(3) The spawning run is constituted chiefly of 5 and 6 year old fish.
(4) In the spawning runs the sexes are at first present in approximately equal numbers, but towards the close of the run the males greatly exceed the females in number.
(5) Males grow more slowly than females. The rate of increase in weight and length of either sex is approximately the same at both ends of the lake.
(6) The chief food of alewives is small crustacea. Insects were found to form a large part of the diet of some individuals taken in shallow water.
(7) Large and small individuals differ slightly in food preference, the large ones taking more insects and larger crustaceans, *e.g.*, *Mysis*.
(8) The alewife is very important as a food for lake trout, ling and eels and competes in no serious way with other species. Indirectly by supplying food for the ling and trout, it protects the ciscoes which are usually taken as a substitute by these piscivorous fish.

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UNIVERSITY OF TORONTO STUDIES

PUBLICATIONS OF THE
ONTARIO FISHERIES RESEARCH LABORATORY
No. 39

CANADIAN HYDRACARINA

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TORONTO
THE UNIVERSITY LIBRARY
1929

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The first important work on the water mites of Canada was a paper by Dr. F. Koenike (1895), in which he described thirty species from material sent to him by Dr. J. B. Tyrrell from Ontario, British Columbia, and Alberta. This paper was revised (1912), two of the earlier species being separated, and seven new ones erected in their places. Three papers by the writer (1921, 1924) describing material collected in the Muskoka region and the Canadian Northwest added nine more species, seven of which were new.

The present paper is devoted to the results of a study of several collections. Most of the material was obtained in Ontario in connection with the work of the Ontario Fisheries Research Laboratory. In the summer of 1928 material was collected by D. S. Rawson from Lake Waskesiu, Prince Albert Park, Northern Saskatchewan, in his study of this lake. Several species from this lake were taken from the stomachs of fish. Alen Mozley, of the University of Winnipeg, kindly sent material from Manitoba and Jasper Park, Alberta. Dr. R. E. Foerster, of the Pacific Salmon Research Station, contributed a large number of mites from Lakes Harrison and Cultus in British Columbia. A few specimens from the Kootenay region of British Columbia were also collected by Charles Mottley during 1928. The author wishes to express her thanks to these investigators for the privilege of examining their collections and to Professor W. J. K. Harkness, of the Ontario Fisheries Research Laboratory, for his assistance in the publication.

The material from Ontario, was mostly obtained from the collections made by members of the Ontario Fisheries Research Laboratory during the summers of 1922-1928, while working on Lake Nipigon in the west, Lake Abitibi in the

northeast and Lake Simcoe in the southern part of the province. This material was accompanied by data upon the vertical and horizontal distribution. The author had also made small collections in Ontario in 1920, in the Muskoka region, near Georgian Bay. Lake Nipigon is about fifty miles north of Lake Superior; it is somewhat quadrangular in shape, fifty miles long by thirty miles broad and very irregular in outline. The area is about 1,750 square miles and depths of 300 feet are frequently sounded. This lake contains several islands; the largest of these, Shakespeare island, contains a lake of the same name, which is three fourths of a mile long and one fourth of a mile wide, with a depth in places of fifty-two feet. During the summers of 1921-1923 Dr. F. B. Adamstone worked over 500 samples of the bottom of Lake Nipigon, sorting the various groups of organisms, in his study of the bottom fauna. In 1926 over 50 samples of the bottom of Shakespeare island lake were taken and sorted by members of the laboratory. Lake Abitibi, 375 miles north of Toronto, is in two parts which have a total length of about forty miles; its entire area is about 356 square miles, but it is very shallow, being only seventeen feet in the deepest part. Ghost river is a tributary of Lake Abitibi. J. L. Hart made a collection of hydrachnids from Lake Abitibi in 1925. Lake Simcoe is forty miles north of Toronto; it is twenty miles long by fifteen miles broad, and for the greatest part fifty feet deep although it may reach a depth of 150 feet in places. During the summers of 1926-28 D. S. Rawson sorted and classified the organisms of 225 bottom dredgings from Lake Simcoe. The remainder of the Ontario material with the exception of my own specimens is from incidental collecting of various members of the fisheries laboratory. Dr. Rawson went over all of these collections and sorted out the hydrachnids which he so kindly sent me. Of special interest in these Ontario collections was the occurrence of several species of water mites in the stomach contents of various fishes.

Harrison lake is in the Fraser river system, British Columbia, seventy-five miles from the Pacific ocean; it is in

shape a broad crescent, forty-five miles in length. Most of the collections were made in Cascade bay in the summer of 1922, by horizontal tows; several hundred individuals were secured, the largest of the collections here considered. Cultus lake, south of Harrison, is about three and one half miles long by one and one half wide, with a maximum depth of forty-five metres.

These collections aggregate many hundred individuals, most of which were identified. They represent twenty-seven genera and fifty-three species and varieties, of which seventeen are new and several are first records for Canada. A description of the species in systematic order follows.

Genus *LIMNOCHARES* Latr.

The common and cosmopolitan species, L. aquaticus (L.), was found in Lake Simcoe and Harrison lake, with eleven individuals.

Genus *EYLAIS* Latr.

Sixteen individuals of the genus were found, representing apparently several species. The determinations offer many difficulties. Over one hundred species of the genus have been described, mostly from European material, the diagnoses being based almost entirely upon the characters of the very small eye capsules which are acknowledged to be variable. Even the palpi are not entirely constant in features. It seems probable that some of the so-called species are only developmental stages. In view of these uncertainties, the author is presenting a description of the specimens but withholding specific names when only one individual shows the given characters. Dr. Koenike described four species for Canada, all closely related to *E. extendens* (O.F.M.) with which he at first identified them, none of which are recognized with certainty in these collections.

EYLAIS INFUNDIBULARIS Koen.

FIG. 10, 11, PLATE I

Two individuals were found, one near Lake Abitibi (pool at Lowbush) and one in Lake Simcoe, which appear to belong to this species, now known for northern Europe and Asiatic Russia. A comparison of these with an identified specimen which Dr. O. Lundblad, the eminent Swedish student, kindly sent to the author, confirms this opinion. The larger specimen measured 4 mm. The eye capsules are relatively large and broad; the bridge connecting them is very deep with a conspicuous anterior blunt broad projection. There is a large hair support next to each capsule, the hairs being moderately long. The posterior concave border of the bridge is faint. The epimera and capitulum are like those in *E. extendens*. The palpi are moderately long and well supplied with bristles, some of which are feathered, the fourth segment having most of them. The fifth is likewise long and has many short bristles near the end while the second and third are stouter and more sparsely supplied.

EYLAIS ABITIBIENSIS nov. spec.

FIG. 1-4, PLATE I

Four individuals were found in Lake Abitibi (Shea's Bay), three of which are of one species, believed to be new. The largest is 5 mm. long. The epimera show no especially distinctive features. The eye capsules are reniform; the intercapsular bridge is broad and long, with a shallow bay posteriorly, the anterior margin with two slightly projecting protuberances. The framework of the eye plate shows two U-shaped obliquely placed supports, their openings on the bridge. The capitulum is relatively short; the palpi are slim, moderately supplied with bristles, the third segment with a small group of short bristles on the inner slightly projecting distal end.

Another individual of the same size found with the last has an eye plate distinctly different (Form B, fig. 7), the bridge being shorter and anteriorly arched, with a deep posterior bay. The underlying supports of the capsules are broadly U-shaped. The capitulum is longer but the palpi are stouter and bear more bristles than in *E. abitibiensis*, while the epimera are the same.

Two other individuals, each measuring 5 mm., found in Ghost River, have eye plates very different. Form A (fig. 5) has a plate which is broad, the capsules diverging posteriorly from a narrow bridge which has two projecting anterior prominences, the under side of each showing a heavy framework around the outside. The capitulum is rather short, the palpi stout, with bristles abundant on segments three and four. Form B (fig. 6) has eye capsules connected by a very broad bridge, anteriorly arched, where it shows several fine scollops; the bay is deep with nearly parallel sides. The underlying support of the right capsule is somewhat O-shaped, while that of the left is S-shaped, illustrating again the great variability in the structure of this organ. A single individual from Prince Albert Park (Beartrap creek), a female, measuring 6 mm., seems to be closely related; the bridge, however, is longer and its anterior border bears two large scollops.

From Lake Simcoe another individual was taken (No. 41), a female measuring 4 mm., with an eye plate like that of *E. desecta* Koen. (fig. 8), but with larger protuberances on the anterior end of the bridge. Also, in the palpi the bristles are more abundant on the third and fourth segments, and the fourth epimera are more completely separated from the third than in individuals previously determined by the author as probably representing the species described by Dr. Koenike. All of the legs have swimming hairs, but they are sparse on the fourth segement. Feathered bristles are abundant. An individual from Prince Albert Park (Beartrap creek) probably belongs to the same species.

Collections from the Winnipeg region gave three individuals each with a different form of eye plate. One of these, a small individual (Sturgeon creek) 1.25 mm. long

and evidently young, has a very broad eye plate (fig. 17), the capsules widely separated by a bridge which is broadly V-shaped, at each point of which is a conspicuous circular plate with a moderately long and heavy hair. The fourth and fifth segments of the palpi are long; they bear several short bristles while the third segment also bears several on the concave side.

From St. Vital pond, near Winnipeg, came two individuals with still different forms of eye plates. One specimen, 1.70 mm. long, a young female, has a plate resembling that of *E. desecta* (No. 35, fig. 18). The capsules are bean shaped, connected by a small bridge on which are two protuberances, probably supports for hairs. The palpi are slim, sparsely provided with hairs, some of which are feathered. The second individual (No. 62, fig. 9) is distinguished by the very slight development of the intercapsular bridge, in this respect resembling *E. wilsoni* Soar, an English species. The eye capsules are nearly elliptical; on the inner side of each, near the anterior end, are slightly developed supports for hairs. Between the capsules lies a faintly chitinized spot. Some distance above the eyes lie two other hair papillae, each bearing a long thin hair. The palpi bear a small number of small hairs, segment three having a small bunch on the projecting inner distal border.

The Harrison lake material yielded one individual of this genus, a small specimen, 1.50 mm. long. The eye capsules (fig. 19) are broad, nearly oval; the bridge is narrow but deep, the posterior outline indistinct, while there are two small protuberances on the anterior border and two conspicuous hair supports. The fourth segment of the palpus is very long with few bristles, the fifth less than half its length; the third segment is stout with a small bunch of small bristles on the inner distal side.

Genus *HYDRACHNA* Müll.

All but one of the eleven individuals of this genus were found in the Manitoba collections. Two new species and one new variety are recognized, with five individuals undetermined.

HYDRACHNA SCHNEIDERI AMERICANA nov. var.

FIG. 25-27, PLATE III

The species *H. schneideri* Koen., found in Europe and reported also for Asia, appears to be represented in North America by a variety. In the parent species the shape of the dorsal anterior plate upon which identification largely rests, as well as the width of the palpus shows some variation. The author has found specimens like the present specimen in material from North Dakota (collection of Dr. R. T. Young and the Smithsonian Institution). One of these individuals was submitted to Dr. Karl Viets who was kind enough to examine it; he gave it as his opinion that this is an American variety of the European species.

A female, 3 mm. in length, found in Mildred lake, Jasper National park, appears to be identical with the specimens just referred to. The integument is only faintly papillose and the slight elevations are not pointed as in the related form. The dorsal shield is large, extending over about one fourth of the length of the body; its anterior border projects out between the eyes and the posterior border is likewise rounded out. The basal segment of the palpus is stout but the succeeding segments are relatively slim. The ventral plates agree closely with those of the parent species.

HYDRACHNA CANADENSIS nov. spec.

FIG. 20-24, PLATE III

Collections from St. Vital pond, near Winnipeg, contained six large specimens of the genus, the three adults present representing this new species. The largest individual,

a female, is 3 mm. long. The integument is covered with small low papillae. Dorsal plates associated with the sense organs are little developed and variable; they resemble those of *H. incisa* Hal., found in Ireland. In the single male present there is a small irregularly shaped plate some distance below each eye; in the females there is a somewhat similar but narrower plate together with a very small obliquely set plate between this and the eye, perhaps a muscle attachment. All of the ventral plates are close together. The third epimera lie very near to the genital plates; each shows a small but conspicuous projection on the inner upper corner. The fourth epimera are nearly rectangular and bear each a large and lobose projection on the lower inner corner. The genital plates of the male are large, filling most of the space between the last epimeral groups; these plates are in the female conspicuously shorter. The palpi are slim, especially in the third segment; the basal segment is broad and the second bears a few short bristles.

With *H. canadensis* were found three nymphs belonging to two other species; specific names are withheld until the adults are discovered. Two of these nymphs, the largest individuals in the collection, measured 5 mm. Posterior to each eye lies a long chitin bar, as in *H. comosa* Koen. The third and smallest nymph shows two short bars, as in *H. leegei* Koen., with a very small plate behind each near the centre of the body.

With this material from St. Vital pond occurred another individual (No. 69) representing apparently another species. Back of each eye is a long irregular broken bar, those of the two sides unlike (fig. 16). Because of this asymmetry of the single specimen, a specific name is withheld. The surface is covered by flat papillae. The third epimera show each an anteriorly projecting inner corner, while the fourth of each side has a projecting inner corner and a rounded posterior outline. The genital area (male) is heart-shaped and very large, extending beyond the epimera. The palpi are slim and bear a few small bristles; the third segment shows a marked concavity of the inner side.

HYDRACHNA MICROSCUTATA nov. spec.

FIG. 28-30, PLATE III

One individual, a female, found in a pool near Lake Abitibi, represents this new species, which is characterized by the possession of a small curved plate close to each eye. The body is 2 mm. in length; the surface is papillose. The third epimera are nearly rectangular, the fourth broadly rounded on the inner posterior corners. The female genital plates are broad and lie close to the third epimeral plates. The palpi are stout.

Genus *SPERCHON* Kram.

Dr. Koenike described three species of the genus for Canada: *S. glandulosus* Koen. from Alberta, *S. parmatus* from British Columbia and *S. tenuipalpis* (locality unknown). The first of these is a European species, and the last two were new. A single individual of this collection from Jasper National park represents still another species closely allied to the first two.

SPERCHON JASPERENSIS nov. spec.

FIG. 14, 15, PLATE II

The body (somewhat wrinkled and shrunken by preservation) is about 1.40 mm. long. The dorsal gland plates are not well developed; they consist of four slightly chitinized pieces in the central dorsal surface with numerous small hair plates over the entire area. The surface is covered with a delicate reticulum of five-sided areas and in profile shows very small irregular projections. Over the epimera and appendages the surface is porous. The epimera are heavy, occupying the anterior half of the body. The genital area, lying between the last two groups of epimera just above the

centre of the body, is elongated, the two plates narrow with curved outlines. The two anterior acetabula of each side are long while the third is circular. The palpi are slightly wider than the first leg and about half the body length. The conical peg of the second segment is slender; segment three is stout; segment four is longer and slim and bears two stout pegs on the inner surface, one in the middle and the other close to the distal end. The legs bear numerous hairs; the fourth is about as long as the body, the first half as long.

The new species closely resembles *S. glandulosus*, of which the author has a specimen from the collection of slides left by Dr. Koenike. It is larger, however, and the plates on the dorsal side are not so well developed. The genital area and epimera agree closely with those of the older species but the palpi do not. From *S. tenuipalpis* it differs also in greater size and in the slight development of the skin plates. While the genital areas agree closely, the epimera do not and the palpi differ in their proportions and structure.

Genus *PSEUDOSPERCHON* Piers.

This genus, with but one species heretofore, *P. verrucosus* (Protz), a European mite, is represented in these collections by one individual taken from Lake Nipigon near the Virgin islands, a new species.

PSEUDOSPERCHON OVALIS nov. spec.

FIG. 31-33, PLATE IV

The body (somewhat distorted in preservation) is oval, moderately elevated and about 1 mm. long. The colour is unknown, but the specimen is dark with a conspicuous irregular dorsal streak and a smaller ventral posterior spot. The surface is covered with very small irregular conical elevations which appear also on the plates and appendages. Several large wart-like elevations are conspicuous features of

the dorsal side close to the margin of the body and in two rows toward the centre, the posterior ones running over on the ventral side. The epimera are like those of the type species but the fourth is more angular. The genital area is situated between the last epimeral groups, above the centre of the body. The genital plates are elongated and narrow; details of the acetabula could not be made out. The capitulum bears an elongated rostrum. The palpi are typical of the genus, with a conspicuous blunt process on the flexor surfaces of both the second and fourth segments. The legs are slender; all are shorter than the body and bear bristles, but no swimming hairs.

A comparison with *P. verrucosus*, of which the author fortunately has identified specimens from the collection of Dr. Koenike and through the courtesy of Dr. Viets, shows that the new species differs conspicuously from the other in shape and in the smaller number of conical elevations on the surface, as well as in details of the structures on the ventral side.

Genus *PSEUDOHYDRYPHANTES* Piers.

This is a small and uncommon genus, with one European species, *P. parvulus* Viets, of limited distribution, and one American species. The present collection adds another closely related species.

PSEUDOHYDRYPHANTES ORBICULARIS nov. spec.

FIG. 36-38, PLATE IV

The material was found in Harrison lake and consists of five individuals. The body is nearly orbicular, low, evenly arched, slightly indented between the eyes and averages 0.50 mm. in length. The surface is covered with small but prominent papillae, slightly projecting and rounded; the plates and appendages are also papillose. The dorsal surface has a few slightly chitinized spots and short hairs are numer-

ous. The epimera are heavy as in the other species; the fourth is nearly triangular in form. One individual was found to have no second epimeron on the left side, the first two pairs of legs coming from the first. The genital area is a little removed from the last epimera, its posterior end lying at the body centre; the genital plates are elongated and curved, the acetabula heavy, slightly elongated. The capitulum is broad and large. The palpi are about the width of the first leg and two-thirds its length, and bear several heavy bristles; the distal prolongation of segment four is conspicuous. The first leg is about one-half of the body length; the sixth segment is stumpy with claws little developed. Leg four is about the length of the body; its third segment bears a few swimming hairs, the fourth more. All legs bear many bristles and end in double claws.

This new species is closely related to *P. latipalpis* Mar. described for Alaska. It differs from it in the character of the body surface and in the shape of the third and fourth epimera, while the palpi are slimmer.

Genus *HYDRYPHANTES* C. L. Koch.

One individual of this large genus was found in the material from St. Vital pond, near Winnipeg. It closely resembles the common European species, *H. ruber* (de Geer) and will be described as a variety of this, dedicated to Mr. Mozley.

HYDRYPHANTES RUBER MOZLEYI nov. var.

FIG. 12, 13, PLATE II

The body is elliptical, slightly bulging between the double eyes, 1.20 mm. long and 0.97 mm. broad. The colour is probably red. The surface shows tiny rounded elevations, scarcely protruding. The dorsal plate bearing the unpaired median sense organ is very large; it is widest at the anterior

end where the outline is parallel to the body margin, while the lateral outlines are concave and the posterior part ends in two large rounded projections. The epimera are heavy, covering more than half of the ventral surface, the groups separated by small spaces; they conform closely to those of *H. ruber* as does also the genital area. The capitulum is broad and the palpi rather stout. The legs are typical of the genus.

The new variety differs most from *H. ruber* in the form of the dorsal plate, as do other varieties of this large species, while showing a general agreement with it in the epimera and genital area.

Genus *DIPLODONTUS* Dugés

A total of nine individuals of this large genus from widely separated areas are identified as *D. despiciens* (Müll), a common species widely distributed over Europe and reported also for Asia, Africa, and the Americas. It has been reported by several authors for North America. The author has described as another closely related species *D. americanus* (1926), from material collected in Iowa and southern Wisconsin, which seemed to differ from the cosmopolitan species in the position and form of the genital area as well as in the surface papillae and colour. It now seems probable, after the examination of more material, including specimens from North Dakota (collection of the Smithsonian Institution) that this is but a local form or variety. In all points the individuals in the present collection conform to the older species of which the author has identified specimens kindly furnished by Dr. Viets. Two individuals came from the Bala region (Muskoka river and outlet of Clear lake), three from Lake Nipigon (bay west of Pipestone point and Shakespeare Island lake), and two each from Lakes Harrison and Cultus. All were nymphs or young adults and came from moderate depths.

Genus *LEBERTIA* Neum.

The genus, a very large one, was found in all of the collections, the individuals numbering over fifty. They represented three species, one of them new.

LEBERTIA POROSA Thor

This cosmopolitan species has already been reported by the author from Alberta and from British Columbia; there is here another record for the latter province in five individuals from Lake Harrison. Two specimens were found in Waskesiu lake, Saskatchewan. Nearly half of the individuals of the species found in these collections came from Lake Nipigon (thirteen collections), in most dredgings made in June and July; they were usually small adults or nymphs and came from depths from one to eight metres, fifty to four hundred metres from shore, one unusual record being an individual one and a half miles out at thirteen metres depth. Other records for Ontario include one specimen each from Muskoka lake and a small bay of Parry Sound; one from a pond near Claremont, and several records from fish stomachs. Three of five collections from Lake Simcoe came from whitefish; one from Glen Major (Ontario county) was found in a speckled trout and one from Lake Ontario in the stomach of an alewife, in all cases the numbers being from one to six mites in each stomach.

LEBERTIA ONTARIOENSIS nov. spec.

FIG. 46, 47, PLATE V

The body is oval; the largest of eight individuals is 1.70 mm. long and 1.50 mm. broad. No definite surface markings could be made out. The epimeral area is relatively small, occuping only the anterior half of the ventral surface. The first epimera extend far back; they have broad anterior ends,

the course of the gland duct from its opening here showing conspicuously. The three posterior epimeral pairs are approximately oblong, incompletely separated, the fourth being broadest, with rounded posterior margins. The genital area is elongated, extending a little beyond the epimera, broadest posteriorly where there is a large chitinous curved bar; the three pairs of acetabula are narrow. The palpi are rather slim, narrower than the legs, and resemble those of *L. porosa;* there are three long hairs on the inner distal end of the third segment with two farther back. The legs are stout, the first about one half the body length, the fourth about three-fourths of its length. All bear many bristles but no swimming hairs.

Five individuals were found in four Lake Nipigon collections from four stations, in one case from a depth of seven metres, eighteen metres from shore (Black Sturgeon bay). Two came from Lake Simcoe: one in a bottom tow at twenty metres, and the other in a whitefish stomach at seven metres. From Lake Waskesiu, Prince Albert park, another individual was found in a whitefish at two metres.

LEBERTIA QUINQUEMACULOSA Mar.

Four specimens were found in a shore collection from Okanagan lake, Summerland, British Columbia.

Genus *OXUS* Kram.

Two species occur in collections from Ontario, both of which are new.

OXUS CONNATUS nov. spec.

FIG. 35, PLATE IV

A single specimen was found in Lake Joseph, in the Muskoka region. Other individuals found in lakes of north-

ern Wisconsin (1928) make possible a fuller diagnosis of the species. The body is elliptical, moderately elevated and measures 1.30 mm.; the surface is covered with fine wavy lines running lengthwise of the body. The dorsal side shows a blending of pale green and orange with dark patches and a dull red streak. The epimera are blue green, while posterior to them the body is dull yellow with brown mottling; the appendages are likewise blue green. The epimeral shield occupies a little more than half of the ventral surface and scarcely reaches the dorsal side; posteriorly it is somewhat truncated and bears here a row of short hairs laterally. The sutures between the pairs of united plates are conspicuous. The projecting anterior ends of the first pair bear small blunt processes. The genital bay is deep and broad, the plates projecting a little beyond it. Legs and palpi are characteristic of the genus.

OXUS ELONGATUS nov. spec.

FIG. 34, PLATE IV

The body is narrowly elliptical, 1.05 mm. long and 0.70 mm. broad, elevated with the anterior end lower. The epimeral shield extends well beyond the body centre and over on the dorsal side. Sutures between the epimeral pairs are not deep. The projecting ends of the first epimera bear small blunt processes. The genital bay is very deep and broad throughout and the portion of the epimeral shield on either side of it is narrow and slightly notched. The genital plates, slightly obovate, do not extend beyond the bay. The fourth legs are nearly as long as the body.

The diagnosis of this new species is based upon examination of one individual from Lake Nipigon (bay west of Pipestone point), found at a depth of two metres, 150 metres from shore. Another poorly preserved individual from Shakespeare Island lake probably belongs to the same species.

Genus *LIMNESIA* C. L. Koch

Four species and varieties of this large genus were found in the present collections; in addition to these the author has already described another species from Canada, *L. columbica*, found in British Columbia.

LIMNESIA UNDULATA (Müll.)

Dr. Koenike reported this cosmopolitan species from Alberta. Material collected by the author in British Columbia was identified (1924) as *L. histrionica* (Herm.). A re-examination of this material and the literature has lead to the belief that these individuals should have been referred to *L. undulata*. In the present collections this species was found in most of the regions represented; it was especially abundant in Harrison lake where several hundred individuals were secured, along with one individual from Cultus lake. In Lake Nipigon it was present in sixteen collections from five different stations (but not in Shakespeare Island lake), to the number of over one hundred, in depths from one to three metres, and from ten to 350 metres from shore. In Lake Simcoe one specimen was found at a depth of eight metres and nineteen in the stomachs of two whitefish. In the Muskoka region over sixty were found at twelve stations (lakes Muskoka, Long, Clear, Gull, Joseph, Rosseau and small lakes and streams near them, as well as in a bay of Parry Sound).

LIMNESIA HISTRIONICA WOLCOTTI Piers.

This common American form was found to the number of thirty-three individuals, over half of them present in a shore collection from Okanagan lake, Summerland, British Columbia. Six came from the Muskoka river. In Lake Simcoe they were found in Kempenfeldt bay at six metres and in the stomach contents of whitefish and ciscoes. In

small bodies of water in this region (ponds at Horning's Mills and Claremont) a few individuals were recovered from the stomachs of trout. Another whitefish record was secured from Waskesiu lake, Prince Albert park.

LIMNESIA MACULATA AMERICANA Piers.

Some fifty individuals of this common species were found; the largest number, about half, from Harrison lake, with one from Cultus lake. From one to two individuals each were found in collections from six stations in Lake Nipigon, with three more from Shakespeare Island lake. The greatest depth recorded for them from this lake was seven metres, and the greatest distance from shore, 400 metres. One individual was found in the Muskoka region (outlet of Clear lake); and three more in as many stations in Lake Simcoe. One of the latter, a male, has an unusually small acetabulum on one genital plate.

LIMNESIA CORNUTA Wol.

This rare species, known before only for Michigan, was found, being represented by one male taken in Lake Simcoe at a depth of one metre.

Genus *LIMNESIOPSIS* Piers.

Material from the vicinity of Ottawa described by Koenike as a new species, *Limnesia anomala*, has since been placed in a separate genus (or subgenus), of which this is the only reported species. It appears to be a northern form, since it has been found outside of Canada only in Michigan and Wisconsin. Four individuals, females, were found in three collections at moderate depths in Lake Simcoe.

Genus *HYGROBATES* C. L. Koch

This genus was well represented in several of the Ontario collections by two species already known for Canada.

HYGROBATES LONGIPALPIS (Herm.)

This cosmopolitan species, first reported by Koenike from British Columbia, is now known from several other localities. In Lake Nipigon seven individuals were found at six stations and one in the Nipigon river; all but one were females and they were found at depths from three to twenty-two metres and from one hundred metres to two and one fourth miles from shore in the lake. Three specimens came from the Bala region (Muskoka, Portage and Rosseau lakes). In Lake Simcoe thirteen individuals were found, mostly females, and small and of special interest as to localities. One came from Kempenfeldt bay; one, a nymph, was found on a stony shore; of two other females, one came from a depth of five metres, one and a fourth miles from shore; while nine others were found in the stomachs of four whitefish. In addition to these, two other individuals were found in speckled trout (Glen Major, Ontario county) and one first larva in an alewife in Lake Ontario.

HYGROBATES NEOÖCTOPORUS Mar.

Described by the author from material collected in British Columbia, Alberta and Alaska as *H. octoporus* (corrected to neoöctoporus), this species was found again in the present collections. Two individuals came from Lake Nipigon (bay west of Pipestone point), one at 350 metres from shore. It was found as part of the stomach contents in a whitefish in Waskesiu lake, Saskatchewan, and in two trout in a pond near Horning's Mills, Ontario.

Genus *UNIONICOLA* Hald.

This large genus is represented here by two well known species, one free and one parasitic.

UNIONICOLA CRASSIPES (Müll.)

A few hundred individuals of this cosmopolitan species, mostly females, were found in the Harrison lake material, with one nymph from Cultus lake. In the Nipigon region they were found only in Shakespeare Island lake, one specimen coming from a whitefish stomach. Some fifty were found in the Muskoka region; they came from the lake and river of that name, from Long lake and a small lake near by, and from Lake Joseph. They were found in Hearican lake (Haliburton county, Ontario), and in two collections from Lake Simcoe, one of which yielded fourteen individuals from the stomach of a whitefish.

UNIONICOLA YPSILOPHORUS HALDERMANI (Piers.)

Some poorly preserved material from Canada was reported by Dr. Koenike as probably representing the common species, *U. ypsilophorus* (Bonz.). The American form is, however, a variety, as pointed out by Piersig. Four individuals of this form, together with the next species, were found by Dr. Rawson in two Anodontas in a small lake on Bruce penninsula, near Georgian bay.

Genus *NAJODICOLA* Piers.

The genus was erected to contain the parasitic mite described by Koenike from Canadian material under the name *Atax ingens*. Sixteen adults and a few nymphs of this species were found with the preceding species.

Genus *NEUMANIA* Lebert.

Specimens of this large genus were found only in Ontario collections, with the exception of an unidentified nymph from Harrison lake. Eight individuals were identified with three known species; three nymphs found were not classified.

NEUMANIA SEMICIRCULARIS Mar.

Specimens of this common species were found in two lakes near Bala (Muskoka and a small lake near Gull lake) and in Lake Simcoe at three stations, one female each. One of the latter was taken from the unusual depth of twenty-three metres.

NEUMANIA OVATA Mar.

One individual only, a female, was found in Lake Simcoe, at a depth of six and one half metres.

NEUMANIA PUNCTATA Mar.

This species was represented also by one individual, a male, in Lake Joseph in the Muskoka region.

Genus *KOENIKEA* Wol.

The common species of the genus, *K. concava* Wol., was represented by one individual, a female, taken from a small lake near Gull lake in the Muskoka region.

Genus *HUITFELDTIA* Thor.

FIG. 51, 52, PLATE V

It is of much interest to find this north European genus with its one species, *H. rectipes* Thor, in Lake Nipigon. Four individuals, males, were secured, one near Virgin islands and three in the stomach of a small whitefish in Shakespeare island lake. Another, a female, was found in the same fish in Waskesiu lake. The species has been found also in four lakes in northern Wisconsin; from these the characters of the living animals are known. The body is oval, the anterior end a little depressed, the posterior end slightly projecting.

Fine wavy lines cover the surface. The general colour is brown; a yellow Y-shaped area shows dorsally. The eyes are dull red, the legs and plates blue or greenish. The antennary bristles are small. These specimens conform closely in epimera, genital areas and palpi with descriptions and with identified material supplied the author by the courtesy of Dr. Viets. Drawings of one of the males from Shakespeare Island lake, measuring 0.75 mm., are added in conformation of this identification. It may be noted that the fourth segment of the palpus bears four fine hairs on papillae near the distal end and that the latter shows a triangular projection on the inner side.

Genus *FORELIA* Hal.

Twelve specimens of this genus were found in the Ontario collections. They are referred to two species, one of which is new.

FORELIA LILIACEA (Müll.)

Two specimens of this cosmopolitan species, young females, were found in two collections from Lake Nipigon.

FORELIA OVALIS nov. spec.

FIG. 42-45, PLATE V

The single male found measures 0.65 mm., the largest female, 0.82 mm. The body is concave between the eyes, elliptical in the female, with a prominent posterior projection in the male. From living material found in Wisconsin, the colours of this mite are known. The body is delicate and semi-transparent; on a pale yellow or bluish background are conspicuous brown masses surrounding a red dorsal trident-shaped figure in front of which are two small irregularly shaped chitinous plates. The red mark shows faintly on the ventral side where the third and fourth epimera meet and also around the anal spot. The legs and plates are bluish or pink in young individuals. The antennary bristles are large and long. The epimera are shaped much as in *F. liliacea* but the genital areas differ. In the male these are broad in the medial line and extend laterally a little beyond the fourth epimera to which their anterior borders are attached for the greater part. In the female the genital plates are relatively narrower and longer and removed from the epimera. The genital acetabula are small and numerous, especially in the female. The palpi are stout and bear few bristles; the second segment is wider than the first leg. The fourth leg of the male is typical of the genus and of the same length as the body; all of the segments are short and stout, the last three bearing long bristles and swimming hairs. The sixth segment of this leg has a broad proximal end which bears four blade-like bristles; its inner margin projects like a long finger and bears a row of similar bristles. This segment is but slightly turned and lies nearly in the same plane as the more proximal segments.

One male and one female of this new species were found in Muskoka lake; eight females were found in three collections from Lake Nipigon at depths from one to six metres.

Genus *PIONA* C. L. Koch

Of this genus, one of the largest of the water mites, about one hundred individuals were collected. None were found, however, in the waters of Lake Nipigon, although they were taken from Shakespeare Island lake. Seven species were represented, one of which is new.

PIONA ROTUNDA (Kram.)

FIG. 53-58, PLATE VI

This cosmopolitan species has been described by many students of the Hydracarina. It appears to be subject to

some degree of variation in the genital area, but presents certain constant features in the palpi and legs. The author is fortunately in possession of identified specimens from Dr. Viets for comparisons. Over fifty adults of both sexes, together with many nymphs, found in Harrison lake (with two from Cultus lake), together with three adults from Shakespeare Island lake are referred to this species. Figures drawn from the latter specimens are presented in conformation of this determination. The body is ovate and elevated; the male is 0.62 mm. in length, the females average 0.90 mm. All plates are well chitinized and distinct. The epimera are close together in the male, separated by moderate spaces in the female. The genital areas in the female are close to the fourth epimera; in the male the united plates are broad and slightly attached to the epimera, with a shallow concavity on the posterior margin near which is the anal spot. The acetabula in both sexes are variable in number and size, even in the two sides of the same individual; there are usually about twenty or more of these in the female, placed irregularly on the two lunate plates with three or four free on the inside area. The palpi are slender, with two pointed papillae near the centre of the flexor side of the fourth segment. In the male the characteristic concavity of the fourth segment of the last leg bears a few blade-like bristles. The third leg ends in a short segment which has a peculiarly shaped claw; while the last segment of the first two legs (as well as the third in the female) are club shaped and bear large double pointed claws.

PIONA INSULARIS Mar.

The species was described by the author from material collected in Yukon Territory and is known for the female only. Two more specimens were found in the stomach contents of two whitefish from Waskesiu lake.

PIONA INCONSTANS (Wol.)

Representatives of this species were found in Muskoka lake and a bay of Parry Sound, seven females in all. The male has not been determined with certainty, but three poorly preserved specimens from this region, together with two nymphs can probably be referred also to this species.

PIONA CONSTRICTA (Wol.)

Females only, to the number of eighteen, were found in three places in Ontario: Long lake in the Muskoka region, Lake Simcoe and Shakespeare Island lake on that island in Lake Nipigon. The latter furnished all but two of the specimens; these were secured in seven collections, three individuals being found in the stomach of a whitefish.

PIONA PUGILIS (Wol.)

FIG. 61, PLATE VI

Four females of this large mite were found in Lake Simcoe, at depths from two to five metres, in three collections. A figure of the ventral side, not included in the original description, is added here.

PIONA TURGIDA (Wol.)

Several individuals were found in widely different areas. In Harrison lake nine were secured; one more was found in a whitefish stomach, Waskesiu lake. Five specimens came from one collection from Lake Simcoe and four others from the stomach contents of two trout in ponds of the same region (at Horning's Mills and Claremont).

PIONA INTERRUPTA nov. spec.

FIG. 59, 60, PLATE VI

This large species, known only for the female, resembles *P. turgida* (Wol.) and *P. pugilis* (Wol.), differing from both

in the genital areas as well as in other details. The largest and oldest individuals measure 1.70 mm. The body is oval, scarcely indented between the eyes, evenly arched and highest back of the middle region. The surface in living material from the author's collections from Wisconsin shows fine lines over small round chitin pieces. The antennary bristles are small. The dorsal surface shows a red Y-shaped figure surrounded by brown blotches on a yellow background; the ventral side has a faint red spot near the first and second epimera and another between the genital area and the anal spot. The eyes are deep red. Legs and plates are blue tinged. The epimera are moderately separated in the midline; the fourth pair are narrow here. The genital cleft is long; the acetabula are small, clear and numerous, one or more on each side being slightly larger than the others, and arranged on an irregularly oblong area devoid of any in the middle of the inner side, a character which has suggested the specific name. The capitulum is broad; the palpi are about one half of the length of the body and wider than the first leg. The fourth palpal segment bears two large and one small pointed papillae on the flexor side. The legs are slender, the last about the length of the body, and all bear swimming hairs and bristles.

This appears to be a northern species, widely distributed. One specimen came from Harrison lake. The largest number thirty-seven, were part of the stomach contents of a perch caught in Waskesiu lake; three more were recovered from two other perch in the same lake. Seven individuals were found in as many collections from Lake Simcoe, the greatest depth being thirteen metres. From five trout taken in a pond at Horning's Mills, Ontario, nine more individuals were secured.

Genus *WETTINA* Piers.

This is the first time, to the author's knowledge, that this small and rare genus has been reported in America. It is represented here by a new species.

WETTINA PRIMARIA nov. spec.

FIG. 39-41, PLATE IV

The body is oval, slightly projecting at each end, 0.47 mm. long. The eyes are large; a pair of prominent papillae lie between them on the ventral side. The epimera have the typical shape and arrangement for the genus, the fourth being somewhat triangular. The male genital area is broad and close to the epimera, the three acetabula of each side large. The capitulum is moderately long. The palpi are small and stout; segment four is considerably constricted at the proximal end. All of the legs are stout, shorter than the body, the last bearing swimming hairs. In the first leg the last segment is longest; it has a large concavity on the flexor side and a large claw. The new species resembles *W. macroplica* Piers. but is smaller, and the body and its plates are relatively broader. Only one specimen, a male was found; this came from Nipigon river at a depth of eight metres, one hundred metres from shore. The female is unknown.

Genus *ACERCUS* Koch

The limits of this genus have not always been clearly defined; but taking as a criterion the peculiar development of the fourth leg, the single individual found in this collection representing a new species should be referred to this genus.

ACERUS DIVERSUS nov. spec.

FIG. 48-50, PLATE V

The body of the young male is nearly circular and 0.40 mm. long. The epimera and genital area resemble those of *A. torris* (Müll.). The palpi are stout, a little wider than the first leg; the fourth segment has a small hair-bearing papilla on the flexor surface, while the distal end, inner side, has a

prolongation and near it a small peg. The legs are of about the same length and longer than the body. The first three pairs are well provided with coarse and fine hairs. The fourth leg is moderately specialized as compared with related species; the fourth segment is only slightly thickened and it bears a sparce row of heavy hairs, while the longer fifth segment is markedly curved but bears no spur on the distal end. This individual was found in Lake Simcoe at a depth of two metres, eight metres from shore. The female has not been determined with certainty.

Genus *PIONOPSIS* Piers.

The species, *P. latilamellis*, known for the female only, described by the author from material found in British Columbia and placed tentatively in this genus, was found again, two specimens being taken in the stomach contents of trout from Horning's Mills, Ontario.

Genus *MIDEA* Bruz.

The genus has long been known in Europe by one species. It is therefore of interest to find it in these collections which is also a first record for North America to the author's knowledge.

MIDEA DETERMINA nov. spec.

FIG. 62-66, PLATE VII

The body is oval, not compressed, in the male measuring 0.80 mm., in the female, 0.90 mm. The integument is heavy, porous and dull green in the preserved condition. The epimera closely resemble those of *M. orbiculata* (Müll.), the type species. The genital area in both sexes is very large, centrally located and close to the epimera with the acetabula indistinct. This region in the female closely

resembles that of the related species. In the male the genital area is elongated, broadened anteriorly and very complex: on the surface of each plate close to the short cleft is a conspicuous oblong appendage below which appear long fine hairs. The palpi are small; the fourth segment is much longer than the others, slimmer and slightly curved. The legs are stout, the first three shorter than the body, with the distal ends of the segments widened. The fourth leg is longer and slimmer than the others and both third and fourth bear swimming hairs. The third leg in the male, as in the type species, shows a peculiar modification: the last segment is short and broad, ending in a point, with a deep concavity on the inner surface into which the large claws can be turned.

The new species was found in Harrison lake, one male and two females. It has been compared with specimens of *M. orbiculata* kindly supplied by Dr. Viets, and found to differ from this most conspicuously in the structure of the male genital area and in the segments of the palpi.

Genus *MIDEOPSIS* Neum.

The common and cosmopolitan species, *M. orbicularis* (Müll.), was represented by ten individuals, all at moderate depths. Eight of these were found in five collections from Lake Simcoe and two in Lake Nipigon (Orient bay).

Genus *ALBIA* Thon.

One individual, a male, was found in Long lake, in the Muskoka region. It belongs to the species *A. caerulea* Mar.

Genus *ARRHENURUS* Dug.

This largest genus of the water mites was not well represented, only seventeen individuals being found in these collections; this, however, is typical of northern habitats. Seven species and varieties were found; three of these are

LIST OF THE SPECIES

1. *Limnochares aquaticus* (L.)
2. *Eylais infundibularis* Koen.
3. *Eylais abitibiensis* nov. spec.
4. *Hydrachna schneideri americana* nov. var.
5. *Hydrachna canadensis* nov. spec.
6. *Hydrachna microscutata* nov. spec.
7. *Sperchon jasperensis* nov. spec.
8. *Pseudosperchon ovalis* nov. spec.
9. *Pseudohydryphantes orbicularis* nov. spec.
10. *Hydryphantes ruber mozleyi* nov. var.
11. *Diplodontus despiciens* (Müll.)
12. *Lebertia porosa* Thor
13. *Lebertia ontarioensis* nov. spec.
14. *Lebertia quinquemaculosa* Mar.
15. *Oxus connatus* nov. spec.
16. *Oxus elongatus* nov. spec.
17. *Limnesia undulata* (Müll.)
18. *Limnesia histrionica wolcotti* Piers.
19. *Limnesia maculata americana* Piers.
20. *Limnesia cornuta Wol.*
21. *Limnesiopsis anomala* (Koen.)
22. *Hygrobates longipalpis* (Herm.)
23. *Hygrobates neoöctoporus* Mar.
24. *Unionicola crassipes* (Müll.)
25. *Unionicola ypsilophorus kaldermani* (Piers.)
26. *Najodicola ingens* (Koen.)
27. *Neumania semicircularis* Mar.
28. *Neumania ovata* Mar.
29. *Neumania punctata* Mar.
30. *Koenikea concava* Wol.
31. *Huitfeldtia rectipes* Thor
32. *Forelia liliacea* (Müll.)
33. *Forelia ovalis* nov. spec.
34. *Piona rotunda* (Kram.)
35. *Piona insularis* Mar.
36. *Piona inconstans* (Wol.)

37. *Piona constricta* (Wol.)
38. *Piona pugilis* (Wol.)
39. *Piona turgida* (Wol.)
40. *Piona interrupta* nov. spec.
41. *Wettina primaria* nov. spec.
42. *Acercus diversus* nov. spec.
43. *Pionopsis latilamellis* Mar.
44. *Midea determina* nov. spec.
45. *Mideopsis orbicularis* (Müll.)
46. *Albia caerulea* Mar.
47. *Arrhenurus rawsoni* nov. spec.
48. *Arrhenurus manubriator* Mar.
49. *Arrhenurus prominulus* Mar.
50. *Arrhenurus elongatus* Mar.
51. *Arrhenurus serratus* Mar.
52. *Arrhenurus americanus* Mar.
53. *Arrhenurus americanus major* Mar.

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EXPLANATION OF THE PLATES

PLATE I

Fig. 1. *Eylais abitibiensis*, eye plate, under side
Fig. 2. *Eylais abitibiensis*, eye plate, upper side
Fig. 3. *Eylais abitibiensis*, capitulum and epimera
Fig. 4. *Eylais abitibiensis*, capitulum and right palpus
Fig. 5. *Eylais* sp. (Ghost River, Form A), eye plate
Fig. 6. *Eylais* sp. (Ghost River, Form B), eye plate
Fig. 7. *Eylais* sp. (Abitibi, Form B), eye plate
Fig. 8. *Eylais* sp. (Simcoe, No. 41), eye plate
Fig. 9. *Eylais* sp. (Winnipeg, No. 62), eye plate
Fig. 10. *Eylais infundibularis*, eye plate
Fig. 11. *Eylais infundibularis*, palpus

PLATE II

Fig. 12. *Hydryphantes mozleyi*, dorsal plates
Fig. 13. *Hydryphantes mozleyi*, ventral plates
Fig. 14. *Sperchon jasperensis*, ventral plates
Fig. 15. *Sperchon jasperensis*, palpus and capitulum
Fig. 16. *Hydrachna* sp. (St. Vital Pond, No. 69), eyes and dorsal plates
Fig. 17. *Eylais* sp. (Sturgeon Creek), eye plate
Fig. 18. *Eylais* sp. (Winnipeg, No. 35), eye plate
Fig. 19. *Eylais* sp. (Lake Harrison), eye plate

PLATE III

Fig. 20. *Hydrachna canadensis*, eye region, male
Fig. 21. *Hydrachna canadensis*, eye region, female
Fig. 22. *Hydrachna canadensis*, genital area and last epimera, female
Fig. 23. *Hydrachna canadensis*, genital area and last epimera, male
Fig. 24. *Hydrachna canadensis*, left palpus, female

Fig. 25. *Hydrachna schneideri americana*, dorsal plate
Fig. 26. *Hydrachna schneideri americana*, genital area, female
Fig. 27. *Hydrachna schneideri americana*, palpus
Fig. 28. *Hydrachna microscutata*, right palpus, female
Fig. 29. *Hydrachna microscutata*, left eye and plate, female
Fig. 30. *Hydrachna microscutata*, ventral plates, female

PLATE IV

Fig. 31. *Pseudosperchon ovalis*, dorsal view
Fig. 32. *Pseudosperchon ovalis*, palpus
Fig. 33. *Pseudosperchon ovalis*, ventral view
Fig. 34. *Oxus elongatus*, ventral view
Fig. 35. *Oxus connatus*, ventral view
Fig. 36. *Pseudohydryphantes orbicularis*, dorsal view
Fig. 37. *Pseudohydryphantes orbicularis*, palpi and capitulum
Fig. 38. *Pseudohydryphantes orbicularis*, ventral plates
Fig. 39. *Wettina primaria*, left first leg, male
Fig. 40. *Wettina primaria*, ventral view, male
Fig. 41. *Wettina primaria*, left palpus, male

PLATE V

Fig. 42. *Forelia ovalis*, ventral view, female
Fig. 43. *Forelia ovalis*, palpus
Fig. 44. *Forelia ovalis*, ventral view, male
Fig. 45. *Forelia ovalis*, left fourth leg, male
Fig. 46. *Lebertia ontarioensis*, ventral plates
Fig. 47. *Lebertia ontarioensis*, palpus
Fig. 48. *Acercus diversus*, right palpus
Fig. 49. *Acercus diversas*, left fourth leg, male
Fig. 50. *Acercus diversus*, ventral view, male
Fig. 51. *Huitfeldtia rectipes*, right palpus
Fig. 52. *Huitfeldtia rectipes*, ventral view, male

PLATE VI

Fig. 53. *Piona rotunda*, ventral view, male
Fig. 54. *Piona rotunda*, sixth segment, second leg, male
Fig. 55. *Piona rotunda*, fourth segment, fourth leg, male
Fig. 56. *Piona rotunda*, end of sixth segment, third leg, male
Fig. 57. *Piona rotunda*, genital area, female
Fig. 58. *Piona rotunda*, palpus, female
Fig. 59. *Piona interrupta*, palpus, female
Fig. 60. *Piona interrupta*, ventral view, female
Fig. 61. *Piona pugilis*, ventral view, female

PLATE VII

Fig. 62. *Midea determina*, dorsal view, male
Fig. 63. *Midea determina*, ventral plates, female
Fig. 64. *Midea determina*, genital plates, male
Fig. 65. *Midea determina*, end of left third leg, male
Fig. 66. *Midea determina*, palpus
Fig. 67. *Arrhenurus rawsoni*, dorsal view, male
Fig. 68. *Arrhenurus rawsoni*, fourth segment, leg four, male
Fig. 69. *Arrhenurus rawsoni*, palpus
Fig. 70. *Arrhenurus rawsoni*, lateral view, male
Fig. 71. *Arrhenurus elongatus*, genital area, female

PLATE I

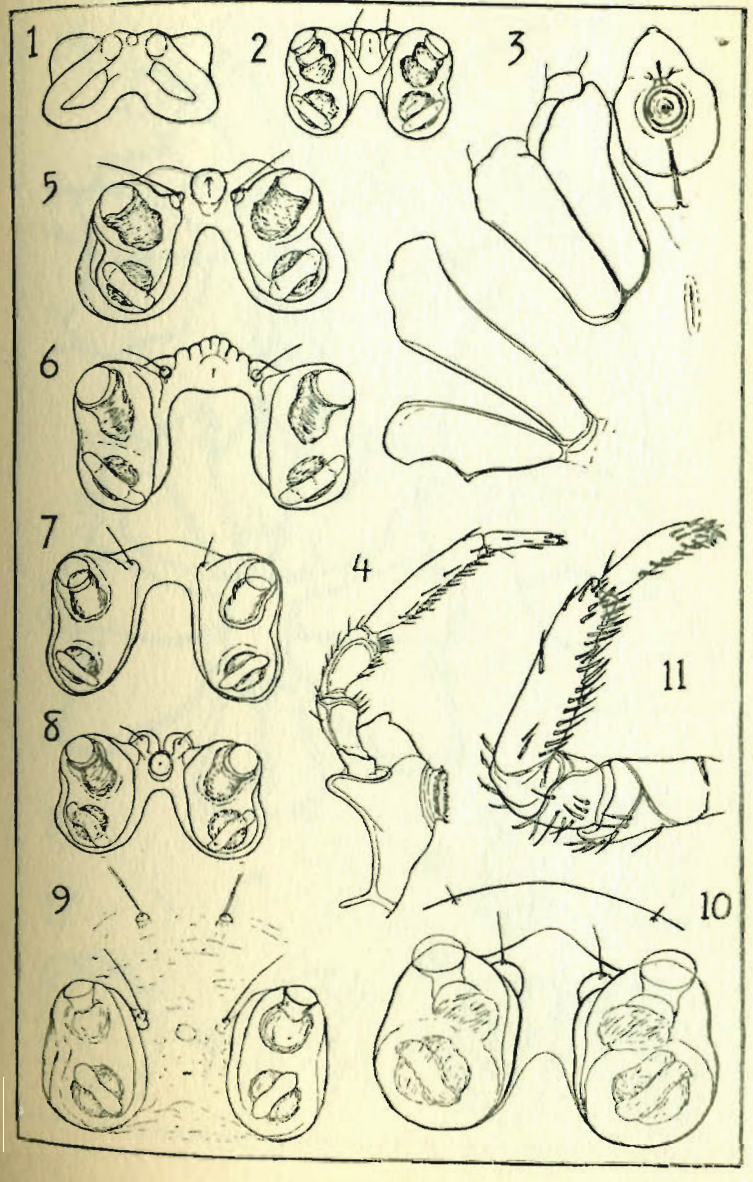

PLATE II

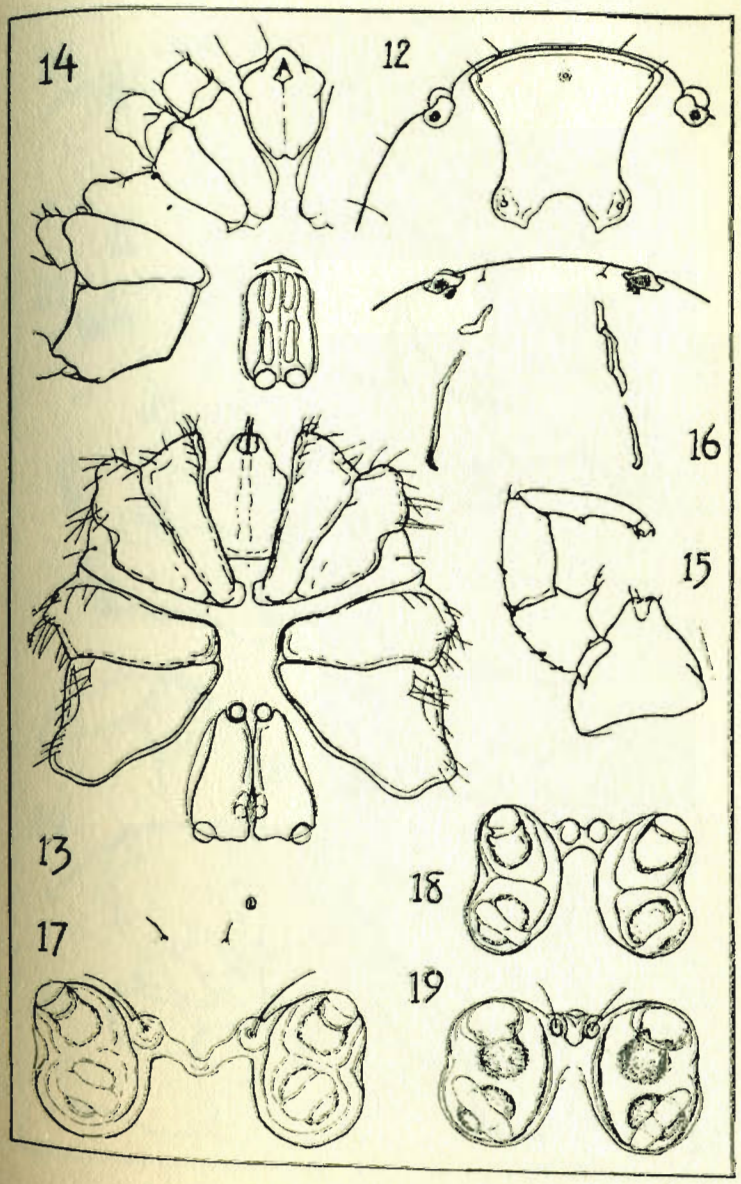

PLATE III

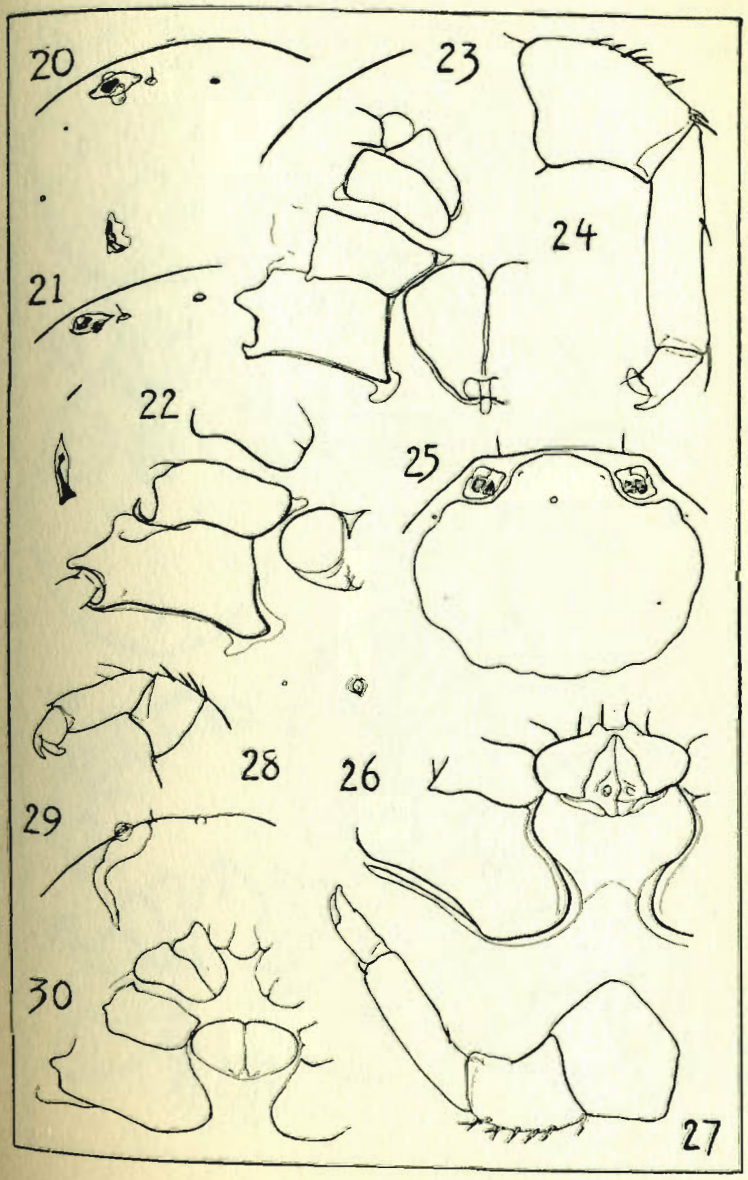

PLATE IV

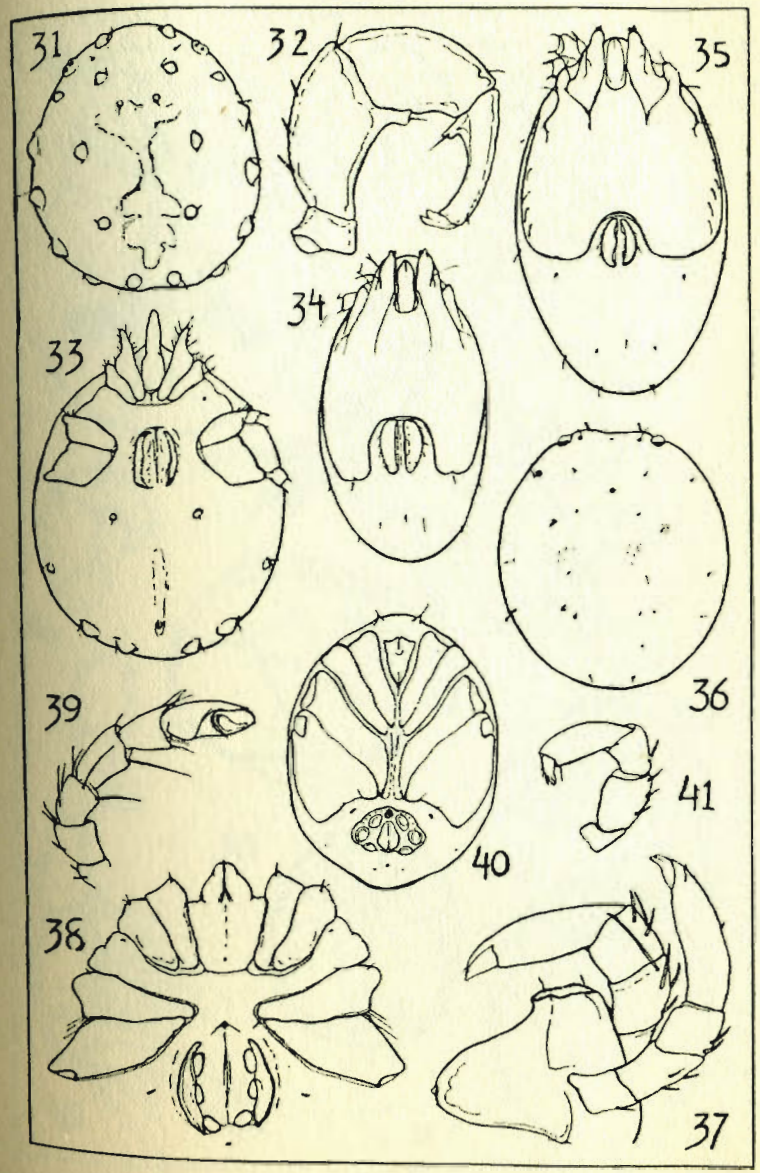

PLATE V

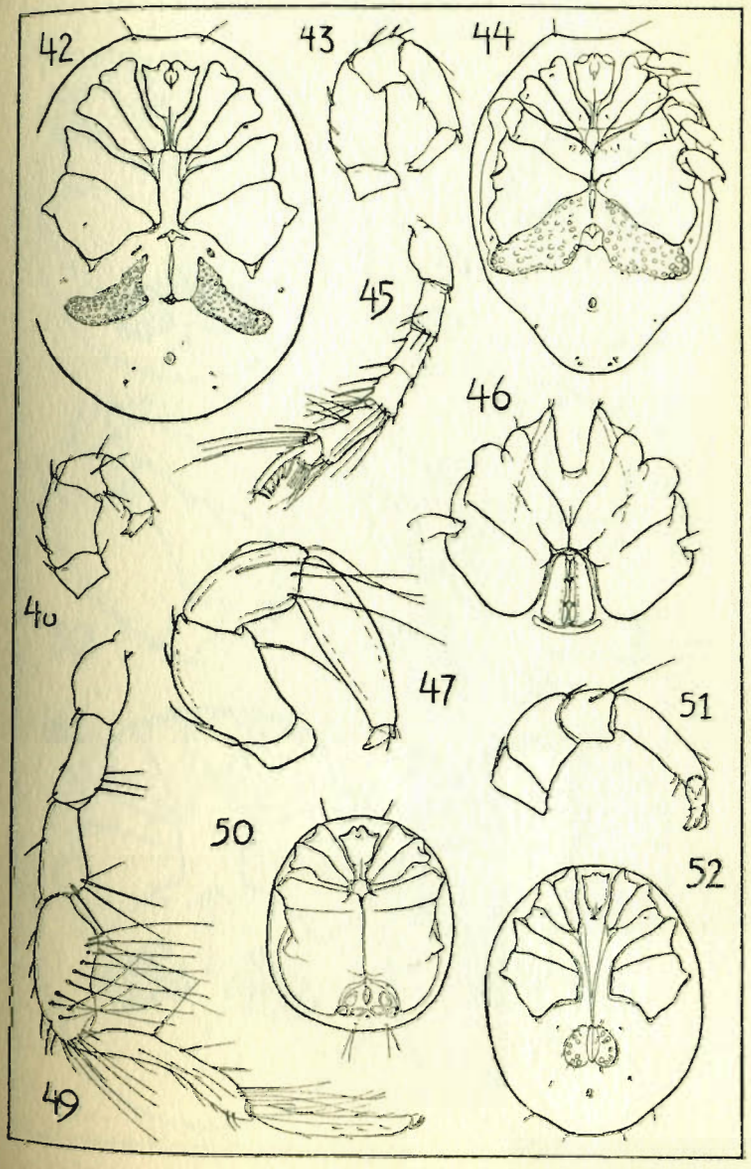

PLATE VI

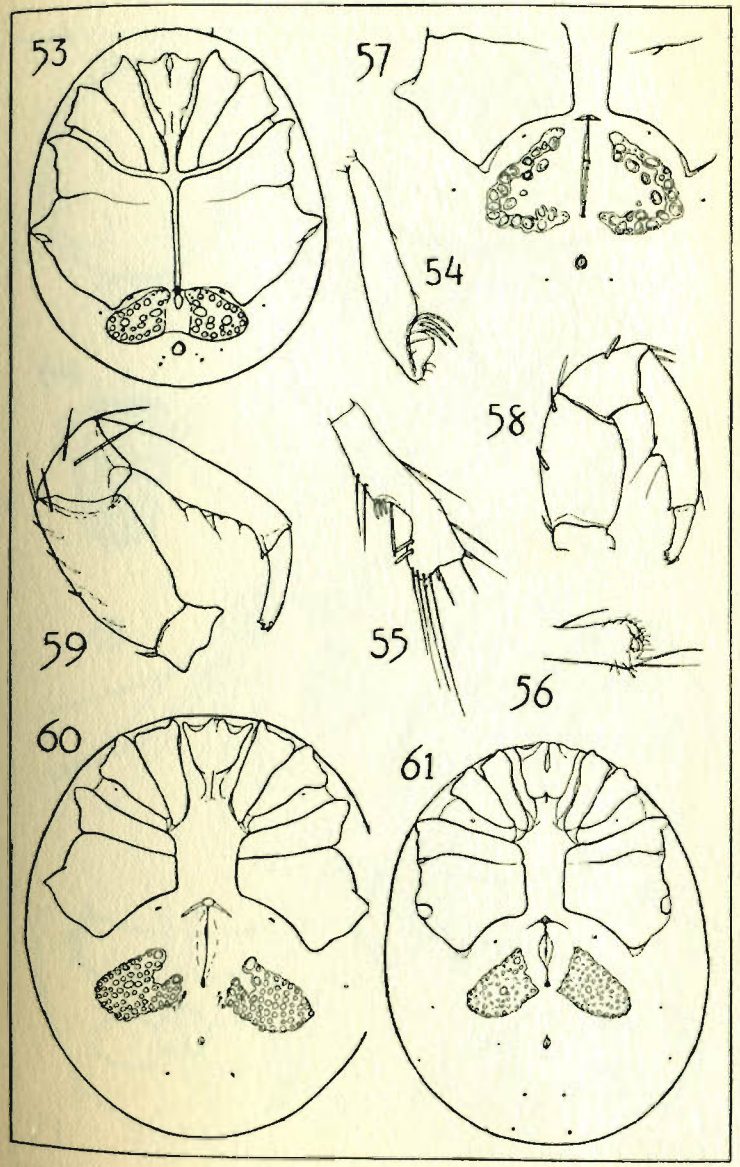

PLATE VII