PRELIMINARY LIST OF THE HYDRACARINA OF WISCONSIN

PART III

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Parts I and II of the *Preliminary List of the Hydracarina of Wisconsin* (Marshall, 1931, 1932) recorded thirty-one species belonging to sixteen genera. The present paper adds twenty-two species belonging to the two large and closely related genera, *Unionicola* and *Neumania,* of the family *Hygrobatidae.* Of these, one species is new. Distribution data are given as far as known, and some of the outstanding features of each species, together with one or more drawings. Complete characterizations of the species will be found in the titles listed in the bibliography.

The two genera under consideration have the characters of the super-family *Hygrobatae,* as given in Part II. These water mites are of medium size, usually about one millimeter in length; the integument is soft and often brightly colored, with a tendency to develop chitin in the case of the Neumanias. The first two pairs of legs are especially stout and they bear dagger-like spines. The fourth epimera are large, approximately rectangular in shape and nearly or quite separated from the third pair. The genital areas are close to the posterior end of the body and the plates on either side bear numerous acetabula. The Unionicolas are of special interest since most of the species are parasitic throughout life in the gills or mantle chambers of the fresh water clams. The earlier work of the author on the Neumanias has been revised and corrected.

For most of the material from Green Lake and the lakes of Vilas County the author is indebted to the Wisconsin Natural History Survey; the Unionicolas from Waukesha and Jefferson counties are from the collections of Mr. A. R. Cahn and those from the Madison lakes were sent to the author by Mr. J. P. E. Morrison.

Unionicola crassipes (Müll.)
Pl. I, fig. 1-4.

Most of the Unionicolas are parasitic in adult life as well as in the larval stages; *U. crassipes,* however, is free and active and found only rarely in fresh water mussels. Largest specimens may be one millimeter or more in length. Individuals are recognized by the two nipple-like lateral protuberances which, with the genital plates, are found on the extreme end of the body. The genital acetabula are in four groups of three each; these are borne on two lunate plates in the male, while in the female there are four somewhat triangular plates adjacent to the genital opening. Palpi are large and slim and the fourth segment bears three long papillae. The legs are very long.

European hydracarinologists have recognized forms of this species in which the individuals are smaller than normal with relatively smaller palpi. In the Wisconsin material (all from lakes) such individuals were common.

This species has been reported from all continents. In North America it has been found in Alaska, British Columbia and Ontario; in Washington, Wyoming, Montana, Nebraska, Iowa, Michigan, Indiana, Ohio, New York and Maine. Over three hundred individuals have been examined from Wisconsin; they have been compared with identified specimens kindly supplied by Dr. Viets and with these they appear to conform. They have been found in lakes Winnebago, Mason, Wingra and Spooner; in ponds and lakes near Portage, Wisconsin Dells, Oxford, Waupaca, Green Bay, Elkhorn, Milton, Delavan, Twin Lakes, Powers Lake and in seventeen bodies of water in Oneida and Vilas counties. They have been collected from near the surface to a depth of over seven meters. At Three Lakes large numbers were found in beds of fresh water sponge; Mr. M. C. Olds has found them in similar places in Michigan, as likewise they have been reported by European collectors.

Unionicola pectinata (Wol.)
Pl. I, fig. 12-14.

This species is rare, free swimming in the adult stage. It closely resembles *U. crassipes* in the genital region; it differs from it in having stouter palpi, without conspicuous papillae, as well as in having weaker legs, the first pair of which have un-

usual pectinate claws. It was described by Wolcott from a few individuals found in Michigan, not well preserved. In the Wisconsin collections but two individuals were found, both females: one in Lake Bragonia, Vilas County, and one in Lake Como. The latter had a fourth small acetabulum on each of the two posterior genital plates.

Unionicola aculeata (Koen.)
Pl. I, fig. 5-8.

A species closely resembling *U. crassipes*, but somewhat smaller, it is chiefly distinguished by the presence of ten rather than twelve large acetabula on the genital plates. In the female each anterior plate on its inner margin is produced into a conspicuous curved process which is tipped with a spine. Piersig (1901) erected a new variety, *U. sayi*, for the North American forms, chiefly on the basis of small differences in the palpi as shown in Wolcott's drawings from Michigan collections. The author believes that this separation is unjustified, since similar variation is found in European reports of the species. Comparison with an identified female from the collection of the late Dr. Koenike confirms this belief.

The species is widely distributed over Europe. In the adult stage it is both free and parasitic in fresh water mussels. In Wisconsin a few individuals were found with other species in clams from lakes Jordan, Wild Cat (Vilas Co.) and La Belle (Waukesha Co.), and free in Green Lake.

Dr. E. C. Faust's account[1] of the species is in error, since his material was evidently *U. abnormipes*.

Unionicola figuralis (Koch)
Pl. I, fig. 9-11.

This species resembles *U. crassipes* and like it is usually found free living in the adult stage. It is distinguished from it by the absence of the large posterior papillae and by the character of the genital area. The genital plates are placed a little more ventrally and they bear but ten acetabula. In the female the inner corners of the plates bear six stout curved bristles; in the male the lunate plates are slightly constricted between the groups of acetabula. The material has been compared with an

[1] Additions to our Knowledge of Unionicola aculeata (Koen.). Trans. A. M. S., v. 37 : 125, fig. 1–6. 1918.

identified female from the collection of Dr. Koenike with which it appears to conform.

The species is widely distributed over Europe and it has been reported also from east Africa and Chili. This is the first record from North America. Eleven individuals were found in lakes of Vilas County; one of these, a female, had but one acetabulum on the anterior genital plate. In an examination of some fifty clams (unidentified) from Jordan Lake, only five of which were found infected, seven adults of this species were found.

Unionicola abnormipes (Wol.)
Pl. II, fig. 24-27.

This is a small species, males measuring 0.57 mm., females, 0.70 mm. The body shows brown patches with a pink or yellow dorsal mark. The distinguishing feature is the unusual development of heavy spines on the fourth and fifth segments of the last leg of the male. The palpus is slender and ends in two large curved claws. The genital areas lie close to the posterior end of the body and bear ten acetabula; in the female there are four wing-shaped plates, similar to those of *U. aculeata.*

Individuals have been found parasitic in several species of clams in New York, Michigan, Illinois and Iowa. In Wisconsin they have been found in lakes Winnebago, La Belle and the Madison lakes and in the Oconomowoc River.

Unionicola intermedia var. *wolcotti* (Piers.)
Pl. II, fig. 21-23.

This small mite has been found parasitic in several species of clams. The body measures 0.50 mm. in the male and 0.75 mm. in the female. The dorsal surface shows brown patches with a yellow dorsal Y-mark. The legs are long and end in large bifid claws. The genital areas are a little removed from the posterior end and resemble those of *U. abnormipes,* with ten acetabula; the four plates in the female are somewhat four sided, with the inner margins produced into outward turned processes bearing spines. In the male the fourth segment of the last leg is somewhat curved.

Piersig (1900) considered the North American forms described by Wolcott a variety of the European species *U. intermedia* (Koen.), chiefly on account of differences in the

palpi, the process on the distal end of the fourth segment being large, blunt and flat, rather than small and slim. This difference appears to the author to be constant and important; in addition, in the specimens examined, the genital plates of the female are more angular and the second acetabula of the anterior plates are uniformly smaller than the others.

The species has been reported from Michigan, Nebraska and Iowa. In Wisconsin it has been found in collections from Jefferson and Waukesha counties.

Unionicola serrata (Wol.)
Pl. II, fig. 28, 29.

Specimens of this parasite are found only occasionally, sometimes with other species, in several species of clams. Females are about one millimeter in length; males are smaller. The genital plates are distinctive. In the male there are two lunate plates which bear a variable number of small acetabula; in the female there are four, with small acetabula, the anterior and smaller plates each produced medially into a curved spine-bearing process. The palpi are large and stout; the fifth segment has two spines on the end. The legs are stout; their spines are often serrate.

Specimens have been found in New York, Michigan and Iowa. In Wisconsin they have been found in Green Lake, the Madison lakes and waters of Waukesha County.

Unionicola ypsilophora (Bonz)
Pl. II, fig. 15-18.

This species is one of the largest and commonest of the parasites of mussels, especially the Anodontas. The body is elongated, very dark, with a yellow dorsal T-shaped mark; females may attain a length of 1.50 mm. The genital area, close to the posterior end, is broad and has in both sexes two plates, each of which bears about twenty acetabula, the plates in the female produced outward into two wide lips bearing bristles. The palpi are stout, with three claws on the fifth segment. The legs end in flat and broadened segments with bifid claws.

Piersig (1900) maintained that the North American forms of this cosmopolitan species represented a distinct variety, which he designated as *U. haldemani,* basing this assumption on certain small differences in the legs, palpi and genital plates, as

shown by Wolcott (1899). The author, after examining some two hundred individuals in the present collection, does not think that this separation is necessary, as the differences pointed out are well within the limits of variation in so large a group. Koenike (1895) reported the species from Canada; he had only fragments of specimens, but he identified these as *U. ypsilophora.* The author has also examined this material, as well as a slide from the collection of Dr. Koenike from Germany and believes that all of the individuals belong to the same species.

The species has been found in New York, Connecticut, New Jersey, Pennsylvania, Michigan, Illinois, Iowa and Nebraska. In Wisconsin it has been found in Mirror and Green lakes, in four lakes of Vilas County and in large numbers in several collections from Waukesha and Jefferson counties and the Madison region.

Unionicola arcuata (Wol.)
Pl. II, fig. 19, 20; Pl. III, fig. 33, 34.

A species similar to *U. ypsilophora,* but not so common, it has been found parasitic in several species of clams. Individuals measure a little more than one millimeter. They are distinguished from the related species most readily by the character of the legs; these are long and slender, especially in the fifth segment, while the last segment is curved and ends in a rounded projecting tip and short bifid claws. The posterior epimeral group is unusually short. The genital plates are broad, much alike in the two sexes, with a large and variable number of acetabula, two of which on each plate are larger than the others.

This species has been found in Michigan and Pennsylvania and in Waukesha County in Wisconsin.

Unionicola fossulata (Koen.)
Pl. III, fig. 35-38.

A parasite throughout life, this species is common in several mussels. Individuals measure a little over one millimeter. They may be recognized by the genital plates which are placed a little forward of the posterior end and bear on each side five large acetabula, of which the last two lie side by side; in the male these are borne on two lunate plates, while in the female the plate of each side is divided. The legs bear large claws, di-

vided near the tips, and the last segment in each case is narrowed at the end. The epimera resemble those of *U. stricta.*

Dr. Koenike (1895) described the species from Canadian material; this the author has examined. It has been reported also from Michigan, Illinois, New York and Iowa. In Wisconsin it has been found in Green and Trout lakes and in collections from Oshkosh and Waukesha and Jefferson counties.

Unionicola stricta (Wol.)
Pl. III, fig. 30-32.

A species closely resembling *U. fossulata,* and like it a parasite in fresh water clams, *U. stricta* is smaller and rarer, and is distinguished chiefly by differences in the genital plates. Here the five acetabula of each side are placed in a curved line on either side of the cleft. The legs are slender, bear simple claws, and the distal end of each is somewhat dilated at the end.

Individuals have been found in several species of clams in Michigan, Illinois and Nebraska. In Wisconsin a few were found in collections from Waukesha and Jefferson counties.

Neumania semicircularis Mar.
Pl. IV, fig. 44-46.

The species is a large one, females attaining a length of 1.40 mm. Plates and legs are blue tinged. The epimera are relatively small and the groups are well separated; the genital plates are somewhat removed from these and from the posterior end of the body and the body papillae near them are not conspicuous.

The male is now recognized; while the females are common, the male has been found but rarely. The genital plates bear a large number of small acetabula as in the female. The epimera show a fine reticulation and the body surface is covered with very fine denticles.

Specimens have been found in Iowa and Illinois. In Wisconsin they have been collected in Mirror, Mendota, Buffalo, Spooner, Lauderdale, Beulah and Green lakes; in pools near Fontana and Wisconsin Dells and in four lakes in Vilas County. In Green and Big lakes they have been found at depths from the surface to ten meters.

Neumania armata Mar.
Pl. III, fig. 39, 40.

These mites have heavy plates, blue tinged; males measure 0.90 mm., females 0.95 mm. The fourth epimera are very long and the inner posterior corner of each is somewhat projecting. The genital areas are very broad and lie close to the posterior end of the body. The palpi are moderately large.

They have been found in Iowa and Illinois. In Wisconsin collections have been made in Mirror, Lauderdale and the Madison lakes, in two lakes of Vilas County, in pools near Wisconsin Dells and in Green Lake at depths to 15 meters.

Neumania tenuipalpis Mar.
Pl. V, fig. 49, 50.

Males measure 1.00 mm., females 1.30 mm. or more. The species resembles *N. armata* but the plates are not so heavy nor are the genital areas as broad. The palpi are unusually small. The author's former identification of the female (1926) was in error; the specimen described is now seen to be *N. punctata.* Fig. 49 of this paper shows the true female of this species, with its close resemblance to the male. The species name *muttkowski* introduced by the author (1922) is now invalid; two of the three males described are found on re-examination to be *N. tenuipalpis* and the other *N. armata.*

Specimens have been recorded for Iowa and Louisiana. In Wisconsin they have been found in Green Lake, the Madison lakes and lakes in Vilas County and in ponds at Whitewater and in Adams County.

Neumania extendens Mar.
Pl. IV, fig. 47, 48.

These are mites of moderate size, males measuring 0.90 mm., females about 1.00 mm. The epimera are large and the groups rather close together. Specimens may be recognized by the broad genital plates which are close to the posterior end of the body and in both sexes show a concavity on the anterior lateral border, while the body papilla of either side near this is small. Acetabula are small and numerous. The female is now recognized. It was earlier erroneously described as the female of *N. punctata* (Marshall, 1922; fig. 29 is an immature female).

Individuals have been found in Spooner, Green and Trout lakes, in the Madison lakes and in ponds in Adams County.

Neumania papillator Mar.
Pl. V, fig. 53, 54.

This species closely resembles *N. extendens* but is smaller, males being about 0.60 mm. in length and females 0.78 mm. The body is semitransparent. The genital areas at the posterior end of the body have fewer acetabula than in the related species and the body papilla near the outer border on either side is very large. The broad genital plates of the male show a concavity adjacent to the papilla.

The species is probably wide spread, since specimens have been found as far south as Louisiana. In Wisconsin they have been found in the Madison and Lauderdale lakes and in Twin, Storr and Green lakes, in the last to a depth of five meters.

Neumania punctata Mar.
Pl. VI, fig. 58, 59.

The great development of the epimera in the male characterizes this species, as well as the conspicuous papillae which join the genital plates on their lateral borders. Males measure 0.75 mm., females 0.90 mm. or more. The color is blue or occasionally red. The body surface and legs show tiny rounded patches of chitin. The author's original drawing of the female (1922, fig. 29) is now seen to be a young *N. extendens;* fig. 59 of this paper corrects this error. The genital plates are somewhat rounded and lie close to the cleft; they are heavy, as in the male, with the adjacent papillae well developed.

In Wisconsin the species has been collected in Green, Delavan, Mirror, Beulah, Drake, Monona and Nashota lakes and in lakes in Vilas and Adams counties.

Neumania fragilis Mar.
Pl. V, fig. 51, 52.

First descriptions of this species (1922), made from a study of prepared slides, contained some inaccuracies; a more complete and accurate characterization, including the recognition of the male, is now possible. Living specimens of this small and delicate mite are recognized by the magenta tinge of the plates and legs; there is a red Y-shaped dorsal mark and the eyes are

large and red. Males measure 0.75 mm. and females 0.83 mm. The surface is covered with very fine denticles. The epimera show a fine reticulation; the underlying processes of the anterior groups are large. The genital plates are placed close to the end of the body; they are broad and in both sexes bear a small number of large acetabula. A large papilla is found close to the outer border of each plate. The fourth legs in the male are one and one half times as long as the body; the fifth segments bear a row of pectinate spines and a few swimming hairs.

Specimens have been found in Michigan and Illinois. In Wisconsin they have been found in lakes Jordan, Green and Nashota and in the Madison and Waupaca lakes.

Neumania hickmani nov. spec.
Pl. IV, fig. 41-43.

One of the smallest species of the genus, males measure 0.42 mm. and females 0.55 mm. The color is reddish brown; the surface is beset with small denticles. The plates occupy a large part of the ventral side. The first and second pairs of epimera are very long; the fourth is unusually narrow on the inner posterior border, with a marked concavity on the posterior side in the female. The genital areas are close to the posterior end; they bear prominent heavy acetabula which are slightly elevated. Just back of the genital plates are three large body papillae. The palpi are moderately large. Legs in the male are all longer than the body; those of the female are relatively shorter and weaker. In the last pair the fifth segment bears a row of pectinate spines and a few swimming hairs, while the sixth segment has two pectinate spines; in the third pair of legs the fifth segment has a few pectinate spines and swimming hairs. There are heavy spines on all legs.

About fifty individuals, mostly females, were found in three lakes of Vilas County in collections made by Dr. J. R. Hickman. One female was found in Green Lake at a depth of ten meters.

Neumania pubescens Mar.
Pl. VI, fig. 55, 56.

When alive, specimens are transparent with plates and legs tinged blue, purple or even red; the dorsal side has brown patches with a central orange dagger-shaped area. Males are 0.675 mm. in length, females 0.80 to 1.00 mm. Hairs on the

genital plates are conspicuously long and abundant. The curved bar over the genital cleft in the female is very large.

Specimens have been found in Iowa and Indiana. In Wisconsin they have been collected in Lake Mills, Powers Lake, Goose Pond (Adams County) and in Green Lake (depths to six meters).

Neumania ovata Mar.
Pl. VI, fig. 57.

Females only are known; these measure 1.20 mm. The epimeral groups are widely separated and the underlying processes from the first pair are unusually short. The genital plates are somewhat oval in form and body papillae are only moderately developed.

A few individuals have been found in Iowa, and in Wisconsin in Twin Lakes, and the Madison lakes.

Neumania distincta Mar.
Pl. VI, fig. 60, 61.

Individuals of this large species are recognized by the unusual form of the genital plates: these are very broad, and in the male, the plate of each side is partly divided by a median constriction, while in the female the separation is complete, resulting in the formation of a smaller detached anterior plate. A similar condition is found in the South American species *N. curvipes* Lund. Dr. Lundblad[2] has erected a subgenus, *Tetraneumania,* for the two species. *N. distincta* is also characterized by the shortness of the underlying processes of the anterior epimeral group. *N. okobojica* Mar. (1926) is now recognized as the female of this species, while *N. brevibrachiata* Mar. (1922) is found to be a young and poorly preserved male. In consequence these two names become invalid.

Specimens have been collected in Iowa. In Wisconsin they have been found in Mirror, Green, Lauderdale and Briggsville lakes.

ROCKFORD COLLEGE,
SEPTEMBER 1, 1932.

[2] Südamerikanische Hydracarinen. Zoolog. Bid. Uppsala. Bd. 13 : 32-36.

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PLATE I

1. *Unionicola crassipes*, right palpus, female, outer side.
2. *Unionicola crassipes*, basal segments of leg I, right.
3. *Unionicola crassipes*, ventral view, female.
4. *Unionicola crassipes*, genital area, male.
5. *Unionicola aculeata*, end of leg I, male (one claw omitted).
6. *Unionicola aculeata*, right palpus, male, outer side.
7. *Unionicola aculeata*, genital plates, male.
8. *Unionicola aculeata*. genital area, female.
9. *Unionicola figuralis*, left palpus, male, outer side.
10. *Unionicola figuralis*, genital area, female (turned).
11. *Unionicola figuralis*, ventral view, male.
12. *Unionicola pectinata*, genital area, female.
13. *Unionicola pectinata*, left palpus, female, outer side.
14. *Unionicola pectinata*, end of leg I, left (one claw omitted).

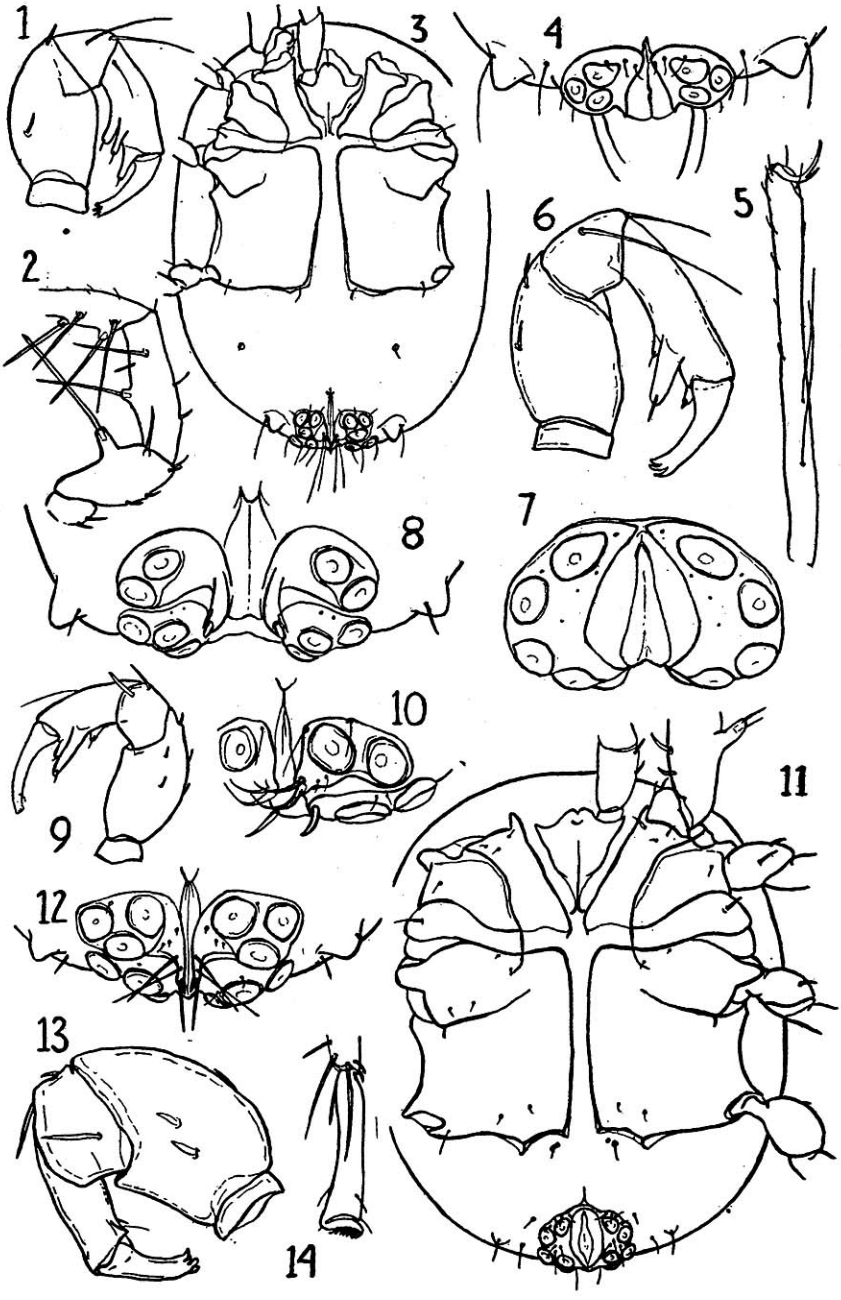
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PLATE II

15. *Unionicola ypsilophora,* right palpus, female, outer side.
16. *Unionicola ypsilophora,* ventral view, female.
17. *Unionicola ypsilophora,* genital plates, male.
18. *Unionicola ypsilophora,* end of leg I, male, left (one claw omitted).
19. *Unionicola arcuata,* epimera III, IV, left, female.
20. *Unionicola arcuata,* end of leg I, right (one claw omitted).
21. *Unionicola intermedia* var. *wolcotti,* left palpus, female, outer side.
22. *Unionicola intermedia* var. *wolcotti,* genital plates, female.
23. *Unionicola intermedia* var. *wolcotti,* end of leg I (one claw omitted).
24. *Unionicola abnormipes,* genital plates, male.
25. *Unionicola abnormipes,* right palpus, inner side.
26. *Unionicola abnormipes,* genital plates, female.
27. *Unionicola abnormipes,* leg IV, left, segments 4, 5, male.
28. *Unionicola serrata,* left palpus, outer side.
29. *Unionicola serrata,* ventral surface and leg I, female.

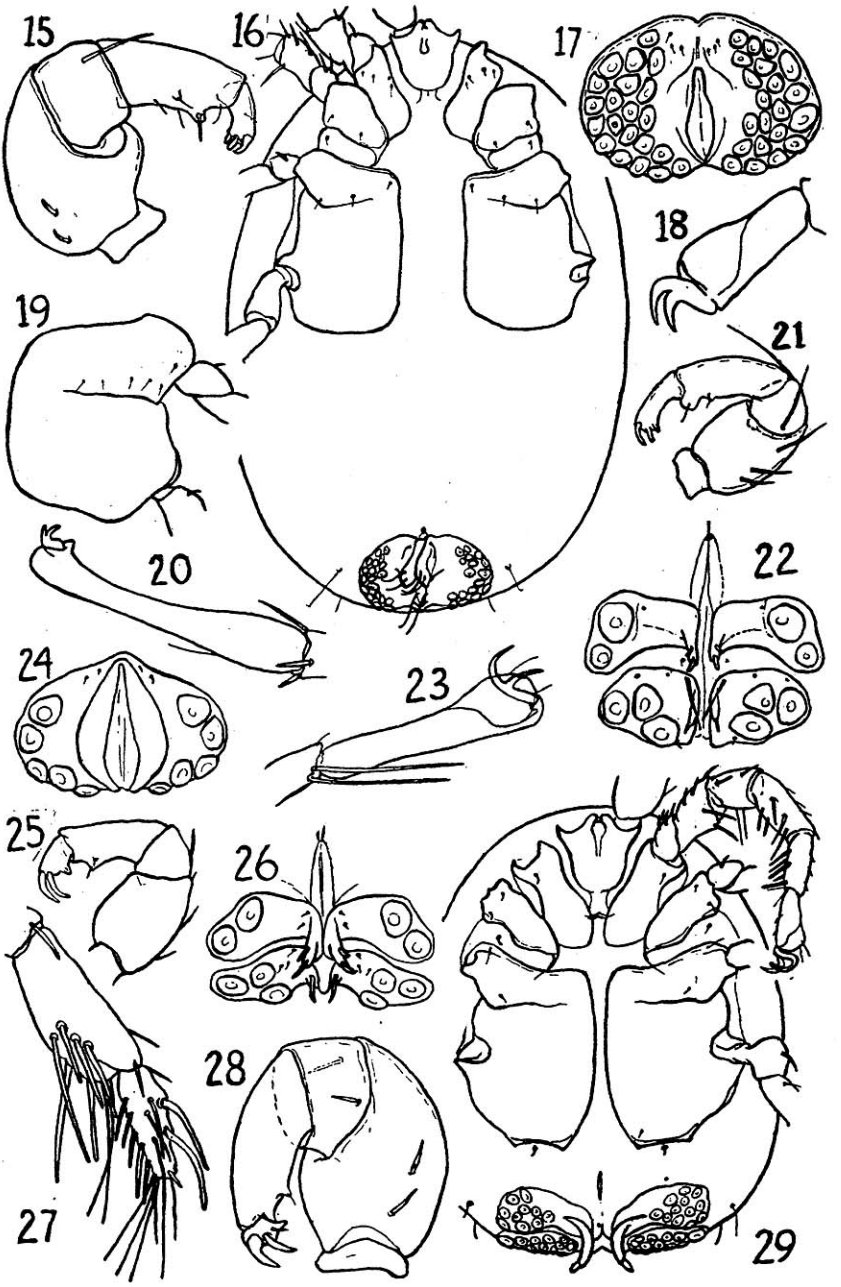
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PLATE III

30. *Unionicola stricta,* ventral view, female.
31. *Unionicola stricta,* genital plates, nymph.
32. *Unionicola stricta,* right palpus, outer side.
33. *Unionicola arcuata,* genital plates, female.
34. *Unionicola arcuata,* left palpus, female, outer side.
35. *Unionicola fossulata,* genital plates, male (after Wolcott).
36. *Unionicola fossulata,* genital plates, female.
37. *Unionicola fossulata,* right palpus, female, inner side.
38. *Unionicola fossulata,* end of leg IV.
39. *Neumania armata,* ventral view, male.
40. *Neumania armata,* genital area, female.

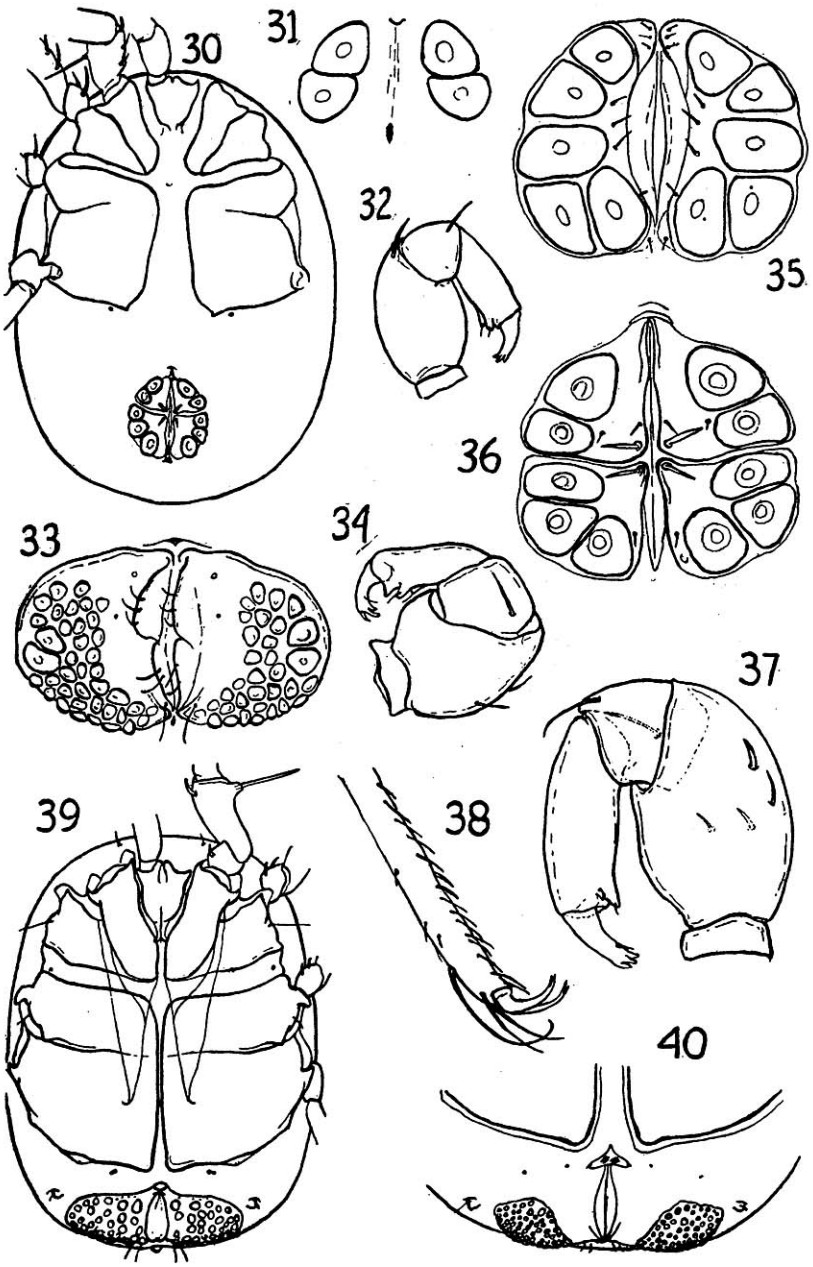
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PLATE IV

41. *Neumania hickmani*, genital plates, male.
42. *Neumania hickmani*, ventral surface, female.
43. *Neumania hickmani*, left palpus, female, outer side.
44. *Neumania semicircularis*, genital area, female.
45. *Neumania semicircularis*, ventral surface, male.
46. *Neumania semicircularis*, right palpus, female.
47. *Neumania extendens*, ventral view, female.
48. *Neumania extendens*, genital area, male.

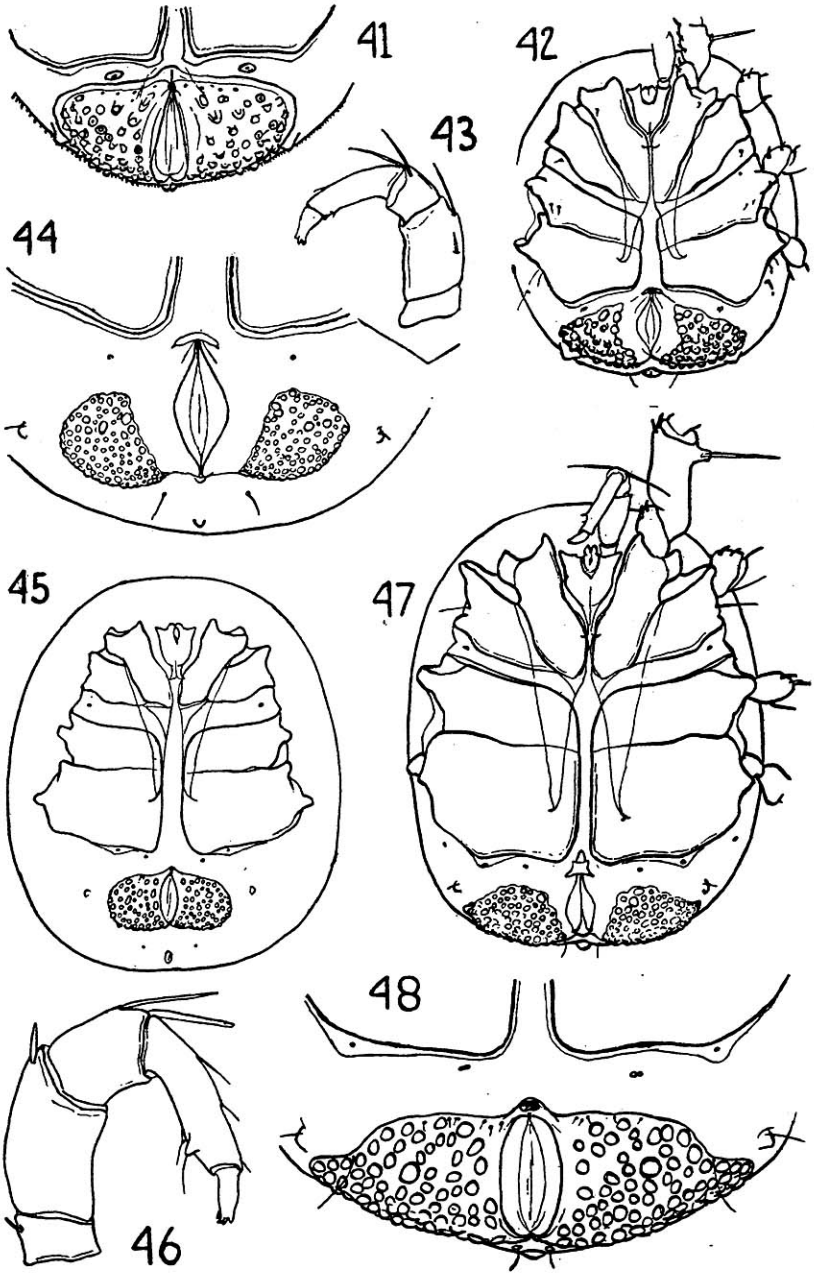
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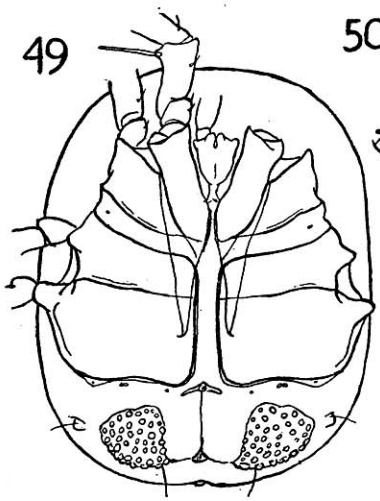
PLATE V

49. *Neumania tenuipalpis,* ventral view, female.
50. *Neumania tenuipalpis,* genital area, male.
51. *Neumania fragilis,* genital area, male.
52. *Neumania fragilis,* ventral surface, female.
53. *Neumania papillator,* ventral surface, female.
54. *Neumania papillator,* genital area, male.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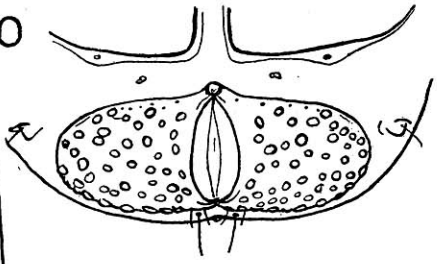
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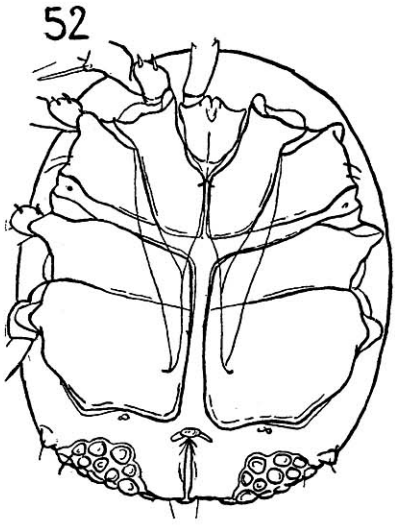
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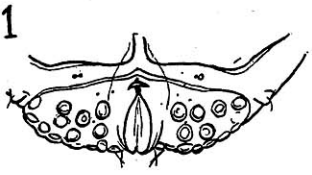
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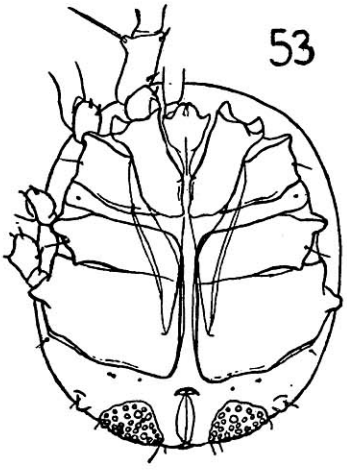
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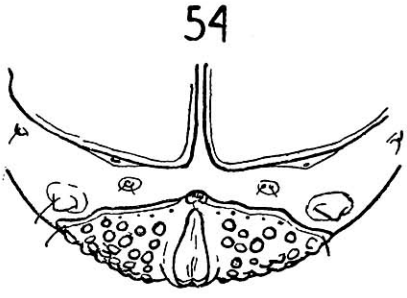
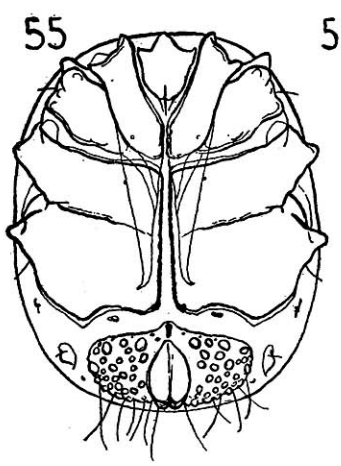
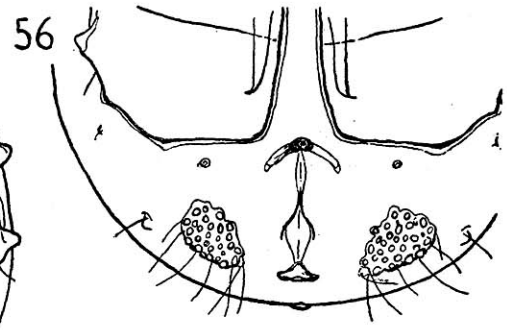
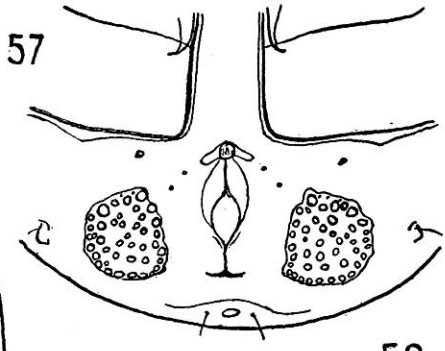

54

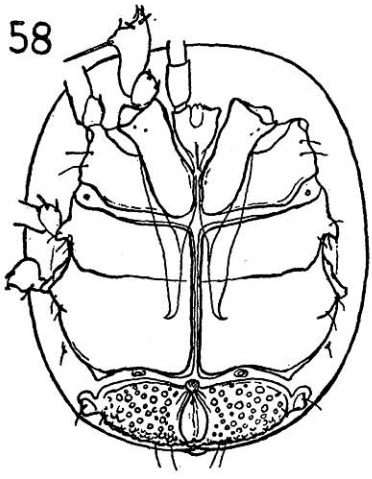
PLATE VI

55. *Neumania pubescens,* ventral surface, male.
56. *Neumania pubescens,* genital area, female.
57. *Neumania ovata,* genital area, female.
58. *Neumania punctata,* ventral surface, male.
59. *Neumania punctata,* genital area, female.
60. *Neumania distincta,* genital area and last epimera, female.
61. *Neumania distincta,* genital area, male.


55


56


57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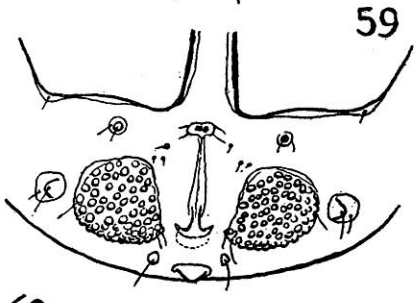
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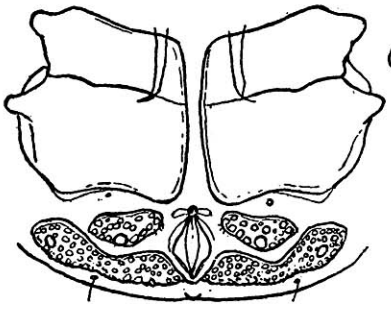
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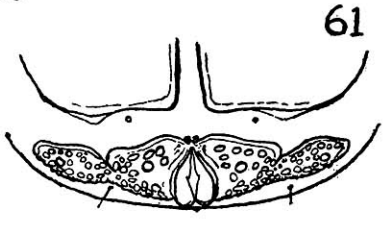
61