PRELIMINARY LIST OF THE HYDRACARINA OF WISCONSIN

PART V*

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Parts I to IV of the *Preliminary List of the Hydracarina of Wisconsin* (Marshall, 1931, 1932, 1933, 1934) recorded sixty-seven species belonging to twenty-two genera. Part IV concluded with six species of the large genus *Piona;* the present paper completes the study of this genus and adds eleven species, one of which is new. In addition to these, two other genera are considered, namely *Hydrochoreutes* and *Acerus,* belonging with *Piona* to the family *Hygrobatidae,* with one species and one new variety, bringing the total number of species described in this paper to thirteen.

The author has recently been fortunate enough to acquire the collections, including type material, of the late Dr. R. H. Wolcott, the eminent American hydracarinologist. In this concluding study of the Pionas it has, therefore, been possible to examine the specimens upon which Wolcott based his descriptions of several species of this genus and to supplement and correct some of the data.

The genus *Hydrochoreutes* is a very small one, closely related to *Piona,* the epimera being very similar. The genital plates carry but six acetabula, three on each side in a row; the plates in the male are close to the posterior end of the body and below them lies a petiole. Palpi and legs are very long and the third leg in the male is modified to serve as a copulatory organ.

The genus *Acerus* is likewise a small one and not common, closely related to *Hydrochoreutes.* Specific determinations depend largely on the characters of the male. The genital plates are similar in the two genera, with three acetabula on each, but there is no petiole in the male and the fourth epimera in the

* In the preparation of this paper, as in the case of Part IV, the author has been greatly assisted by a grant in aid of research of the Society of Sigma Xi. She is also indebted to the Wisconsin Natural History Survey for most of the material from Green Lake and the lakes of Vilas County.

female are more pointed posteriorly. The last leg in the male is distinctive, the four segment being more or less flattened.

1. *Piona setiger* (Wol.)
Pl. VI, fig. 33-37.

The body is elliptical, depressed between the eyes; the average length in the males is 0.70 mm., in the females, 1.10 mm. Colors have not been recorded. The surface is finely striated. The antennary bristles are very long, a character which suggested the specific name. The epimeral groups are moderately separated. The tongue-shaped genital plates of the male extend laterally a little beyond the posterior angles of the fourth epimera and enclose a seminal receptacle which has a broad opening with a small bay where it approaches the inner corners of the last epimeral pair. Each plate bears about fifteen acetabula, one being close to the seminal opening, the others on the outer and lower margins; the united plates leave a broad bay posteriorly, with the anal plate well removed from them. (Fig. 51, Wolcott, 1901, is inaccurate in details.) In the female the genital acetabula, usually fifteen on each side, are arranged in a broken sickle formation, the most anterior one on a small plate with a few fine hairs near the curved bar over the genital slit, the others on a large plate or broken plate. The entire genital area does not extend laterally beyond the limits of the posterior angles of the fourth epimera. The palpi are unusual in that they differ considerably in the papillae in the two sexes; in the female the fourth segment bears two small ones, while in the male there are two moderately long papillae and four smaller ones close to these. Legs in the male are moderately long; the terminal segment of the third is slightly curved and bears small weak claws and several fine hairs, while the fourth segment of the fourth leg has a deep excavation bordered by large stout bristles and a spur on the distal end.

Material has been found in Nebraska, and in Wisconsin in two small pools in Adams and Sauk counties and in a bog in Vilas County.

2. *Piona debilis* (Wol.)
Pl. V, fig. 25-27; Pl. VI, fig. 43, 44.

Dr. Wolcott (1901) described this species from the study of a single male; material in the present collection makes possible

the addition of new data, including a description of the female. The body is elliptical, measuring in the male 0.85 mm., and in the female 1.10 mm. The surface is striated and shows dark blotches on a yellow-green background; the legs and plates are blue and the eyes deep red. The fourth epimera are separated from each other by unusually wide spaces in the male, and the genital plates are somewhat removed from these, except where they are slightly joined in the mid-line. In the male the genital plates resemble those of *P. inconstans;* they are tongue-shaped, each bearing from fifteen to eighteen prominent acetabula, and extend outward from their union in the mid-line more diagonally than in the related species, reaching about as far as the posterior angles of the fourth epimera. They enclose a central shallow circular depression, below which is an area devoid of acetabula. (Wolcott's fig. 46 is inaccurate in details.) In the female the acetabula, similar in appearance and number to those of the male, are placed in a crowded row on sickle-shaped plates, with one or more embedded in the body surface; these plates do not extend laterally as far as the posterior angles of the fourth epimera. The genital slit is surmounted by a short stout curved bar. The posterior inner margins of the fourth epimera show a shallow concavity. The palpi are small, not exceeding the legs in width; the fourth segment carries two papillae. The legs are relatively long but weak, a character which suggested the specific name. The third leg in the male has a long slightly curved terminal segment which bears a long straight claw and unusually long hairs; the fourth leg has a shallow concavity in the fourth segment which is bordered anteriorly by a few short blade-like bristles.

This species has been found in Massachusetts, and in Wisconsin in Lake Mason and in ponds near Cable and Wisconsin Dells.

3. *Piona exilis* (Wol.)

Pl. VII, fig. 45-48.

The elliptical body has an average length of 0.87 mm. in the male and 0.90 mm. in the female; the surface shows coarse irregular lines. The antennary bristles are short. The color is transparent brown, with blue epimera and legs and a patch of red in the center of the body. The epimera are large, approxi-

mate in the male, separated by only small spaces in the female; the inner posterior margins of the fourth are slightly concave. The united genital plates of the male touch the fourth epimera in the mid-line and extend laterally about as far as their posterior angles, as do also those of the female; the genital slit is short and surrounded by an elliptical depression. In the female the long genital opening is flanked by large chitinous plates; the broad tongue-shaped lateral plates extend diagonally out and down from the slit. Genital acetabula are very numerous in both sexes and irregular in number, size and position. The anal plate lies just inside the triangular bay produced by the genital plates; in the male this plate is fused with the latter. The palpi are nearly as long as the body and thicker than the first pair of legs; the third segment is constricted near its base and bears two papillae near its center. The legs are moderately long; in the male the last segment of the third leg is about three-fourths as long as the fifth, is slightly bent and bears weak claws, one of which has a curved piece. The fourth segment of the last leg in the male is moderately long and has a shallow excavation on the fourth segment bordered by several stout spines.

The species has been found in Michigan and Colorado. In Wisconsin it has been collected in Green and Mirror lakes and in the Madison lakes.

4. *Piona pugilis* (Wol.)
Pl. III, fig. 1-5.

In this large species males may attain a length of 1.50 mm. and females 2.00 mm. or more. The body is elliptical, the surface covered with fine wavy lines. On the dorsal side there is a yellowish Y-shaped area, usually with a central red blotch, surrounded by brownish blotches; epimera and appendages are blue, or reddish orange in young specimens. The eyes are ruby. The epimera are heavy, finely reticulated, the groups well separated in the female, with the fourth showing a concave inner posterior border. The broad tongue-shaped genital plates extend laterally well beyond the posterior angles of the fourth epimera, and bear each sixty or more distinct acetabula of various sizes, two of which on each plate are larger than the others. The united plates in the male are fused with the last epimera in the mid-line; the small cleft lies at the upper end of an oval de-

pression. The anal plate in young males is connected with the genital plates by a strip of chitin, but becomes separated from them in older specimens. The palpi are very long, wider than the first pair of legs, with relatively small papillae on the fourth segment. The legs are distinctive and suggested the specific name. The last segment of the first three pairs in the female and the first two in the male are curved and are usually flexed upon the fifth segment; the latter is narrow distally and broad toward the center and bears several bristles. The third and fourth legs of the male are not strongly modified; in the former the last segment is relatively long and bears small weak claws, while the fourth segment of the last leg is also long and has only a shallow excavation.

The species is a common one, being known for Ontario, New York, Michigan and Iowa; in Wisconsin it has been collected in lakes Winnebago, Green, Mirror and Jordan, in the Madison lakes and several of the lakes of Vilas County.

5. *Piona turgida* (Wol.)
Pl. IV, fig. 16-19.

This species is one of the largest of the water mites; females may attain a length of 3.00 mm., males somewhat less. The body is oval, slightly concave between the eyes; the surface is finely striated. The color, according to Wolcott (1901) is "brilliant scarlet-red with dark patches"; only a red Y-shaped dorsal mark has been observed by the author. The epimera are extensive and heavy; in the female the inner posterior border of the fourth is a straight line or only slightly concave. In the male the united genital plates enclose a large broad opening to the seminal pouch, the latter having a broad rounded bay on its anterior and posterior borders and a smaller bay on either side (see fig. 16, Pl. IV, correcting Wolcott's fig. 21). The broad male genital plates, each bearing over fifty acetabula, two of which are larger than the others, extend laterally barely beyond the sharp posterior angles of the fourth epimera; where they unite just behind the genital orifice there is a deep bay and at the mouth of this lies the anal plate. In the female the genital cleft has above it a conspicuous curved bar and is flanked by two narrow delicate flaps (rather than conspicuous broad ones, as shown in Wolcott's figure 20), while over and outside of these are several

rows of short hairs. The irregularly oval genital plates, with acetabula as in the male, come together at their inner borders below the cleft, extend diagonally outward from about the level of the posterior third of the cleft to a point in line with the posterior angles of the last epimera but some distance removed from them. The palpi exceed the legs in width and are stouter in the male than in the female; the fourth segment bears two large slim papillae and two small ones. In the male the third pair of legs, the shortest, end in club-shaped segments which bear short curved claws; these segments, as semen carriers, are often seen on the genital orifice. The fourth segment of the last leg in the male has a deep excavation with a strongly produced posterior tip and many stout spines.

Specimens have been found in Ontario, British Columbia, Michigan and New York; and in Wisconsin in lakes Winnebago and Spooner, the Madison lakes and lakes of Vilas County.

6. *Piona interrupta* Mar.
Pl. IV, fig. 10-15.

This is a large species, oldest females measuring up to 1.70 mm. and males, 1.20 mm. The body is oval, slightly indented between the eyes; the surface is covered with fine lines and small chitin dots. The dorsal surface shows a red or yellowish Y-shaped mark surrounded by dark blotches; the eyes are red and the plates blue tinged. The epimera are finely reticulate; the fourth pair in the female are relatively narrow on the median side and show a long concave inner posterior border. The genital area in the male closely resembles that of *P. turgida*; the broad plates, however, each bearing over fifty acetabula, extend laterally beyond the acute angles of the fourth epimera and the large broad seminal orifice is shaped somewhat differently, the anterior bay being deeper and the lateral ones having an acute angle. The anal plate lies at the mouth of the deep bay formed by the plates back of their union behind the seminal pouch. In the female the genital cleft is surmounted by a conspicuous curved bar, beween the ends of which and the genital plates on each side are seen a few fine hairs. The broad genital plates bear somewhat smaller and more numerous acetabula than in the related species; they are more or less deeply indented on the inner median borders, and here no acetabula are found, a char-

acter which suggested the specific name. These plates extend laterally beyond the limits of the fourth epimera, from which they are widely separated, and their inner anterior borders start at about the level of the angles but do not meet behind the cleft; on their inner posterior borders on each side are three or four fine hairs, either on the plates or on separate small plates. The palpi are somewhat slimmer than in *P. turgida,* but are wider than the legs, and the fourth segment bears two long papillae and two small ones. The third leg in the male ends in a club-shaped segment, a little shorter than in the related species; the fourth segment of the last leg is very similar in the two species, being deeply excavated, with a large posterior spur and many bristles.

The species is abundant and has been taken at various depths from the surface to twelve meters. It has been found in British Columbia, Ontario, Montana and Michigan. In Wisconsin collections have been made in Mason and Green lakes, several lakes of Vilas County and in ponds near Oshkosh and in Adams County.

7. *Piona americana* Mar.
Pl. V, fig. 20-24.

This species closely resembles *P. turgida* and *P. interrupta,* especially in the male, but it is smaller and differs from them in details of the ventral plates and appendages. It is one of the very few American species of water mites whose developmental stages are known (Marshall, 1929). Largest females attain a length of 1.35 mm., males, 1.20 mm. The body is oval, the surface covered with very fine striae and tiny dotes of chitin. The antennary bristles are short and fine and on small papillae. The dorsal surface shows a yellow or reddish Y-shaped mark surrounded by dark blotches. The last epimeral groups do not quite join in the male; in both sexes the fourth epimera show a deep concavity on the posterior inner borders and close to them lie the genital plates. The latter are oval and bear each from thirty to forty indistinct acetabula, two of which on each side are slighly larger than the others. In the male the inner margins of the genital plates meet to surround a seminal pouch, the opening of which is very large, inverted trifoliate in form. The genital plates in both sexes extend laterally only a little beyond the

posterior angles of the fourth epimera. In the female the genital plates are more closely approximated than in the related species; they barely touch on their inner posterior borders. The anchoral bar above the female genital opening is small. The palpi are broader than the first pair of legs; the fourth segment bears one large papilla and three smaller ones. In the male the last segment of the third leg is short and curved, broad at the distal end, and bears a claw transformed into a long delicate hook; these legs are often found, as in the two related species, with their tips together over the opening of the seminal pouch. The fourth segment of the fourth leg has a posterior spur carrying long hairs, and deep concavity bordered by rows of short blade-like spines.

Specimens were found in large numbers in three lakes near Minocqua and also in Green Lake, Wisconsin. Individuals found in Alaska, originally identified by the author as *P. turgida,* are now seen to represent this species.

8. *Piona constricta* (Wol.)
Pl. III, fig. 6-9.

The body is elongate, large specimens measuring 0.90 mm. in the male and 1.70 mm. in the female. The anterior border is emarginate between the eyes and constricted behind them; the posterior end is elongated (not "smoothly rounded posteriorly," as stated by Wolcott, 1901, p. 222). The surface shows fine lines. Antennary bristles are conspicuous. Young specimens are deep red, while older ones are brownish red; the legs are red and the eyes ruby. The epimera in the female are relatively small and well separated; in the male they are large with considerable spaces between the inner ends of the two anterior groups. The posterior inner margins of the fourth epimera are distinctly concave, especially in the male. The united genital plates in the male are in contact with the fourth epimera in the median line and also at their posterior angles, extending laterally a little beyond these. There is present a seminal pouch having a large broad opening with a small anterior bay; from this the genital plates, each bearing nine or ten large acetabula, extend laterally leaving scarcely any bay. In the female the genital area is some distance from the last epimera; a sickle-shaped plate flanks the posterior two-thirds of this area on either

side, each plate bearing eight to ten large acetabula and several fine hairs. The palpi are rather short, a little wider than the first pair of legs, relatively smaller in the female than in the male; the fourth segment bears two papillae of equal size. The species name refers to the slight constriction in the fifth segments of the legs. The last segment of the third leg of the male is enlarged and curved distally and bears curved claws. The fourth segment of the last leg is very broad and bears a deep concavity and spur, with numerous bristles.

Specimens have been found in Ontario, Michigan, Nebraska and Montana; and in Wisconsin collections have been made in the Madison lakes and in lakes of Adams and Vilas counties.

9. *Piona spinulosa* (Wol.)

Pl. VI, fig. 38-42; Pl. VII, fig. 53.

One of the smallest of the Pionas, this species seldom exceeds 0.50 mm. in length, males and females being of about the same size. The body is broadly elliptical; the dorsal surface shows dark patches on a transparent background, with sometimes a red patch. The epimera cover the greater part of the ventral surface, the groups close together even in the female, the fourth showing a sharp posterior angle. The genital areas are also large and reach the posterior border of the body in young individuals as shown by Wolcott (1901, fig. 24, 25; the latter is here reproduced as fig. 39). The genital plates are similar in form in both sexes, being broad and tongue-shaped, each bearing from twenty to thirty scattered acetabula, very variable in size and arrangement. The united plates in the male enclose a depressed area with a distinct anterior border in which lies the genital opening. The anal plate lies close to the genital plates. The maxillary shield is very broad. The palpi are relatively long; the second segment is rather stout, especially in the male, and the fourth bears two small papillae. The legs are long and heavy; swimming hairs and spines are relatively few but the latter are stout. In the first two pairs the terminal segments have very narrow proximal ends, while the flexor side is convex, characters especially pronounced in the male. In the third leg the sixth segment is short and one of its claws bears a very long process. In the last leg, the fourth segment bears a deep con-

cavity with short spines and several long ones, together with three swimming hairs on the distal end.

Specimens have been found, often in large numbers, in Massachusetts, Michigan, Illinois, Louisiana and Indiana; and in Wisconsin in lakes Spooner, Wingra and Mason and a pond at Montello.

10. *Piona carnea* (Koch)
Pl. V, fig. 28-32.

A cosmopolitan species, this is the first record of its occurrence in this country. The body is elongated, the anterior end strongly protruding. The largest males found measured 1.85 mm., the females, 2.00 mm. The surface is covered with fine lines and small circles. The dorsal surface shows large dark blotches on a yellowish background; the eyes are large, magenta colored, and the legs are bluish with orange tips. The epimera are heavy and brownish; the fourth in the male are separated from each other by a larger space than is usual in this sex, and their posterior angles in both sexes are very long and acute. The genital areas are small; the plates bear each from eighteen to twenty very distinct acetabula and extend laterally but little beyond the posterior angles of the fourth epimera. In the male the rounded plates are joined by a narrow strip both above and below a large seminal opening; the latter is nearly circular with a narrow bay where the plates touch the epimera in the midline. In the female the genital plates, irregularly pyriform, extend laterally out from the posterior end of the genital slit; a large curved bar surmounts the slit, between which and the anterior margins of the plates are several fine scattered short hairs. The maxillary shield and the palpi are unusually small, the latter being narrower than the legs; the fourth palpal segment bears on the flexor side two long hairs close to two slight papillae. The legs are all shorter than the body and well provided with swimming hairs. The first two pairs (and the third in the female) bear very large claws. The third leg in the male is the shortest and narrowest; its end segment is slightly curved and bears reduced claws and many fine hairs. In the fourth leg of the male the first three segments are short and stout; the fourth has a deep excavation bordered by many short

stout bristles and ends in a spur with long hairs, while the fifth and sixth segments are weak.

This species is reported from all parts of Europe and from Siberia, Turkestan and Palestine. In Wisconsin several individuals were found in Panto Lake, Vilas County. Two males found in Alaska and described by the author (Marshall, 1924) as a new species, *P. neocarnea,* are found on re-examination to be true *P. carnea;* hence the former name becomes a synonym and must be discarded.

11. *Piona wolcotti* nov. spec.
Pl. VII, fig. 49-52.

The new species, one of the largest of the Pionas, is known for the male only. The body is elliptical, lowest at the anterior end, slightly protruding between the eyes. The largest of the three males found measured 1.50 mm. in length. The body is covered with very fine lines and minute points. The antennary bristles are very small. The general color is deep orange to red, lighter at the anterior end, with appendages and plates dull blue. The eyes are small. The epimera are heavy; the anterior groups lie close to the third and fourth pairs, while the latter are in contact on their inner borders and have acute posterior angles. The male genital plates are distinctive; they are completely fused to form a broad triangular area well within the bay made by the four epimera, touching the latter only slightly at the anterior end. The genital opening is surrounded by a considerable area which is dotted with many fine hair papillae. The genital acetabula are distinct and numerous, with two on each plate larger than the others. The united plates leave a small deep bay on the posterior median line in which is situated the anal plate. The palpi are slim but exceed the legs in width; the fourth segment bears two large and two small papillae and has also a large spur armed with a peg on the distal end, inner side. The legs are moderately long, all exceeding the body in length; swimming hairs are coarse and abundant on the second and third, absent on the first, scanty on the fourth, while bristles are abundant on all legs. The third leg has a long slim terminal segment with a knee on the proximal end which causes it to lie in a slightly different plane from the other segments; it ends in very small claws. In the fourth leg the segments diminish in width suc-

cessively from the first, so that the sixth is very slim, with small claws; the fifth segment is the longest. The fourth segment of this leg has a shallow concavity bordered by bristles, both hair-like and flattened, while a row of seven large bristles is set on the convex side.

This new species is given the name of the late Dr. R. H. Wolcott who did the first important work on the Pionas in this country. Specimens were found in Little John and Star lakes, Vilas County and in Three Lakes, Oneida County.

12. *Hydrochoreutes ungulatus* (Koch)
Pl. VIII, fig. 54-57.

This is a cosmopolitan species. Males measure up to 0.60 mm. in length; the females are much larger and may reach a length of 1.70 mm. The body is broad, in the male somewhat angular, in the female oval. The antennary bristles are long. The surface has fine lines; dark blotches show on a background of delicate yellow or blue, with a pale yellow or red T-shaped mark showing dorsally. The epimeral groups are moderately separated and the genital plates are well back of these. The latter in the female are slightly lunate, the same length as the slit and carry the three large acetabula of each side, together with fine hairs. In the male the genital plates lie within a deep recess at the posterior end of the body; they are broadly lunate and the three acetabula of each side lie in a crowded row near the long slit. Below these is a conspicuous petiole, as long as the slit; it ends in a tooth and has on each side a shorter protecting sheath. The palpi are slender, about as long as the body in the female, exceeding it in the male; the fourth segment is the longest and bears several hairs and inconspicuous papillae. The legs are slender, much longer than the body. In the third leg of the male, the fourth segment has a large papilla near the center which is armed with a large sword-shaped spine inserted laterally, while the distal end bears a still larger sickle-shaped spine with a process at its base.

The species is found in all parts of Europe and is reported for Siberia. It is probably widely distributed in this country, since it has been collected in Maine, Michigan and California. In Wisconsin it has been found in lakes Mason, Spooner and Green and in two lakes in Vilas County.

13. *Acercus torris americanus* nov. var.
Pl. VIII, fig. 58-61.

A small number of individuals (one male, four females) in the author's collection bear a close resemblance to the cosmopolitan species, *Acercus torris* (Müll.), but are larger (male, 0.80 mm., largest female, 1.30 mm. in length) and differ from it in certain details, especially in the palpi, sufficiently to justify the erection of a new variety, *A. americanus* for them. As in *A. torris,* the body is oval, emarginate over each eye and at the posterior end, with a surface indistinctly striated, showing dark blotches on a pale orange red background, numerous fine hairs and two small chitin spots anterior to the center, dorsally. Only one pair of antennary bristles are present, instead of two; but epimera, genital plates and legs present only differences in detail from the parent form. The epimera are relatively small in the female but cover the greater part of the ventral surface in the male; the posterior prolongations of the fourth form right angles in the female but are rounded in the male. The three genital acetabula in the female lie on a triangular plate nearly as long as the genital opening; in the male they lie on broader united plates which fill most of the bay left by the approximated fourth epimera. The palpi are a little wider than the legs and slimmer than in *A. torris,* due to the greater length of the second and fourth segments; the first three segments bear heavy bristles, the fourth has two small papillae midway of the flexor surface and many fine hairs on the extensor side, with a peg on the distal end, while the fifth segment ends in three finger-like processes. The legs are longer than the body, with swimming hairs on the last three pairs. In the male the third leg is the shortest; the fifth segment is about as long as the sixth and bears many short hairs and a pair of weak claws. The fourth leg of the male is the longest and very distinctive: the first three segments are very short; the fourth is longer, very broad and flat and thickly beset on its margins with long fine hairs; the fifth segment, the longest, is slightly curved and has a spur armed with a peg on the distal end.

The new variety has been found in Illinois, and in Wisconsin in the Madison lakes and a pool near Jordan Lake.

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Plate III

1. *Piona pugilis*, ventral surface, old female
2. *Piona pugilis*, segments 5, 6, leg I, male
3. *Piona pugilis*, middle segments, leg IV, male
4. *Piona pugilis*, genital area, old male
5. *Piona pugilis*, palpus, female
6. *Piona constricta*, genital area, old female
7. *Piona constricta*, left palpus, outer side, female
8. *Piona constricta*, segment 6, leg III, right, male
9. *Piona constricta*, genital area, male

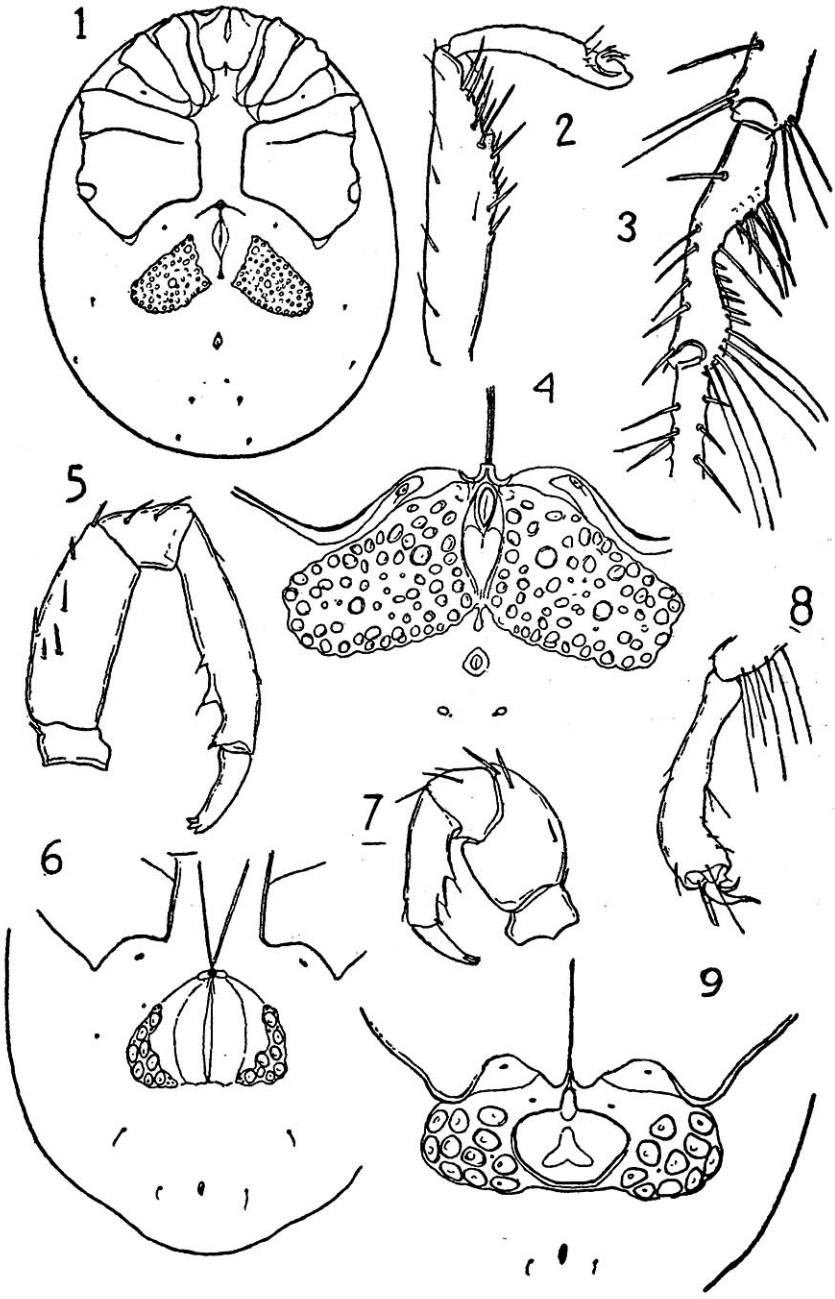
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Plate IV

10. *Piona interrupta*, ventral surface, female
11. *Piona interrupta*, right palpus, inner side, male
12. *Piona interrupta*, segment 4, leg IV, right, male
13. *Piona interrupta*, legs III, male, on genital orifice
14. *Piona interrupta*, segment 6, leg III, male
15. *Piona interrupta*, ventral surface, male
16. *Piona turgida*, genital area, male
17. *Piona turgida*, segment 6, leg III, right, male
18. *Piona turgida*, genital area, female
19. *Piona turgida*, right palpus, inner side, male

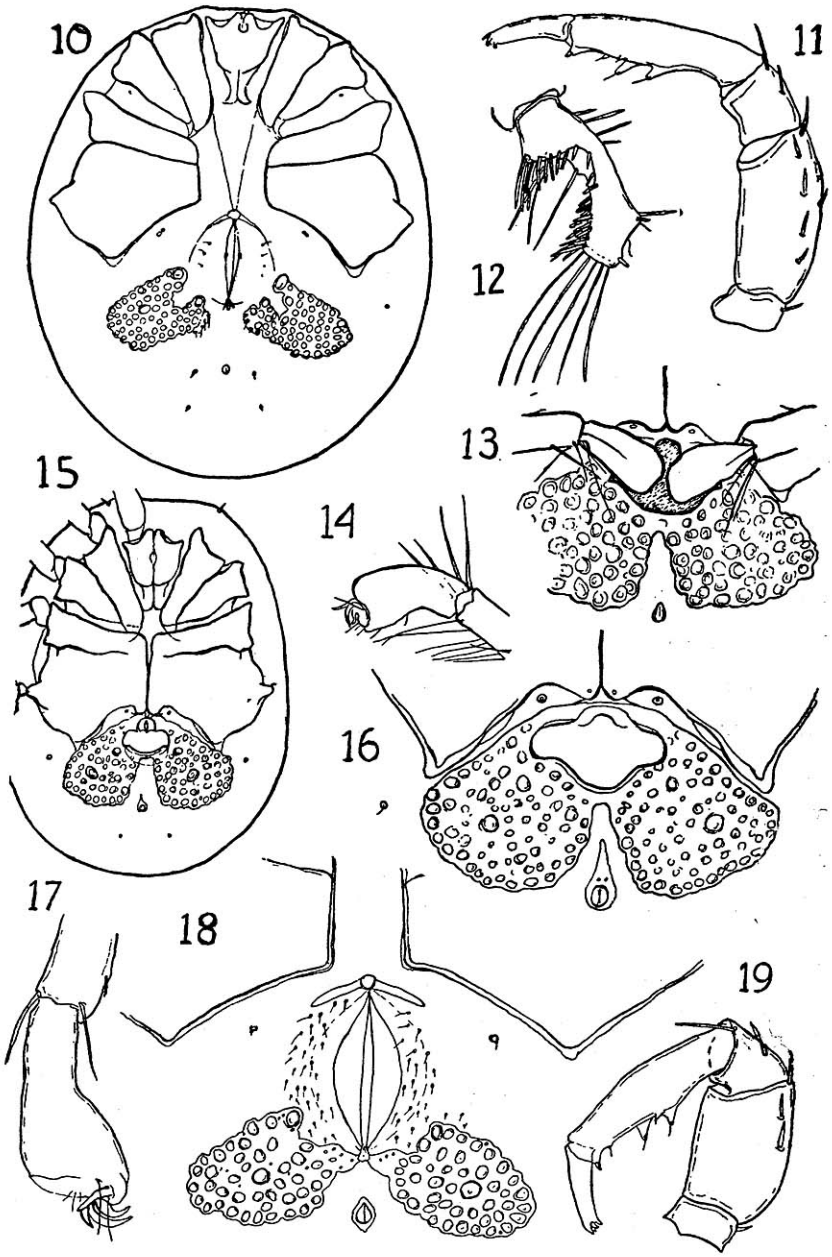
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Plate V

20. *Piona americana*, genital area, female
21. *Piona americana*, segment 4, leg IV, male
22. *Piona americana*, ventral surface, male
23. *Piona americana*, left palpus
24. *Piona americana*, segment 6, leg III, male
25. *Piona debilis*, segment 4, leg IV, male
26. *Piona debilis*, segment 6, leg III, male (from Wolcott)
27. *Piona debilis*, left palpus, female
28. *Piona carnea*, middle segments, leg IV, left, male
29. *Piona carnea*, genital area, female
30. *Piona carnea*, ventral surface, male
31. *Piona carnea*, *segment* 6, leg III, right, male
32. *Piona carnea*, right palpus, female

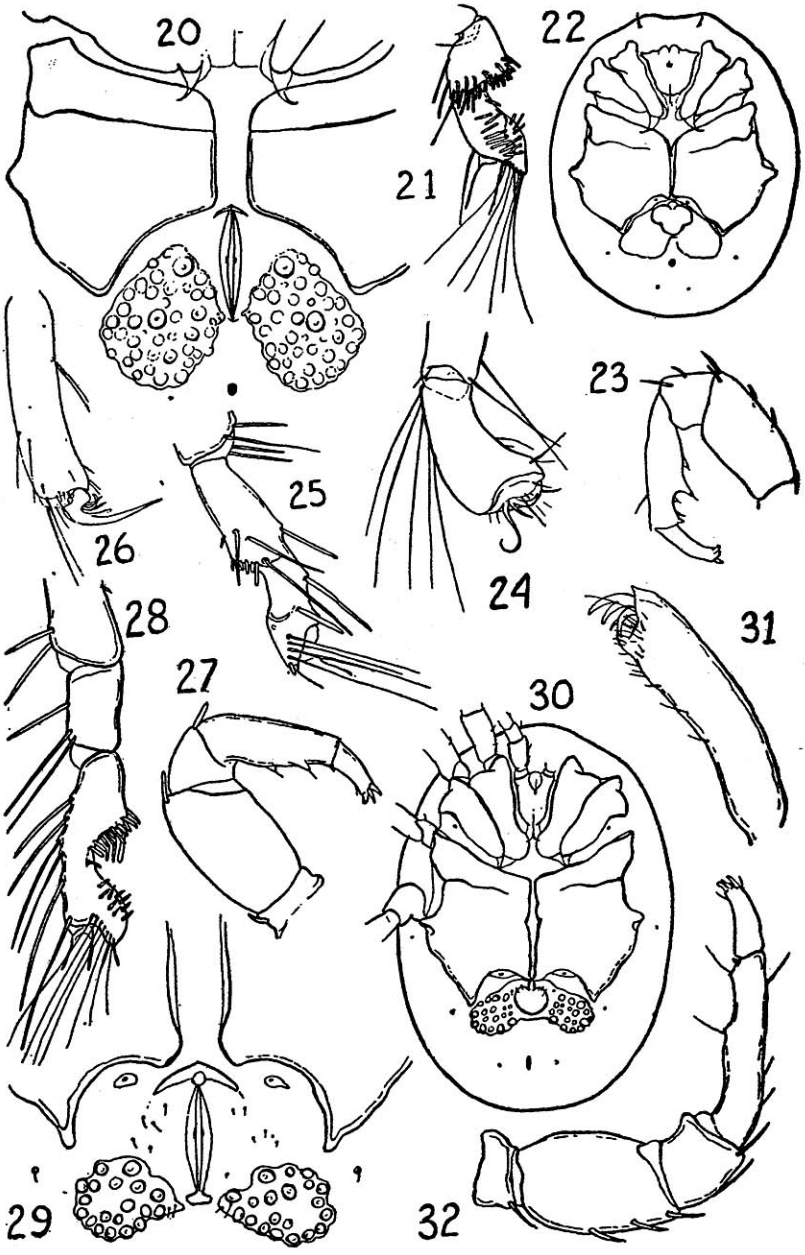
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Plate VI

33. *Piona setiger*, right palpus, outer side, female (from Wolcott)
34. *Piona setiger*, segment 6, leg III, male (from Wolcott)
35. *Piona setiger*, left palpus, outer side, male (from Wolcott)
36. *Piona setiger*, ventral surface, male
37. *Piona setiger*, ventral plates, female
38. *Piona spinulosa*, segments 5, 6, leg III, male
39. *Piona spinulosa*, ventral surface, young male (fromWolcott)
40. *Piona spinulosa*, right palpus, inner side, male (from Wolcott)
41. *Piona spinulosa*, segment 4, leg IV, male (from Wolcott)
42. *Piona spinulosa*, genital area, old female
43. *Piona debilis*, ventral surface, male
44. *Piona debilis*, genital area, female

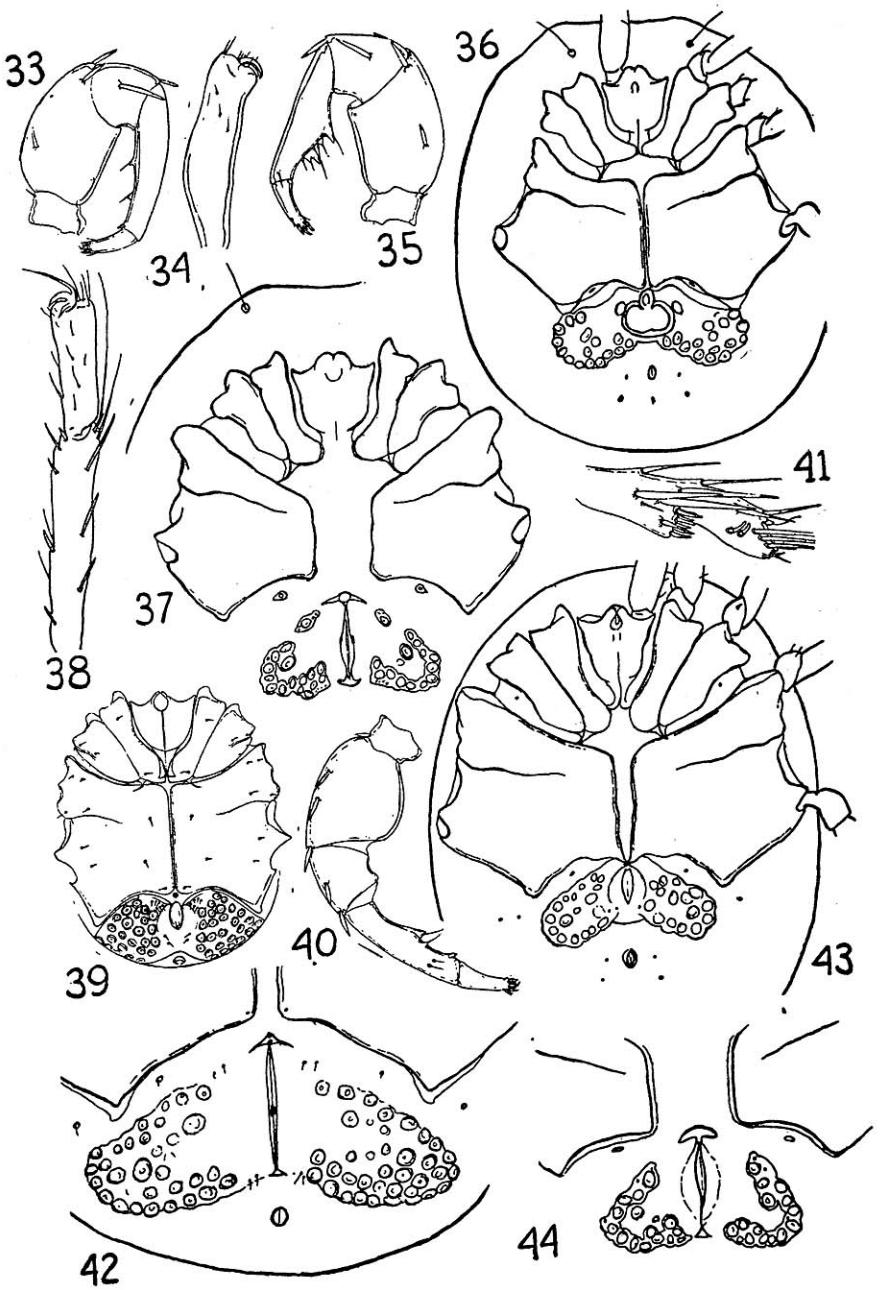
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Plate VII

45. *Piona exilis*, right palpus, outer side, male
46. *Piona exilis*, genital area, female
47. *Piona exilis*, segment 6, leg III, male (from Wolcott)
48. *Piona exilis*, ventral surface, male
49. *Piona wolcotti*, segment 6, leg III, right, male
50. *Piona wolcotti*, ventral surface, male
51. *Piona wolcotti*, right palpus, male
52. *Piona wolcotti*, segment 4, leg IV, right, male
53. *Piona spinulosa*, segments 5 and 6, leg I, right, male

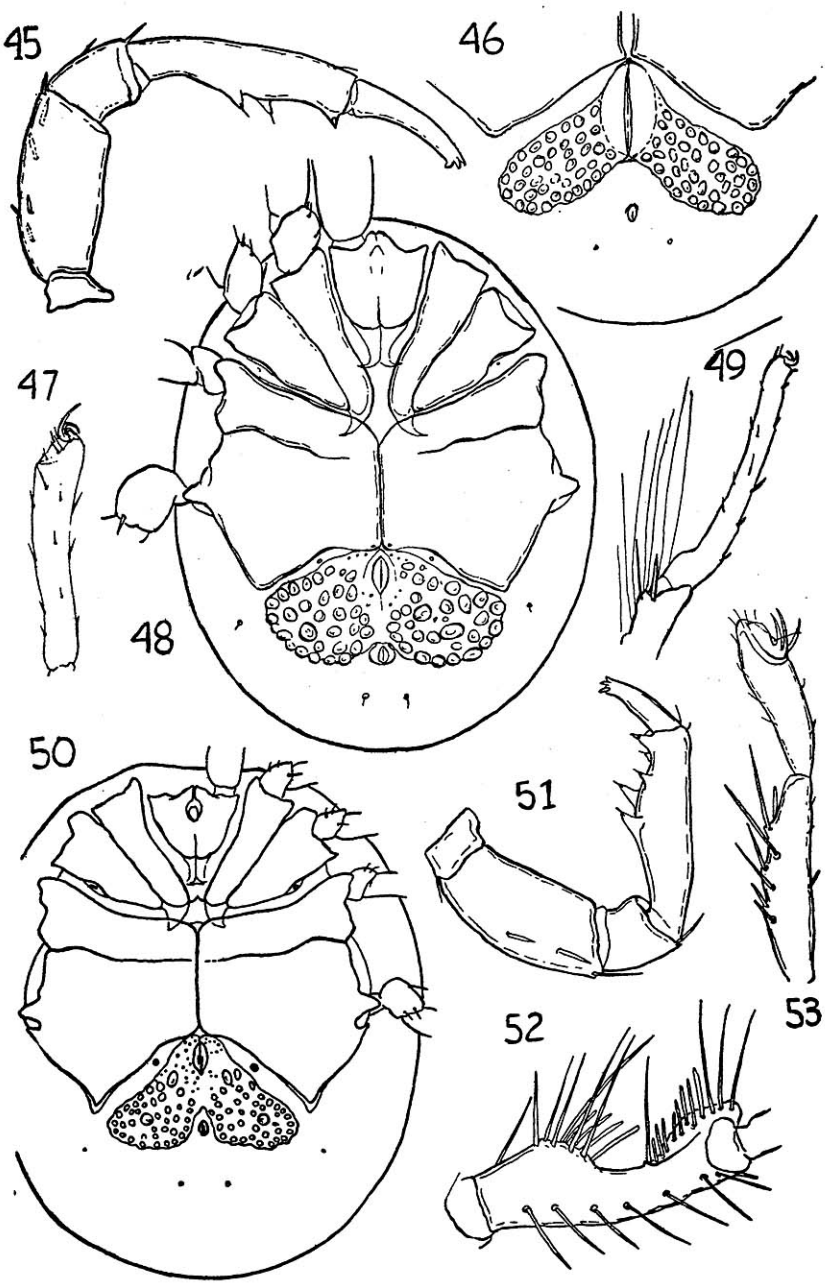
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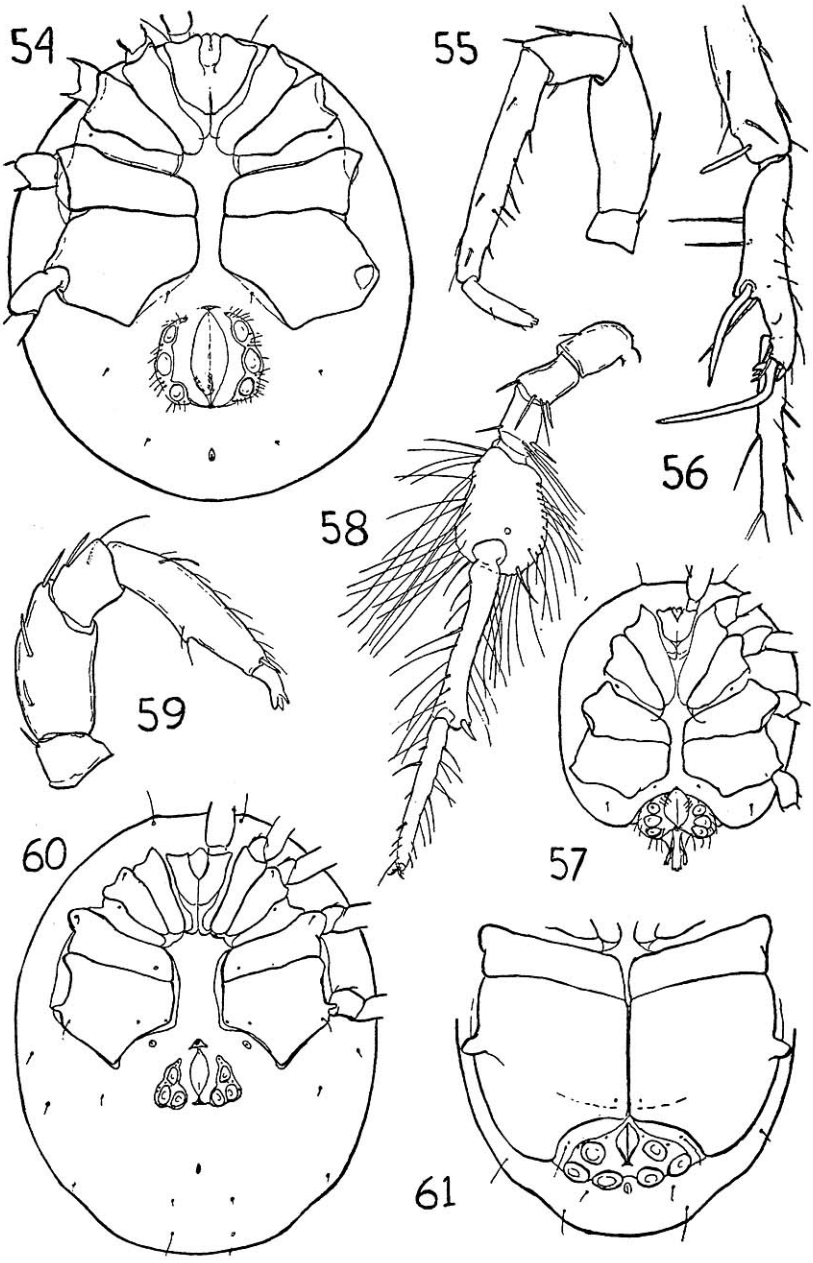
Plate VIII

54. *Hydrochoreutes ungulatus*, ventral surface, female
55. *Hydrochoreutes ungulatus*, left palpus, male
56. *Hydrochoreutes ungulatus*, middle segments, leg III, left, male
57. *Hydrochoreutes ungulatus*, ventral surface, male
58. *Acercus torris americanus*, leg IV, right, male
59. *Acercus torris americanus*, left palpus, inner side, male
60. *Acercus torris americanus*, ventral surface, female
61. *Acercus torris americanus*, posterior ventral surface, male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