) Bulb one, then cardiac; or none. Spinneret present..... 19
19. (20) Pharynx cupshaped, then conoid, longitudinally ribbed; without œsophageal bulb..... Cyatholaimus Bastian
20. (19) Pharynx less conspicuously ribbed; œsophagus with a distinct cardiac bulb..... 21
21. (26) Dorsal tooth well developed..... 22
22. (25) Pharynx cyathiform, then conoid, joining the œsophagus rather indefinitely 23
23. (24) Dorsal tooth opposed by one or more small teeth, amphids spiral, at side of head..... Achromadora, Cobb
24. (23) Dorsal tooth single, amphids invisible or inconspicuous, towards front of head..... Chromadora, Bastian
25. (22) Pharynx cyathiform, then prismoid, ending behind very definitely; amphids distinct..... Ethmolaimus, De Man
26. (21) Dorsal tooth very small, circular amphids well developed... .. Microlaimus, De Man
27. (16) Œsophagus plain Cryptonchus, Cobb
28. (11) Pharynx without teeth..... 29
29. (42) Œsophagus with bulbs..... 30
30. (33) Amphids circular or nearly so; pharynx compound, much elongated 31
31. (32) Chitinous external marking of amphids circular.. Plectus, Bastian
32. (31) Chitinous external marking of amphids not circular..... .. Chronogaster, Cobb
33. (30) Amphids apparently absent..... 34
34. (37) Œsophagus with two more or less well developed bulbs; males with a bursa..... 35
35. (36) With no "diggers" on head..... Rhabditis, Dujardin
36. (35) With dorsal and ventral "diggers" on head.... Diploscapter, Cobb
37. (34) Œsophagus with only one well developed bulb; males without bursa 38
38. (39) Pharynx long and narrow..... Rhabdolaimus, de Man

39. (38) Pharynx not long and narrow..... 40
 40. (41) Striæ not resolvable into rows of dots.....Cephalobus, Bastian
 41. (40) Striæ resolvable into rows of dots, altered on lateral fields
 Teratocephalus, de Man
 42. (29) Œsophagus without bulbs..... 43
 43. (46) Pharynx none 44
 44. (45) Amphids spiral.....Aphanolaimus, de Man
 45. (44) Amphids circular or ellipsoidal..... Tripyla, Bastian
 46. (43) Pharynx present 47
 47. (48) Cavity relatively large, amphids very small.....
 Pristmatolaimus, de Man
 48. (49) Cavity small, amphids usually well developed..... 49
 49. (50) Form of cavity conoid, open in front; circular amphids
 considerably behind it.....Monhystera, Bastian
 50. (49) Form of cavity various, closed in front; amphids nearly
 opposite it 51
 51. (52) Lateral organs inconspicuous.....Trilobus, Bastian
 52. (51) Lateral organs more or less conspicuous spirals or circles..
 Anonchus, Cobb

VII. Literature Cited.

The following specific descriptions have been prepared by Dr. N. A. Cobb, Department of Agriculture, Washington, D. C., who examined the collection with the view of adding to the completeness of the key he is preparing for the identification of the American free-living freshwater nematodes.

1. *Tylencholaimellus* n. g. $\frac{.6 \quad 6.6 \quad 12. \quad -M- \quad 97.}{1.1 \quad 2.2 \quad 3.6 \quad 4.7 \quad 27.8}$ mm.
- diplodorus*, n.sp.

The thin transparent layers of the colorless, naked cuticle are traversed by exceedingly fine transverse striæ visible for the most part only in the subcuticle. Longitudinal striæ exist throughout the body, probably associated with the attachment of the muscle cells to the subcuticle. The conoid neck becomes convex-conoid near the head which is rounded and not set off in any way. On the outer margin of the head there are six minute flattish conoid papillæ which when seen in profile slightly interrupt the outer contour of the head. Surrounding the mouth opening there are what appear to be similar papillæ, but they are very inconspicuous so that at first glance the head appears to have only a single circllet of cephalic papillæ, namely, the posterior. The vestibule is very narrow, the lips closing together over the apex of the spear, which apparently is located normally a distance twice as far from the anterior extremity as the posterior circllet of papillæ. The main portion of the spear is one-fifth as wide as the corresponding portion of the head. This is followed by a "hilt" half as long as the main shaft, and half as wide again, ending in a short, three-bulbed base fully one-third as

wide as the corresponding portion of the neck. The entire length of the spear is about four times the width of the lip region measured opposite the posterior cirlet of papillæ. The anterior portion of the spear is more strongly chitinized than the posterior portion. It has a dorsally oblique opening similar to that seen in *Dorylaimus*, and presents the striking peculiarity of *having an extra piece of chitin on the dorsal side*. This extra piece is bowed outward very slightly so that there is a space between it and what would be regarded as the normal dorsal wall of the spear,—that is, the wall which comes next to the lumen, through which the food must pass. It is this peculiarity which gives rise to the specific name. The œsophagus begins at the base of the spear as a tube about one-fourth as wide as the corresponding portion of the neck and continues to be narrow to near the posterior portion of the neck. At the beginning of the posterior fifth of the neck, or thereabouts, the œsophagus suddenly enlarges to produce an elongated cardiac swelling or bulb two-thirds as wide as the base of the neck and two and one-half times as long as wide. The lining of the œsophagus is very faint throughout its length. There is no very distinct cardia. The intestine, which is separated from the œsophagus by a distinct constriction, becomes at once three-fourths as wide as the body. Its cells contain small scattered fairly numerous yellowish granules which are not disposed so as to give rise to any tessellation. The appearance by transmitted light is that of a firmament in which the stars are unusually close together.

The tail of the male begins to taper from some little distance in front of the slightly elevated anus and is conoid to the rounded terminus which has a diameter one-third as great as that of the base of the tail. No papillæ or hairs occur on the tail. The supplementary organs are two in number. One occurs a short distance in front of the anus opposite the junction of the distal and middle thirds of the spicula. The second is nearly twice as far in front of the anus as the proximal ends of the spicula. The supplementary organs are simple in character, consisting of very low flat cones which interfere but little with the ventral contour. The posterior is perhaps double, that is, consists of two papillæ side by side close to the ventral line. The two equal arcuate spicula are one and two-thirds as long as the anal body diameter. They are simple in character and are made of a rather frail framework. They are widest toward the proximal extremity where the greatest width is one-fourth as great as that of the corresponding body diameter. They taper toward the proximal end from this widest part, and the proximal end is almost imperceptibly cephalated by expansion. No very distinct accessory pieces have been seen, though the lining of the sheath in which the spicula glide is a little more pronounced toward the anus. The faintest possible traces of very oblique copulatory muscles have been seen. There are two small testicles outstretched in opposite directions after the manner of *Dorylaimus*. The blind end of the anterior one is one and one-half times as far behind the base of the neck as this latter is behind the anterior extremity. Nothing is known concerning the renette.

Locality: Maple River, Mich.

2. *Actinolaimus propinquus*, n.sp. $\frac{.6 \quad 6.7 \quad 24. \quad '47' \quad 91.}{.8 \quad 1.5 \quad 1.9 \quad 2 \quad 1.2} 2.4$ mm.*

The thin layers of the transparent, colorless, naked cuticle appear to be destitute of transverse striations. If any occur they must be exceedingly minute. Faint longitudinal striations exist throughout the length of the body, and are most readily visible outside the borders of the lateral fields. The posterior portion of the neck is cylindroid; toward the head it becomes conoid. The subtruncate head is set off by a very broad, almost imperceptible constriction. The contour of the front of the head is approximately flat. This flat portion occupies about two-thirds of the diameter of the front of the head, and from its margin the head slopes at an angle of forty-five degrees to join the short subcylindrical portion of the head opposite the anterior part of the pharyngeal cavity. The lips are thoroughly amalgamated, and the two blunt angles caused by the oblique marginal surface are the locus of the two circlets of labial papillæ which do not extend out so as to materially break the contour, but are seen in optical section as refractions rather than as elevations. The innervations are obscure. Amphids are present in the form of somewhat elliptical markings, the plainest of which is a refractive chitinous curve on the surface of the head opposite the anterior portion of the collar of the spear. The width of these markings is about one-fourth to one-third as great as that corresponding portion of the head. When the amphids are seen dorso-ventrally they have the form of narrow slits leading inward and backward from a distinct narrow groove opposite the base of the lips, that is to say, opposite or slightly behind the bottom of the anterior portion of the pharyngeal cavity. The mouth opening is circular and fits the spear. Surrounding the mouth there is a somewhat discoid structure which is separated from the outer portion of the wall of the head by a circular groove as in *Actinolaimus radiatus*. The outer wall of this shallow groove is very finely longitudinally striated. The disk-like structure represents the inner portion of the lip region and is arched over the anterior part of the pharynx which is more or less globoid in form, and one-half as wide as the corresponding portion of the head. At its base there are six chitinous processes which surround the spear and serve to guide it in action. These project into the spheroidal chamber so that its base, instead of being flat or concave, is really convex or conoid toward the lips. The optical section of this portion of the cavity is therefore that of a somewhat broad crescent rather than circular. The lateral walls of this cavity when seen in optical section sometimes present appearances leading to the conclusion that it is minutely dentate in some such way as is the wall of the pharynx of some species of *Mononchus*. The observations on this point, however, are not yet sufficiently decisive. At a distance from the anterior extremity equal to about two-thirds of the radius of the front of the head is found the beginning of the

* Formula derived from a single specimen which apparently had lost a short portion of the tail.

guiding collar for the spear, which is compound, wider posteriorly than it is anteriorly. Anteriorly it is but slightly wider than the spear, and there is a narrow, refractive chitinous element or ring clearly indicating the anterior border of the collar. The substance of the collar behind this border is practically cylindrical, although it diminishes slightly in diameter to a little in front of the middle of the collar, where it is flared and receives a second element inside the space formed by the flare. This second element is itself flared, though it is smaller than the first, and is continued backward and ends rather indefinitely. Both these expansions, or "capes," are margined with refractive chitinous rings. Measuring to the limit of the second flare, which is indicated by a chitinous ring similar to that which indicates the anterior limits of the collar, it may be said that the collar is about as long as it is wide in its widest part, namely, about twice as wide as the spear. This latter is fully one and one-half times as long as the head is wide. It is slightly swollen just behind the oblique dorsal aperture. In its posterior three-fifths the spear is cylindrical, while in the anterior two-fifths it tapers to an acute point, the ventral contour being slightly arcuate, while the dorsal contour is nearly straight. The diameter of the shaft of the spear is about one-fifth as great as that of the corresponding portion of the head, perhaps a little less. The walls of the spear are well chitinized. Following the spear is a tubular, rather indefinite portion, about three-fourths as long as the spear, which joins a fusiform swelling about one-half as wide as the corresponding portion of the neck and about as long as the spear, through which the lumen continues to be only slightly less narrow than in the spear itself. The fibers in this fusiform portion extend forward as well as outward. Behind this fusiform part the œsophagus is a tube nearly one-third as wide as the corresponding portion of the neck. It continues to have this diameter, although it varies a little, to a short distance in front of the nerve ring, where there is an obscure swelling of very faint character. Behind this swelling, the œsophagus for a short distance, where it passes through the nerve ring, is about one-fourth as wide as the corresponding portion of the neck, or a little less. Behind the nerve ring it expands gradually to a point where there is a break in the musculature. At this point the œsophagus is nearly two-fifths as wide as the corresponding portion of the neck. It continues to have this diameter for a distance nearly equal to two of the corresponding body diameters and then rather suddenly enlarges at a point where there is a second break in the musculature. Thence onward the œsophagus is cylindrical and nearly two-thirds as wide as the corresponding portion of the neck. For a short distance near the base of the œsophagus the internal tissues stain differently from those farther forward. They take the carmine more strongly. This portion of the œsophagus is one and one-half times as long as it is wide. It is not set off from the rest of the œsophagus by any striking difference in the internal structure. The lining of the œsophagus is a distinct feature, especially in the enlarged cylindrical portion, where its optical expression consists of several marked refractive,

parallel, longitudinal lines occupying fully one-fourth of the optical longitudinal section. The rather broad conoid cardia is two-thirds as long as the body is wide. The cardiac collum is about one-third as wide as the body and presents the peculiarity that the lining of the œsophagus extends into it a short distance. The constriction between the œsophagus and the intestine is not only deep but rather broad, and one or two special spherical cells are to be seen in this region. The thick-walled intestine becomes at once about three-fifths as wide as the body, and is composed of cells of such size that a considerable number are required to build a circumference, probably about eight. These cells contain numerous brownish-yellow granules of variable size, the largest having a diameter about one-half as great as the internal diameter of the spear. The tail begins to taper from some little distance in front of the anus and tapers at the same rate behind the anus. It continues so to taper until near the extremity, which is sometimes blunt, sometimes conical, and sometimes subacute. For some little distance in front of the terminus, namely, a distance fully equal to the length of the anal body diameter, the tail is cylindrical and not more than one-twelfth to one-twentieth as wide as at the anus. This latter is very slightly raised in that the posterior lip is slightly elevated. From it the conspicuous rectum, which is lined with refractive chitin, and is fully twice as long as the anal body diameter, extends inward and forward. Anal muscles are present and rather conspicuous, as are also rather numerous glandular cells. The pre-rectum is about five times as long as the corresponding body diameter and about three to four times as long as the rectum. The pre-rectum differs from the rectum in being smaller in diameter, and its cells do not contain the brownish-yellow granules seen in those of the intestine. The lateral fields are distinct and nearly one-third as wide as the body. Nothing is known concerning the renette. The nerve ring surrounds the œsophagus somewhat squarely. From the rather small vulva the vagina leads inward at right angles to the ventral surface about half way across the body, where it joins the two symmetrically placed uteri. The reflexed ovaries, which taper toward the blind end, reach three-fourths of the way back to the vulva and contain about two dozen developing ova, most of which are arranged in single file and are more or less compressed into disk-like form. The eggs are ellipsoidal and somewhat longer than the body is wide and a little less than half as wide as long. The eggs are apparently deposited before segmentation.

Locality: Maple River and Beach Pools, Douglas Lake, Mich.

3. *Dorylaimus sulcatus*, n.sp. $\frac{.5 \ 12. \ 33. \ Y \ 92.}{.8 \ 2.5 \ 3.1 \ 29 \ 1.7}$ 1.6 mm.

The very thick layers of the transparent, colorless, naked cuticle appear to be destitute of transverse striations. Prominent longitudinal striæ to the number of about 32 are found throughout the length of the body except on the lateral fields where for a distance equal to about one-fourth of the body-width, they are absent. The cuticle becomes thinner near the lips. The

neck is conoid, tapering more rapidly toward the truncate head which bears a lip region set off by an almost imperceptible, broad constriction. The lips are thoroughly amalgamated, and each is armed with two plainly innervated papillæ, one on the outer surface and outward pointing, and one on the outer margin of the front surface and forward pointing. These papillæ do not interfere with the contour of the lips. The front of the head is very slightly depressed in the middle. The pharynx is beaker-shaped, half as wide as the front of the head, and a little deeper than it is wide. The apex of the spear appears on a level with the front surface of the lips. Under these circumstances this beaker-shaped portion of the pharynx is continued as a somewhat narrower cylindrical part which is nearly filled by the spear for a distance almost equal to the depth of the beaker-shaped portion. At the base of this second narrow portion of the pharynx occurs the guiding collar of the spear which closely surrounds the spear for a distance about equal to its own width. The limits of the collar are indicated by two chitinous rings, the anterior of which rather closely surrounds the spear, the posterior and stronger of which is somewhat wider. The relatively small, somewhat stirrup-shaped amphids are just behind the outer circlet of papillæ. They are about one-third as wide as the corresponding portion of the head. Their anterior contour is a nearly straight, transverse element, from the ends of which there extend backward and inward convex contours which become indefinite opposite the base of the beaker-shaped portion of the pharynx. There are no eye-spots. The massive spear is three times as long as the front of the head is wide and tapers from base to apex. Seen in profile, the taper of the posterior three-fifths is only slight, whereas that of the anterior two-fifths is more pronounced; the contour is straight on the dorsal side, where the opening is, and slightly convex on the ventral side. The apex is acute. When seen in optical longitudinal section, the chitin forming the spear is seen to be bifurcated at the posterior margin, more particularly on ventral side. At its maximum width, namely, at the base, the spear is nearly half as wide as the front of the head and about one-fifth as wide as the corresponding portion of the neck. There is no distinct fusiform swelling at some little distance behind the spear as is often the case in *Dorylaimus*. The lumen of the spear is continued by that of the œsophagus for a distance about equal to the length of the spear; at the posterior extremity of this portion there is an obscure joint in the lining of the tube. Otherwise, there is no indication of the secondary extending element of the spear. The œsophagus begins behind the secondary element as a tube fully one-third as wide as the corresponding portion of the neck, and continues to have this diameter until it passes through the nerve ring. At this point it begins to enlarge almost imperceptibly, and finally at the beginning of the posterior third, it enlarges rather rapidly so that in this portion of the neck it occupies one-half of the diameter. At the extremity, finally, it is really a little more than one-half as wide as the base of the neck. There is a somewhat spheroidal cardia, one-fourth as wide as the base of the neck. The

lining of the œsophagus is a very distinct feature throughout its length. In the posterior enlarged portion the lining consists of several parallel longitudinal elements occupying one-fourth of the optical longitudinal section; in the narrow tubular part the lining occupies one-third of the diameter. The rather thick-walled intestine, which is separated from the œsophagus by a fairly distinct constriction, becomes at once two-thirds as wide as the body. Its walls are composed of cells of such size that probably a considerable number are required to build a circumference, perhaps six to eight. These cells contain rather numerous brownish-yellowish granules of variable size, the largest of which have a diameter about one-third as great as the thickness of the cuticle, the smallest of which are much smaller. The granules are so arranged as to suggest a faint tessellation. Of the large granules, two to three would go side by side into the base of the spear. From the slightly depressed anus the conspicuous, chitinized rectum, which is one and one-half times as long as the anal body diameter, extends inward and forward. The pre-rectum is about three times as long as the rectum and is distinctly separated from the intestine by difference in size as well as difference in structure; it is considerably narrower. Only a short distance in front of the constriction separating the pre-rectum from the intestine, the intestine is nearly fifty per cent wider than the pre-rectum. The brownish-yellow granules characteristic of the cells of the intestine are absent from those of the pre-rectum. The tail begins to taper from some distance in front of the anus; near the anus it tapers more rapidly, and again more rapidly still behind the anus, in such fashion that the anterior three-fourths are concave-conoid; the reduction in diameter is such that at the beginning of the final fourth, the tail measures only about one-tenth as wide as at the base. Thence onward the tail tapers but very slightly to the rather blunt, colorless terminus. The posterior fourth is destitute of axial matter. The cuticle of the posterior portion of the body, though not striated in the usual way, is radially striated. These radial markings come out most clearly in optical longitudinal section, and are visible on the surface, inasmuch as the surface appears to be finely granular. These striations are so minute that they would escape observation except with high powers and under favorable conditions. Once having seen this striation in the posterior part of the cuticle, one remarks it as less plainly visible throughout the body. Nothing is known concerning the renette. The nerve ring is rather massive and surrounds the œsophagus rather squarely. Connected with it, and near by, are numerous ganglion cells, somewhat more conspicuous than is usual in this genus. From the depressed vulva, the strongly chitinized, massive vagina leads inward at right angles to the ventral surface fully half way across the body. The vagina is rather complicated in structure, consisting of central masses of structureless chitin forming a somewhat bell-shaped contour when seen in optical longitudinal section. These elements are surrounded by granular and fibrous muscular structures, and into the internal angle which the chitinous elements form near the axis there extend

other refractive, more or less chininous elements. Small unicellular glands are to be seen on both sides of the vagina,—anterior and posterior. The uteri are two in number and symmetrically disposed. The reflexed ovaries reach half way back to the vulva, at least in immature specimens such as that from which the description is derived. At a distance in front of and behind the vulva about equal to the length of the corresponding body diameter, there are slightly depressed ventral areas in which the radial striation of the chitin is materially altered and into which there appear to pass fibrous elements from the sub-cuticle, connected with special groups of small cells, presumably nerve cells, located in the body wall.

Locality: Maple River, Michigan.

				35.9		
4. <i>Ironus minor</i> , n.sp.	2.2	8.1	21.9	51.8	90.2	1.6 mm.
	1.	1.5	1.7	1.9	1.1	

The moderately thick layers of the transparent, colorless, naked cuticle appear to be traversed by exceedingly fine transverse striæ. The conoid neck ends in a slightly expanded, rounded head whose chitinous elements are unusually refractive. On the outer surface of the head at a distance from the anterior extremity about equal to the radius of the head there is a cirlet of four, equal, arcuate, spreading cephalic setae, one-third as long as the corresponding portion of the head is wide. There are three lips each armed with a highly refractive, arcuate-conoid, acute, inward-pointing tooth with a somewhat forward pointing apex. These teeth, which are nearly half as long as the head is wide, are arranged opposite each other near the mouth opening and are doubtless capable of being everted, though they have not been seen in the everted position. In growing specimens additional sets of these teeth are often seen at a distance from the anterior extremity about equal to two to three head widths. Immediately behind the vestibule, which is the narrow passage leading between the teeth, the pharynx is wider than it is farther back. At this point, immediately behind the base of the lips the pharynx is one-half as wide as the corresponding portion of the head. It soon narrows, so that at a distance from the anterior extremity equal to the diameter of the head, it is less than one-third as wide as the corresponding portion of the head. Thence on, it is of uniform diameter, tubular and slightly sinuous to the truncate end. The walls of the pharynx are distinctly chitinized and are surrounded with little tissue. The œsophagus begins at the base of the pharynx as a tube two-thirds as wide as the corresponding portion of the neck and very gradually expands as it passes backward, so that finally it is two-thirds as wide as the base of the neck. The lining of the œsophagus is a distinct feature throughout its length and generally appears in optical, longitudinal section as a series of two or three parallel longitudinal lines, occupying about one-eighth of the optical section. There is a flattish-hemispherical cardia about half as wide as the base of the neck. The vaguely-tesselated intestine, which becomes at once about two-

thirds as wide as the body, is separated from the œsophagus by a distinct constriction. It is thick-walled and is composed of cells of such size that probably but few are required to build a circumference. These cells contain scattered, yellowish-brown granules of variable size. From the inconspicuous but slightly elevated anus, the rectum, which is one and one-half to two times as long as the anal body diameter, extends inward and forward. The rectum is separated from the intestine by a fairly definite pyloric constriction. The tail tapers from some distance in front of the anus and continues to taper behind the anus at about the same rate to the nearly hair-fine terminus, which is destitute of a spinneret. The longitudinal fields appear to be one-third as wide as the body. The nerve ring surrounds the œsophagus somewhat obliquely. Nothing is known concerning the renette. From the elevated vulva, the well developed vagina leads inward at right angles to the ventral surface half-way across the body, where it joins the two symmetrically placed uteri. The reflexed, tapering ovaries reach about half-way back to the vulva and contain about eight developing ova. The moderately thin-shelled, smooth eggs are much elongated and about five times as long as the body is wide, and about one-sixth as wide as long. They appear to be deposited before segmentation begins.

Locality: Beach pools and bogs, Douglas Lake, Michigan.

	19.					
	2.1	7.7	27.	64.	95.	
5. <i>Mononchus lacustris</i> , n.sp.	1.8	2.1	2.4	2.7	1.8	1.7 mm.

The thin layers of the transparent, colorless, naked cuticle appear to be destitute of transverse striations. If any are present they must be exceedingly minute. The cylindroid neck tapers slightly toward the head, which bears a very slightly expanded lip region composed of six confluent lips, each bearing two papillæ, one on the outer surface and outward pointing, and one on the front surface halfway between the margin and the body axis, and forward pointing. This inner circlet of papillæ is composed of members of somewhat larger size than those of the outer circlet. Both are flattish conoid in shape, and impart to the contour of the lips a somewhat angular appearance. The thick lips are arched together over the goblet-shaped pharynx, which has a depth equal to the diameter of the head, measured opposite the base of the pharynx. At its widest part, a short distance behind the lips, opposite the apex of the dorsal tooth, the pharynx is three-fifths as wide as the corresponding portion of the head. Thence backward it tapers rather regularly to near the base, where it tapers a little more rapidly in that part which extends into the anterior end of the œsophagus. The walls of the œsophagus are well chitinized. The dorsal tooth springs from near the middle of the dorsal side of the pharynx, and extends inward and forward. The apex is forward pointing. At its greatest width the tooth is about one-third as wide as the corresponding portion of the pharynx, though it projects forward so that its apex lies opposite the axis of the head. The

axis of the dorsal tooth is not straight, but slightly curved, that is to say, has the form of a line of beauty. Surrounding the œsophagus opposite the dorsal tooth there is a band of minute chitinous teeth on the wall of the pharynx arranged in transverse series. Where these teeth are most numerous there are at least six transverse rows. They begin near one lateral line and extend around the ventral side of the pharynx to the other lateral line. Viewed at a certain angle, which is very near the lateral view, these teeth appear, on a surface inspection, to occupy an elongated elliptical area, and with low powers one might easily mistake one of these areas for the outer expression of one of the amphids. Behind this area of minute rasp-like teeth there are two small projections from the inner surface of the pharynx, which are undoubtedly rudimentary teeth of the same character as the large dorsal teeth. These are several times larger than the minute teeth just mentioned, and are located opposite the base of the large dorsal tooth just behind the rasp-like area. They are practically submedian in position, one near each ventrally submedian line. The inconspicuous amphids are on the lips just behind the outer papillæ. They are somewhat circular in contour, one-fifth as wide as the lip-region, and only their anterior contours are definite. There are no eye-spots. The œsophagus receives the base of the pharynx, and is at that point almost imperceptibly enlarged. A short distance behind the pharynx the œsophagus is nearly three-fifths as wide as the corresponding portion of the neck. Thereafter it diminishes very slightly, until after it passes through the nerve-ring, when it begins to increase, and continues gradually to increase throughout the remainder of its length. It finally becomes two-thirds as wide as the base of the neck. The lining of the œsophagus is a very distinct feature throughout its length, more particularly in the anterior part, where it occupies about one-fourth of the longitudinal optical section, and finds optical expression in three refractive parallel lines. There is no very distinct cardia. The intestine, which is set off from the œsophagus by a distinct constriction, becomes at once about two-thirds as wide as the body. It is composed of cells of such a size that six to eight posteriorly, and ten to twelve anteriorly, are required to build a circumference. These cells are packed with minute granules of rather uniform size, which, together with refractive cell walls, give rise to an indistinct tessellation. From the raised anus the conspicuous rectum, which is about as long as the anal body diameter, extends inward and forward. The conoid tail tapers from the anus and ends in a subtruncated terminus, containing a single somewhat depressed axial pore, which forms the outlet for the secretions of the three caudal glands. These latter lie in a tandem series, one opposite the rectum, and the other two immediately behind, the posterior cell being slightly the smallest, and having its limits near the middle of the tail. The ducts form a conspicuous feature, and together occupy about one-third the diameter of the middle of the tail. They are slightly expanded posteriorly, so that one may with correctness speak

of the presence of ampullæ. The lateral fields are about one-third as wide as the body. From the slightly elevated vulva the vagina extends forward at right angles to the ventral surface nearly halfway across the body, where it joins the two symmetrically placed uteri. The reflexed ovaries reach nearly three-fourths the distance back to the vulva, and contain about a dozen developing ova, arranged for the most part somewhat irregularly. The distal end of the ovary tapers rather rapidly. Judging from the size of the ripe ova the eggs are nearly twice as long as the body is wide, and not much more than one-third as wide as long. Nothing is known concerning the renette. The nerve-ring surrounds the œsophagus somewhat squarely. The single specimen examined contains the remains of an organism that has been swallowed. This may be the skin of another nematode.

Locality: Beach Pools, Douglas Lake, Michigan.

				21		
6. <i>Cyatholaimus fluviatilis</i> n.sp.	1.7	9.2	16.	'49.'	86.	
	2.	2.6	2.7	3.9	2.3	.9 mm.

The thin layers of the transparent, colorless, naked cuticle are traversed by exceedingly fine transverse striæ, resolvable with the very greatest difficulty into rows of dots which are not modified on the lateral fields. The conoid neck ends in a rounded head which is not set off in any way. The lip region is divided internally into about twelve parts, whose refractions give rise to a striated appearance of the vestibule extending backward from the front of the head to near the apex of the dorsal tooth. When the mouth is partially open each of these elements has a triangular contour, the bases being adjacent to a sinuous, refractive, chitinous line encircling the base of the lips on the inside of the vestibule. The pharynx is open and somewhat elongated. Near the base it is about one-fourth as wide as the base of the head. A little farther forward it is 50% wider; in this part the thumb-shaped dorsal tooth is found. This tooth springs from the dorsal side of the pharynx and extends inward at an angle of approximately 30° with the axis of the head. It is slightly arcuate, so that its apex is directed nearly forward. The wall of the pharynx is fairly well chitinized. There are ten cephalic setæ on the outer margin of the head opposite the apex of the dorsal tooth, two on each submedian line, and one on each lateral line. These setæ are about equal in length throughout the series,—about one-third as long as the corresponding diameter of the head. The amphids are so located that their posterior margins are a little in front of the base of the pharynx; they consist of spirals of a little more than two winds, and are about one-third as wide as the corresponding part of the head. The œsophagus surrounds the pharynx without being enlarged. It begins at the base of the pharynx as a tube fully two-thirds as wide as the corresponding portion of the neck, and retains this diameter throughout most of its length, but finally expands to form an obscure, ellipsoidal bulb or pseudo-bulb, five-sixths as wide as the base of the neck. The lining of the œsophagus is a

fairly distinct feature throughout its length. There is no distinct valve in the pseudo-bulb. The moderately thick-walled intestine is separated from the œsophagus by a very deep and distinct constriction and becomes at once two-thirds as wide as the body. The cells composing the intestine are of such size that about eight to ten are required to build a circumference. They contain scattered granules of variable size, the largest of which have a diameter such that they would slip inside the dorsal tooth. From the inconspicuous anus the *very unusually long rectum* extends inward and forward. The rectum is separated from the intestine by a distinct pyloric constriction. The entire length of the rectum is three to four times as great as the anal body diameter. The tail is conoid from the anus to the terminus, whose diameter is about one-fifth as great as that of the base of the tail and bears a plain, conoid, apparently unarmed spinneret. There do not appear to be any setæ on the tail. The lateral fields are about one-half as wide as the body and are composed of cells of large size arranged somewhat irregularly in two rows. From the slightly elevated vulva the chitinized vagina leads inward at right angles to the ventral surface nearly half-way across the body, where it joins the two symmetrically placed uteri. The reflexed, tapering ovaries reach half way back to the vulva and contain comparatively few developing ova. The thin-shelled eggs have been seen in the uterus one at a time and are three times as long as the body is wide, and somewhat less than one-third as wide as long. They are apparently deposited before segmentation begins.

Locality: Maple River, Michigan.

7. *Chromadora inornata*, n.sp. $\frac{3.2 \ 10.8 \ 19. \ 49. \ 90.}{3.2 \ 4.8 \ 5.2 \ 6.4 \ 2.4}$.5 mm.

The thin layers of the transparent, colorless, naked cuticle are traversed by very fine striæ which do not appear to be further resolvable. It should be noted, however, that the examination was confined to a single balsam specimen, and that a more complete observation may perhaps show the striæ to be further resolvable. Along the lateral field are faint longitudinal striæ, beginning near the middle of the neck and extending on to the tail. Of these there are two double lines quite near together, occupying a space probably not greater than one-twelfth of the diameter; outside these, other fainter lines. No traces of cephalic setæ have been seen, but, as the description is derived from a single specimen, it is barely possible that they are present and have been broken off. Other specimens in the same lot being in fairly good preservation, it seems likely that there are no cephalic setæ. Unfortunately this specimen is dirty at the head end, so these matters have to be left in uncertainty. The conoid neck ends in a somewhat rounded head which is not set off in any way. In the specimen examined the lips are drawn together and the dorsal tooth is located at a distance from the anterior extremity nearly equal to the radius of the front of the head. Under these circumstances the lips are closely surrounded by a narrow vesti-

bule. The number of lips remains uncertain, but there are at least six, and probably may be twelve. The vestibule, however, does not appear to be striated. That portion of the pharynx behind the lips and in front of the dorsal tooth is small, not more than one-fourth as wide as the corresponding portion of the head. The narrow portion behind the dorsal tooth is tubular or prismoid and extends backward to a point removed from the anterior extremity a distance slightly greater than the diameter of the head. This portion of the pharynx is only about one-eighth as wide as the corresponding portion of the head. The dorsal tooth is small, rather narrowly conoid, acute, and forward pointing, and is located at the body axis. Its altitude is about equal to the width of the posterior portion of the pharynx. There are no eye-spots. No amphids have been seen. There is a fairly distinct pharyngeal swelling, whose presence is indicated not so much by its size as by the fact that it is separated from the œsophagus by a difference in internal structure; the fibers composing it are arranged in longitudinal manner. Beginning at the base of the pharynx the œsophagus is about three-fifths as wide as the corresponding portion of the neck. It continues to have this diameter until the middle of the neck, where it diminishes very slightly in diameter and then passes through the nerve ring. Just in front of the cardiac bulb, its width is about two-fifths that of the corresponding portion of the neck. The cardiac bulb is prolate and five-sixths as wide as the base of the neck. It does not contain any distinct valve, or if it does the valve is hidden by the radiating muscles. The bulb is divided into subequal parts by a break in the musculature slightly behind the middle. There is no distinct cardia. The lining of the œsophagus is a fairly distinct feature throughout its length. The intestine, which is separated from the œsophagus by a distinct constriction, becomes at once three-fifths as wide as the body, and the width of the cardiac collum is about one-half as great as that of the base of the neck. The intestine is composed of cells of such size that probably two to three are required to build a circumference. These contain rather numerous small granules of uniform size. The anus is nearly continuous, but the posterior lip is very slightly elevated. The rather refractive rectum which is somewhat longer than the anal body diameter extends inward and forward. There is a fairly distinct pyloric collum. The tail tapers from some little distance in front of the anus and continues to taper behind the anus at the same rate to the terminus which bears an elongated, conical, truncate, unarmed spinneret, whose length is considerably greater than that of the diameter of its base. This latter is about one-eighth as wide as the base of the tail. The three caudal glands are located in tandem series in the anterior two-fifths of the tail. Their nuclei are placed toward the dorsal side. The cells themselves are contiguous and are rather broadly saccate. The lateral fields are one-third as wide as the body. The renette is located a short distance behind the base of the neck and presses the intestine rather sharply to one side. It is about one-half as long as the body is wide and one-half as wide as long. The location of the excretory pore remains uncertain, but it

seems likely that it is near the lips. The nerve ring surrounds the œsophagus somewhat squarely. The female organs are double and symmetrically reflexed. Nothing is known concerning the size, number and form of the eggs, as the description is derived from a single, immature female.

Locality: Maple River and Bessey Creek, Douglas Lake, Michigan.

NOTE—This species bears a general resemblance to *Chromadora örleyi*, de Man, but *örleyi* has a striated vestibule and cephalic setæ, and also appears to have a somewhat more elongated pharynx. The discovery of the male might show other differences.

				19.	
8. <i>Ethmolaimus gracilicaudatus</i> , n.sp.	2.8	10.	17.5	'50.'	84.
	2.	3.	3.2	3.5	2.7
					.6 mm.

The thin layers of the transparent, colorless cuticle are traversed by fine striæ, resolvable with difficulty into rows of minute dots which are not modified on the lateral fields. Short, scattered and very inconspicuous hairs are found on the body. These are usually of a length not much greater than the thickness of the cuticle. The conoid neck ends in a rounded head which is not set off in any way. On the outer surface, removed from the anterior extremity a distance nearly equal to the length of the radius of the head, there are four very slender, spreading cephalic setæ, each half as long as the head is wide. There are scattered hairs to be found on the neck, seldom more than one-fourth as long as the corresponding body diameter. The amphids consist of spirals of a little more than one wind, placed opposite the middle of the posterior half of the pharynx and each about one-third as wide as the corresponding portion of the head. The anterior portion of the pharynx is broadly conoid or cup-shaped, and at the base of this part the forward pointing dorsal tooth is seen lying in the axis of the head. This anterior portion of the pharynx at its widest part is half as wide as the head, and is about two-thirds as deep as wide. Extending backward from this is a comparatively definite rather uniform, narrow tubular portion of the pharynx whose walls are well chitinized and which *ends suddenly* at the point where the œsophagus proper begins. The pharynx is surrounded by a distinct pharyngeal bulb which is set off from the œsophagus by a distinct constriction. The pharyngeal bulb is three-fourths as wide as the head. The anterior portion of the pharynx is surrounded by minute more or less confluent lips, too small to be accurately enumerated. It is not unlikely that there are twelve of them. They do not materially break the comparatively rounded contour of the front of the head. The dorsal tooth has a length about equal to one-sixth the diameter of the head. It is somewhat blunt and the width of its base is nearly as great as its altitude. The œsophagus begins as a tube two-thirds as wide as the corresponding portion of the neck and continues to have this diameter until it expands to form the prominent ellipsoidal cardiac bulb which is five-sixths as wide as the base of the neck. The bulb contains a rather obscure, apparently rather simple, fusiform valvular apparatus about one-fourth as wide as itself. The lining of the œsophagus

is not a very distinct feature. The anterior portion of the intestine, which is separated from the œsophagus by a very distinct constriction, is slightly different in histological structure from that portion which immediately follows. The portion thus characterized is only about half as long as it is wide. The intestine joins the middle of the posterior surface of the cardiac bulb, and the cardiac collum is one-third as wide as the base of the neck. The intestine becomes at once about two-thirds as wide as the body, but in the anterior part is pushed to one side by the renette cell, so that immediately behind its beginning it is only about one-third as wide as the body. Its cells contain minute granules of rather uniform size, not distributed in such a way as to give rise to any tessellation. The number of cells required to build a circumference is few, perhaps only two. The lining of the intestine, at any rate in the posterior part, is refractive, so that the narrow, sinuous lumen is rather readily seen. The tail tapers from in front of the anus, but only slightly. Behind the anus it tapers more rapidly, and rather uniformly in the anterior three-fourths. The posterior fourth is rather slender and tapers but little. The spinneret is very narrow and elongated-conoid, slightly blunt at the end, and is armed with exceedingly slender, rather short setæ. The caudal glands are arranged in a close tandem series in the anterior fourth of the tail. From the anus, only the posterior lip of which is raised, the slightly chitinized rectum, which is about as long as the anal body diameter, extends inward and forward. The lateral fields are one-third as wide as the body. The nerve ring surrounds the œsophagus somewhat obliquely. The renette is a cell half as long as the body is wide and apparently two-thirds as wide as long, located a short distance behind the base of the neck. The position of the excretory pore remains to be discovered. From the rather inconspicuous vulva, the chitinized vagina leads inwards at right angles to the ventral surface half way across the body, where it joins the two symmetrically placed uteri. The reflexed ovaries reach well back toward the vulva. This description is derived from a female specimen in an unsatisfactory state of preservation, and these details are subject to revision. Nothing is known concerning the size, number and form of the eggs.

Locality: Maple River, Michigan.

The female of this species at any rate presents many of the characters belonging to Dr. de Man's genus *Ethmolaimus*, but possesses distinct spiral amphids which could hardly have been overlooked in the type species of *Ethmolaimus*.

53.

9. *Aphanolaimus viviparus*, n.sp. $\frac{.5 \quad 9 \quad 16 \quad '48' \quad 87.}{.3 \quad 1.5 \quad 1.8 \quad 3 \quad 1.5}$ 1.2 mm.

The moderately thick layers of the transparent, colorless, naked cuticle are traversed by 700 plain transverse striæ which are not further resolvable and are not modified on the lateral fields, but which are interrupted there by a single, distinct, refractive wing. The contour throughout is somewhat crenate.

The conoid neck ends in a rounded head whose lip region is set off by an almost imperceptible expansion. At the base of the lip region, at a distance from the anterior extremity nearly equal to the radius of the lip region, there are four well-developed, submedian, spreading, rather flexible, slightly-tapering, cephalic setæ, each about one and one-half times as long as the head is wide. The three exceedingly small lips project a little from the middle of the front of the head, and lead directly to the œsophageal passage. There does not seem to be any distinct pharynx. The amphids are so located that their anterior borders are opposite the bases of the cephalic setæ. They sometimes appear to be subcircular, a little longer than they are wide, and appear to be about two-thirds as wide as the corresponding portion of the head. In some specimens they may be clearly seen to be open spirals of about one and one-half winds. Their contours are distinctly refractive, and the tissues just outside them stain a little more strongly. The striæ, which are so prominent on the neck as to cause a distinct crenate contour, become less distinct opposite the posterior borders of the amphids. There seem, nevertheless, to be about three striæ opposite the amphids. There are no eye-spots. The œsophagus begins as a tube about one-half as wide as the base of the head and expands but little and very gradually. Toward the end it becomes half as wide as the corresponding portion of the neck and then diminishes so as to be only one-fourth as wide as the base of the neck; for a short distance before joining the intestine it tapers so as to be one-half as wide as it is a short distance farther forward. The constriction between the œsophagus and the intestine is very broad and shallow. The lining of the œsophagus is a distinct feature throughout its length. There is no distinct cardia, but for a short distance the cells composing the intestine are smaller and stain more strongly than those farther back. The intestine gradually becomes one-half as wide as the body and is composed of cells of such size that only a few, probably three to four, are required to build a circumference. The intestine is moderately thick-walled. It is separated from the œsophagus by a distinct cardiac constriction. From the slightly raised anus the chitinized rectum, which is one and one-half times as long as the anal body diameter, extends more directly forward than is usually the case. The tail tapers from a little distance in front of the anus and continues to taper at the same rate behind it until near the end, where it is cylindrical for a short distance. The terminus is not expanded and ends in a concave-conoid, truncated, unarmed spinneret. It constitutes a short, broad apiculum. The caudal glands constitute a rather open tandem series in front of, opposite to, and behind the anus,—occupying the anterior fourth or fifth part of the tail. The lateral fields are about one-third as wide as the body. The renette cell is a much elongated cell lying opposite the cardiac constriction. It is fully twice as long as the body is wide and not much wider than the œsophagus. It possesses a distinct nucleus near its middle. The duct leading forward from it is narrow and apparently empties through the excretory pore located opposite the nerve ring. The nerve ring sur-

rounds the œsophagus obliquely. From the almost imperceptibly elevated vulva the chitinized vagina leads inwards at right angles to the ventral surface one-third the distance across the body, where it joins the two symmetrically placed uteri. The small reflexed ovaries reach about one-fourth the distance back to the vulva and contain about a dozen developing ova arranged for the most part single file. Each of the uteri contains a half-dozen thin-shelled smooth eggs in various stages of development, the most advanced containing fully-formed embryos. It is not unlikely that the species is viviparous. Male supplementary organs 5 to 8.

Locality: Beach pools, Douglas Lake, Michigan.

				23.	
10. <i>Aphanolaimus communis</i> .	.3	8.7	17.	'48.'	85.
	.6	1.5	2.5	2.7	1.2
					1. mm.

The rather thin layers of the transparent, colorless, naked cuticle are transversed by about 600 transverse striæ, which exist in the outer cuticle, and are of such a nature that they cause the contour to be minutely crenate throughout the length. These striæ are not further resolvable. They are interrupted on the lateral fields by a single highly refractive wing. It is probable that there are four minute, somewhat forward pointing submedian cephalic setæ, each about one-third as long as the head is wide. The conoid neck ends in a rounded head, which is not set off in any way. The mouth pore in the front of the head is exceedingly minute; it is very slightly depressed. The circular amphids are so located that their anterior borders are removed from the anterior extremity a distance about equal to the radius of the head, or a distance about equal to their own radius. They appear to be about half as wide as the corresponding portion of the head. Although they appear circular at first sight, they are probably really spiral in form, and unclosed in the anterior border. There is a very minute pharynx about one-third as wide as the front of the head, one-half as wide as the amphids. Possibly there is a chamber extending backward from this, having a length such that it extends a little farther back than the amphids, but this is somewhat doubtful. The œsophagus begins opposite the amphids as a tube nearly half as wide as the corresponding portion of the head, and expands very slightly in diameter as it passes backward, until it reaches the nerve-ring. Thereafter it is uniform in diameter. There is no cardiac swelling. The intestine is set off from the œsophagus by a distinct constriction, and in the anterior portion is not much wider than the base of the œsophagus. Gradually, however, it widens until it becomes two-thirds as wide as the body. It is relatively thin walled, and is composed of elongated cells of such a size that probably three to four are required to build a circumference. From the rather inconspicuous anus the chitinized rectum extends inward and forward. There is a distinct pyloric collum. The tail tapers from some distance in front of the rectum, and continues to taper through its anterior four-fifths. Thence onward the tail is cylindroid to the convex-conoid terminus, which

bears a truncate conoid spinneret. The wall of the tail is relatively thick, and the caudal glands are rather small sized, and are located in a tandem series in the anterior third of the tail. The lateral fields appear to be about one-third as wide as the body. The renette is of relatively large size, and is located opposite the posterior portion of the oesophagus. It is fully half as wide as the base of the neck, and is about one-third as wide as long. Anteriorly it tapers to join the duct, which leads forward and perhaps empties near the base of the lips. The nerve-ring surrounds the oesophagus somewhat obliquely. From the slightly depressed vulva the chitinated vagina leads inward at right angles to the ventral surface fully half-way across the body, where it joins the two symmetrically placed uteri. The broad reflexed ovaries contain a dozen or more developing ova arranged somewhat irregularly. Only the distal third of the ovary is tapering. The somewhat thin-shelled eggs are fully one and one-half times as long as the body is wide, and less than half as wide as long. They have been seen in the uteri one at a time, and apparently are deposited before segmentation begins.

$$\frac{.3 \quad 10. \quad 18. \quad M \quad 92.}{.6 \quad 2.2 \quad 2.4 \quad - \quad 1.8} .9 \text{ mm.}$$

The tail of the male is similar in size and form to that of the female. The two equal, arcuate spicula are one and one-half times as long as the anal body diameter. They are broadest in the middle, and of uniform width for some distance in the middle part. Near the distal extremity they diminish rather suddenly in size, and thence outward they are of uniform diameter to the end. The formation of the proximal end is somewhat the same, but this portion is longer and slightly arcuate. There is no distinct cephalum. At their widest point they are one-fifth as wide as the corresponding body diameter. In front of the anus there are ten tubular supplementary organs arranged at an angle of about forty-five degrees with the body axis. These organs are about half as long as the body is wide, and are themselves somewhat arcuate. The proximal end of each is slightly cephalated. The diameter of the main portion is about the same as the diameter of the distal portion of the spicula. Each tubule ends in a slight depression on the ventral line, and is probably protrusile. The posterior member of the series is opposite the proximal ends of the spicula, and the anterior member nearly as far in front of the anus as the terminus is behind it. The ejaculatory duct is about one-third as wide as the body. The vas deferens is about half as wide.

Locality: Beach Pools, Douglas Lake, Michigan.

$$11. \text{ Pristomatolaimus digitatus, n.sp. } \frac{1.1 \quad 12. \quad 26. \quad 63' \quad 81.}{1.2 \quad 2.1 \quad 2.3 \quad 2.8 \quad 1.9} \overset{24}{.6} \text{ mm.}$$

The rather thin layers of the transparent, colorless cuticle are traversed by 380 transverse striæ, resolvable with high powers into rows of minute elements, at any rate toward the head end. Scattered setæ are found here and there on the surface of the body. These have a length

equal to the width of two to three annules. The somewhat cylindroid neck tapers but little, and ends in a rounded head, which is not set off in any way. On the outer surface of the head, opposite a point between the anterior and middle thirds, there is a circlet of six wide-spreading, finger-shaped setæ, each bearing a minute bristle at its end. These setæ are nearly half as long as the head is wide. The thin lips are arched together over the pharynx, and each bears a minute, forward-pointing and slightly outward-pointing papilla, which may be seen quite distinctly with high powers when the lips are which may be seen quite distinctly with high powers when the lips are brought into exact profile. The unarmed prismoid pharynx begins immediately behind the base of the thin lips and ends suddenly at a distance from the anterior extremity equal to the width of the head. The width of the pharynx is about as great as the width of the head, and it is half as long as wide. There are no eye-spots. The amphids are ellipsoidal markings about one-third as wide as the corresponding body diameter. They have their long axis located transversely, and are situated about twice as far behind the base of the pharynx as this latter is behind the anterior extremity. The œsophagus receives the base of the pharynx, and is at first two-thirds as wide as the base of the head. It continues to have about the same diameter throughout its length, but it expands somewhat posteriorly so that it becomes about two-thirds as wide as the neck. Between the œsophagus and the intestine there is a spheroidal element nearly as wide as the œsophagus. This perhaps may be regarded as a strongly developed cardia. It is set off by a constriction on both sides, particularly on the side toward the œsophagus. The lining of the œsophagus is a fairly distinct feature throughout its length. The thick-walled intestine, which is set off from the œsophagus by a distinct constriction, becomes at once about three-fourths as wide as the body. It is composed of cells of such a size that three or four are required to build a circumference. The anus is slightly raised, and the rectum, which is as long as the anal body diameter, extends inward and forward. The tail end begins to taper a short distance in front of the anus, and tapers with considerable regularity to the terminus. This latter has a width about one-eighth as great as that of the base of the tail, and appears to bear a minute apiculum, but has no spinneret. The lateral fields appear to be about one-third as wide as the body. The nerve-ring surrounds the œsophagus somewhat squarely. Nothing is known concerning the renette. From the elevated vulva the vagina leads inward and forward. The single uterus extends forward. The ovary is reflexed, and has its blind end located in the vicinity of the vulva, at least when the uterus is not occupied by an egg. Judging from the size of what appears to be a mature ovum, the eggs are considerably elongated, probably three to four times as long as the body is wide, and about one-fourth as wide as long. The ovary may contain fifteen to twenty ova, arranged single file except toward the tapering blind end.

Locality: Beach Pools and Bogs, Douglas Lake, Michigan.

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