

SYSTEMATICS OF *UNIONICOLA LAURENTIANA*, N.SP., AND
U. NEARCTICA, N.SP., SPONGE-ASSOCIATED HYDRACARINA
(PARASITENGONA: UNIONICOLIDAE) FROM NORTH AMERICA¹

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Abstract. The sponge-associated Hydracarina of North America historically have been considered conspecific with the European species *Unionicola crassipes* (Müller 1776). Ratio diagrams based on numerous morphological characteristics distinguish the North American crassipes-like mites from *U. crassipes* and two North American species are described. *Unionicola laurentiana*, n.sp., occurs in the Laurentian Great Lakes and St. Lawrence River basins. *U. nearctica*, n.sp., occurs in that region and its range extends across Canada from Ontario to British Columbia.

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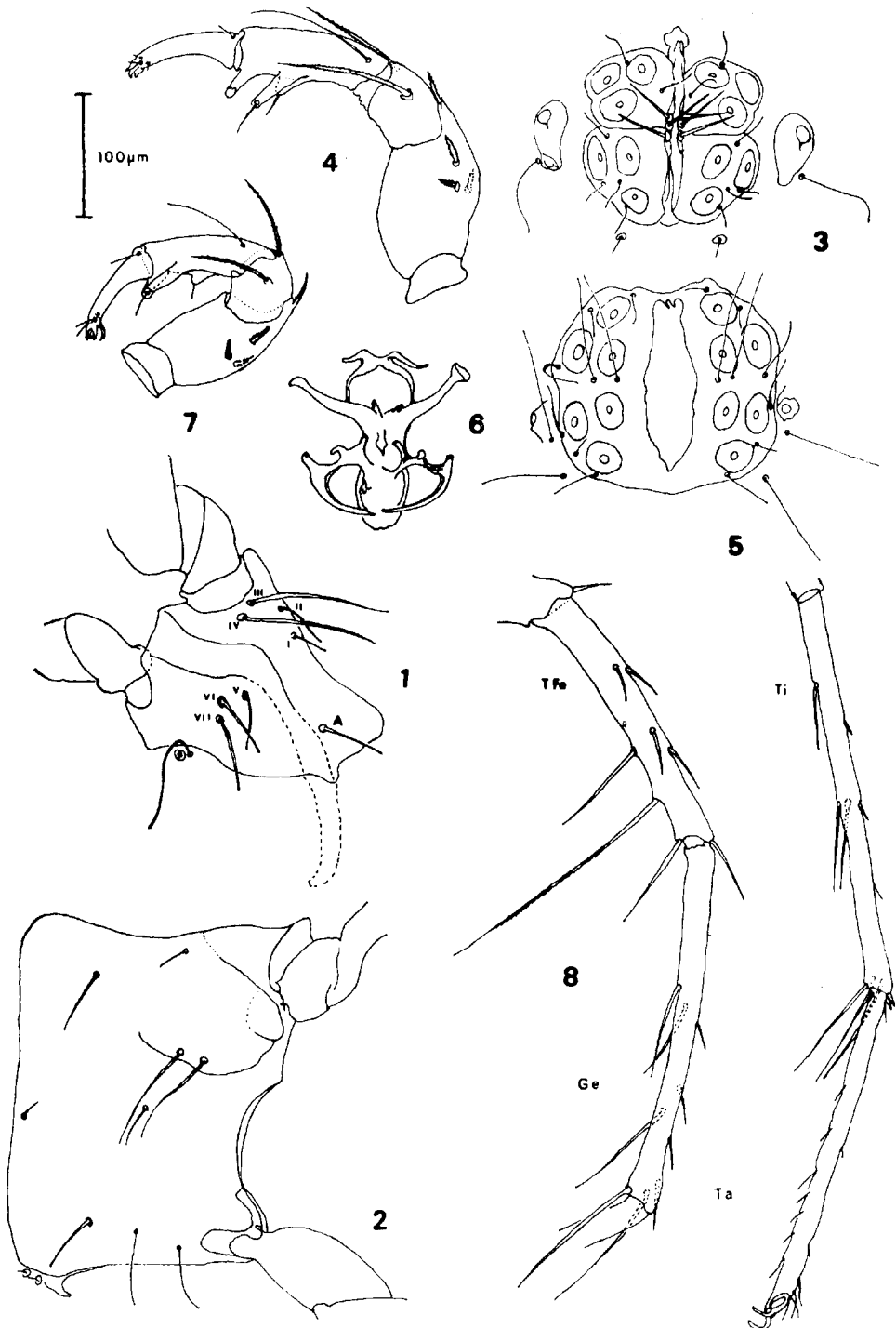
Since the time that Stoll (1887) first described the species which he called *Atax dentipalpis* and subsequently synonymized it after consultation with Koenike with *Unionicola crassipes* (Müller 1776), there has been considerable question about the identity of the crassipes-like mites in North America. The confusion was compounded somewhat by the description of the subspecies *Unionicola crassipes minor* (Soar 1900), (which has been subsequently questioned by several authors) and the assortment of published host records has only added to the confusion. *U. crassipes* (Müller 1776) has long been known to occur in association with freshwater sponges (Arndt and Viets 1938). In records now considered questionable, Wolcott (1899) and Imamura (1953) reported *U. crassipes* from mollusks in USA and Japan, respectively. On the basis of more recent work (Böttger 1972), it now seems clear that the crassipes-like mites have a typical parasitic relationship with midges (Chironomidae). They have an obligatory relationship with sponges (Spongillidae) during their transformation stages and the mites do emerge from and re-enter the sponge during deutonymphal and imaginal stages.

Conroy (1974) in a study of a mite

population occurring in freshwater sponges and in the plankton of Marion Lake, British Columbia, concluded that the species was *Unionicola crassipes crassipes* (Müller) and that "the subspecies *minor* and the other subspecies of *U. crassipes* are of dubious standing and should be discarded". Other authors have not distinguished between the two subspecies in reporting *U. crassipes* from North America. Hevers (1975, 1977, 1978) has thoroughly reviewed the systematic position of *U. crassipes minor* (Soar 1900). By the application of statistical techniques, particularly the use of ratio diagrams, to the indigenous mites of Germany Hevers established the identity of *U. minor* as a species distinct from *U. crassipes*.

Materials used in this report were gathered from several sources. Initially, crassipes-like mites were collected from sponges taken in Joe Indian Lake in St. Lawrence County, N.Y. (RMC—July-Aug. 1962). In size part of those specimens match *U. crassipes crassipes* and part of them match *U. crassipes minor*. They do not match well, however, the palpal proportions and other characteristics as described. To attempt to resolve the dilemma, North American specimens for comparison were obtained from the Chicago Natural History Museum (the Ruth Marshall Collection), from the

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FIGURES 1-8. *Unionicola laurentiana*, n. sp. (scale equals 100 μm) 1. ♀ coxae I+II. 2. ♀ coxae III+IV. 3. ♀ genital plates. 4. ♀ left palp, lateral view. 5. ♂ genital plates. 6. ♂ genital skeleton. 7. ♂ left palp, lateral view. 8. ♂ leg IV, posterior view.

Royal Ontario Museum, Toronto, and from Dr. John Conroy, Winnipeg. Additional specimens were collected from sponges in Missisquoi Bay, Lake Champlain, at Highgate Springs, Vermont (RMC/JME—Aug. 1976). European materials were provided by Dr. K. O. Viets, Wilhelmshaven and Dr. Jürgen Hevers, Lubeck, Germany, and additional material was collected at Kortenhoeft, The Netherlands.

Comparison of the European and North American materials has led to the conclusion that the North American crassipes-like mites are not only different from the European *Unionicola crassipes* but that there are 2 species in the fauna studied.

Unionicola laurentiana, new species

Diagnosis. *Unionicolids* with characteristics of the genus and subgenus *Unionicola*. Palps of females average 382 μm in length; male palps 388 μm . Ratio of breadth of σ^3 genital skeleton to length of genital plate >0.9 ; fused coxae III+IV average 1.25 x longer than wide.

Unionicola laurentiana is represented by specimens from Wisconsin (Eagle River, 27 Aug. 1921; Oneida Co., 30 Aug. 1921, and Waupaca, 10 Aug. 1927; col. Ruth Marshall, New York (Joe Indian Lake, St. Lawrence Co., 5 Jul. and 1 Aug. 1962) and Vermont (Missisquoi Bay, Lake Champlain, 8 Aug. 1976). The name is proposed in reference to its occurrence in the Laurentian Great Lakes and St. Lawrence River basins.

U. laurentiana is a small mite, with sclerotized body parts being about 10% smaller than those of the European *U. minor*. Overall size is highly variable since much of the body is not sclerotized and varies with sex, recency of emergence, and feeding activity. The idiosomal length of females examined averages 528 μm , of males 570 μm .

Female. Coxae are arranged in 4 groups with pronounced separation in the mid-line and between the second and third coxae of each side. The suture between first and second coxae (fig. 1) extends to the medial margin and is produced into an elongate apodeme. The suture between coxae 3 and 4 (fig. 2) is visible only about half the width of the fused plate. The fused third and fourth coxae average 244 μm (range 186–316) in length by 198 μm (range 162–266) in breadth. The external genitalia (fig. 3) consist of 2 pairs of acetabular plates, each plate bearing 3 acetabula. Medially there are 3 pairs of prominent, stout bristles.

Palps of *U. laurentiana* females (fig. 4) average 382 μm (range 308–455) in length; the palpal tarsus (P-5) averages 86 μm (range 61–100). The palpal tibia (P-4) bears on its flexor surface 3 tooth-like pegs, the lateral and longest of which is just equal to the greatest dorso-ventral dimension of the segment. The palpal

genus (P-3) bears 2 long, prominent, feathered setae, one on the medial surface and one terminally on the flexor surface. The palpal femur (P-2) bears 4 short, stout, feathered setae, 2 medially situated, one lateral and one terminal on the flexor surface.

Male. Coxal plates of male *U. laurentiana* are arranged as described for the female. The third and fourth coxal plates of males measure 242 μm (range 236–251) in length by 205 μm (range 186–218) in breadth. External genitalia of males (fig. 5) consist of paired plates, joined medially at their anterior and posterior ends, and bearing 6 pairs of genital acetabula. The genital plates measure 159 μm in length. The initial genital skeleton (fig. 6) measures 148 μm as the greatest span of its proximal arms.

Palps of male *U. laurentiana* (fig. 7) average 388 μm (range 370–401) in length; the palpal tarsus averages 90 μm (range 86–94). As in the female 3 prominent projections are borne on the flexor surface of the palpal tibia. These show much the same proportions as in the female, but the more medial, proximal peg is somewhat less prominent. The longer, lateral peg is not longer than the dorso-ventral thickness of the segment. Setae are arranged as in the female.

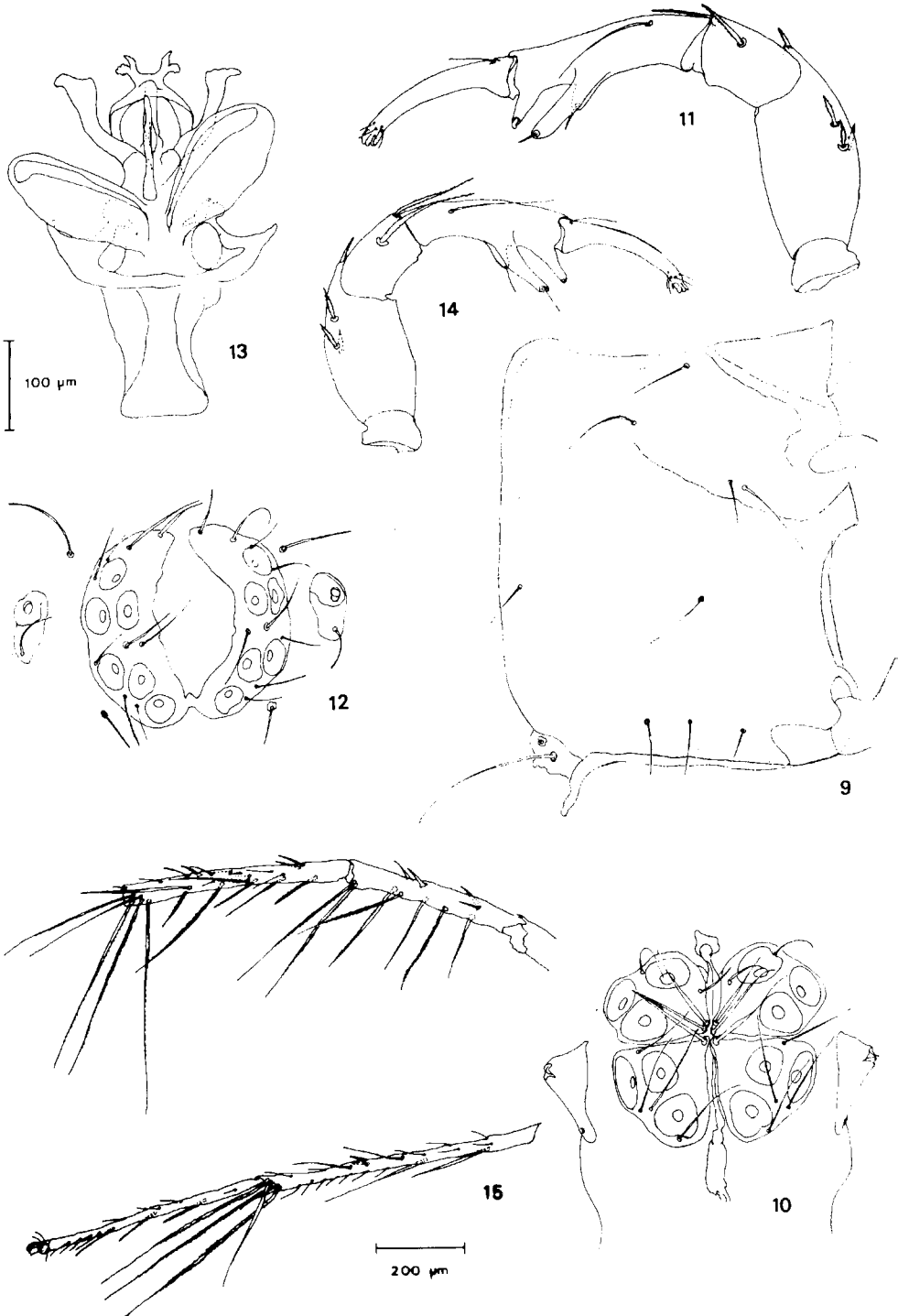
Comparisons. This species can be distinguished from other species of *Unionicola* associated with sponges by size, palpal characteristics, tarsal and tibial proportions of the fourth leg, and proportions of the male genital apparatus. Its small size and short palps (particularly its palpal tarsus length not more than 100 μm) distinguish it from all spongedwelling species of *Unionicola* except *U. minor*. Proportions of the coxal plate III+IV distinguish these species. In *U. laurentiana* its length is 1.25 x its width; in *U. minor* its length is 1.33 x its width. Other distinctions will be pointed out in the discussion following the subsequent species description.

Type material. Holotype and paratypes of this species will be deposited in the field Museum of Natural History, Chicago. Paratypes will also be deposited in the Royal Ontario Museum, Toronto.

Unionicola nearctica, new species

Diagnosis. *Unionicolid* mites with characteristics of the genus and subgenus *Unionicola*. Female palps average 760 μm in length; male palps 652 μm . Ratio of breadth of σ^3 genital skeleton to length of genital plate = 0.8; fused coxae III+IV average 1.20 x longer than wide.

Specimens of *Unionicola nearctica* have been examined from the following localities: Wisconsin (Lake Winnebago, 1920, col. F. C. Baker; Oneida Co., 30 Aug. 1921, and Waupaca, 10 Aug. 1927, col. Ruth Marshall), New York (Joe Indian Lake, St. Lawrence Co., 1 Aug. 1962),



FIGURES 9-15. *Unionicola nearctica*, n. sp. (scale equals 100 μ m) 9. ♀ coxae III+IV. 10. ♀ genital plates. 11. ♀ left palp, lateral view. 12. ♂ genital plates. 13. ♂ genital skeleton. 14. ♂ right palp, lateral view. 15. (scale equals 200 μ m) leg IV, posterior view.

Ontario (Sioux Narrows, 17 Aug. 1964, col. D. Barr; Geraldton, 14 Jun. 1966, and Baysville, 19 Jul. 1966, col. I. Smith) and British Columbia (Marion Lake, 25 and 29 Jul. 1969, col. J. Conroy; Windermere Lake, 2 Aug. 1969, col. R.O.M. Fld. Pty.). The name refers to its widespread Nearctic distribution.

U. nearctica is a large mite with long appendages also found in association with sponges. It is a prominent species in the plankton of lakes at certain times (Conroy 1974). As in other sparsely sclerotized mites there is considerable variation in size. Females in the series examined have a mean idiosomal length of 1006 μm ; males 816 μm .

Female. Coxae of this species are arranged much as in other species of the subgenus. The suture joining the third and fourth coxae (fig. 9) is apparent approximately two-thirds the width of the coxal plate. The fused coxae III+IV average 451 μm (range 324–528) in length by 374 μm (range 252–432) in width. The female genital field (fig. 10) shows two pairs of acetabular plates, distinctly separated, and each bearing 3 acetabula. Three pairs of very stout bristles are medially situated.

Palps of females of *U. nearctica* (fig. 11) average 760 μm (range 612–893) in length, with the palpal tarsus averaging 182 μm (range 145–233). The prominent lateral peg on the palpal tibia is distinctly longer than the dorso-ventral dimension of the tibia; usually, but not invariably, it is nearly twice as long. Setal distribution is as described for the previous species, but individual setae are generally smaller in proportion to the size of the palp.

Male. Coxae of the male are arranged as in the female. The fusion of coxae III+IV forms a plate which averages 375 μm (range 228–468) in length by 308 μm (range 204–360) in length. Male external genitalia (fig. 12) of *U. nearctica* average 235 μm (range 192–288) in length, consisting of paired, arched plates bearing 6 pairs of acetabula. The breadth of the internal genital skeleton (fig. 13) is 187 μm (range 132–228).

Palps of the male *U. nearctica* (fig. 14) average 652 μm (range 589–756), a size equalling 0.8 of the average idiosomal length; palpal tarsus averages 158 μm (range 142–192). Pegs on the flexor surface of the palpal tibia exhibit the same proportions to the tibial size as in females. Setal distribution and size are comparable to that of females.

Comparisons. *U. nearctica* differs from other sponge-associated unionicolids in size, palpal characteristics, proportions of certain leg segments and proportions of the male genital apparatus. The proportions of the palpal tibia, being not more than 4 times longer than its dorso-ventral dimension, distinguishes it from species other than *U. crassipes*. Proportions of fused coxal plate III+IV distinguish *U. nearctica* (length 1.20 x width) from *U. crassipes* (length 1.32 x width).

Other comparisons are presented in the subsequent discussion.

Type material. Holotype, allotype and paratypes will be deposited in the Royal Ontario Museum, Toronto. Paratypes will also be deposited in the Field Museum of Natural History, Chicago.

DISCUSSION

The diagnostic key presented by Hevers (1975) will separate the North American material examined into two groups, one of which is similar to but not identical with *Unionicola minor* and the other similar to *U. crassipes* in its characteristics. Having made that separation, each was then compared with its European "near-relative".

Ratio diagrams were prepared based on linear measurements of 20 characteristics of female mites and 22 characteristics of male mites. The measurements include palpal tibia and tarsus (P-4 and P-5 respectively); segments 3, 4, 5, and 6 (telofemur, genu, tibia and tarsus) of the legs (figs. 8 and 15); the length and breadth of coxal plates III+IV; and in males the length of the genital acetabular plate and the breadth of the genital skeleton measured at the greatest span of its proximal arms (cf. Barr 1972, fig. 2a). Appendage segment measurements represent the length of the extensor surface of the podomere. Coxal plate length represents the length of the fused, sclerotized coxae III+IV measured from the level of the anterior medial corner to the level of the posterior margin, not including the apodeme visible on the posterior margin. Coxal plate breadth was measured from the medial margin of the sclerite to its lateral extremity which is at the position of the articulation of the fourth leg. Comparisons are based on 12 females and 3 males of *U. laurentiana* and 15 females and 13 males of *U. nearctica*.

Figure 16 presents a ratio diagram comparison of these species with the European species, *U. minor* (Soar), using the data presented by Hevers (1975) for males of that species as a base line. Points in the diagram represent the percentage of difference in measurements from comparable characteristics of *U. minor*. Broken lines in the figure are based on ratio dia-

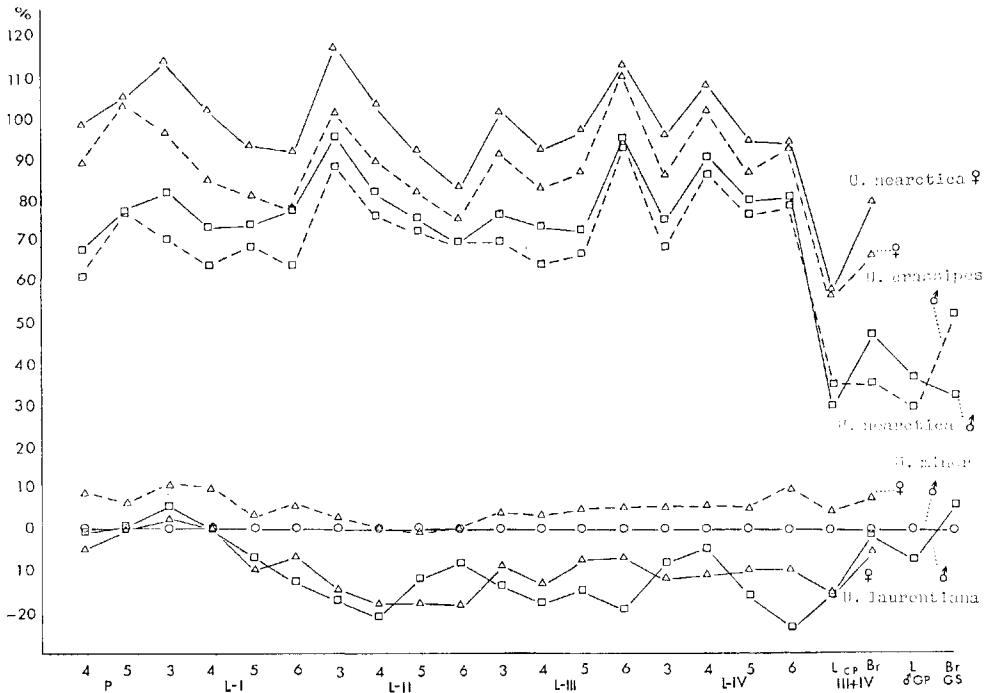


FIGURE 16. Ratio diagram comparing *Unionicola laurentiana*, n. sp. (below) and *U. nearctica* n. sp. (above) with *U. minor* and *U. crassipes*. \circ = *U. minor* $\sigma\sigma$; \triangle = ♀♀ ; \square = $\sigma\sigma$; broken lines = *U. crassipes* (above) and *U. minor* ♀♀ (below).

grams presented by Hevers (1975) for *U. minor* ♀♀ and *U. crassipes*, and are included for comparison.

The fact that most points in the profiles of *U. laurentiana* are below the baseline (fig. 16) means only that the North American species is, in general, smaller than *U. minor*. Differences in females of the two species are noted in the lesser length of the palpal tibia (P-4) (mean 109 μm ; range 84-133) and tarsus (P-5) (mean 86 μm ; range 61-100) of *U. laurentiana* (compared to: mean 123 μm ; range 101-156 and mean 95 μm ; range 79-115 in *U. minor*) in proportion to those of *U. minor* males, the deviation being emphasized by the different orientation of the line joining those points. *U. laurentiana* females also differ in the lesser length of the fourth tarsus (L-IV-6) (mean 312 μm ; range 248-384) in proportion to the fourth tibia (L-IV-5) (mean 360 μm ; range 286-444) than in females of *U. minor* (mean 375 μm ; range 291-474 and mean 415 μm ; range 333-

517). The difference between these species is further confirmed by the deviation from the baseline between males of *U. laurentiana* and *U. minor* (fig. 16). In the same way lines not parallel to each other indicate differences between females and males of the same species, and the ways in which they differ indicate species distinctions.

In the upper portion of figure 16, comparison is made between the same baseline and ♀ and σ of *U. nearctica*. The profile for females shows that they differ from *U. crassipes* in the greater length of the first telofemur (L-I-3) (mean 461 μm ; range 336-546) in proportion to the palpal tarsus (P-5) (mean 182 μm ; range 145-233) (cf. mean 425 μm ; range 309-750 and mean 181 μm ; range 141-245 in *U. crassipes*) and in the greater length of the fourth tibia (L-IV-5) (mean 776 μm ; range 588-924) in proportion to the fourth tarsus (L-IV-6) (mean 674 μm ; range 420-768) (cf. mean 745 μm ; range 545-980 and mean 665 μm ; range 493-

TABLE 1
*Distances (in μm) between coxal setae in *Unionicola minor*, *U. laurentiana* and *U. nearctica*.*

| | A-I | A-II | A-III | A-IV | A-V | A-VI | A-VII | I-II | II-III | III-IV |
|-----------------------|------|------|-------|------|------|------|-------|------|--------|--------|
| <i>U. minor</i> | | | | | | | | | | |
| Mean | 79 | 109 | 123 | 121 | 73 | 89 | 93 | 30 | 29 | 16 |
| Min. | 69 | 91 | 103 | 103 | 65 | 71 | 81 | 24 | 24 | 12 |
| Max. | 86 | 121 | 139 | 137 | 83 | 103 | 102 | 37 | 38 | 27 |
| s(n=6) | 7.3 | 11.4 | 14.0 | 13.4 | 6.3 | 11.7 | 7.0 | 5.0 | 5.0 | 5.9 |
| <i>U. laurentiana</i> | | | | | | | | | | |
| Mean | 81 | 102 | 113 | 107 | 68 | 82 | 81 | 24 | 25 | 15 |
| Min. | 75 | 97 | 103 | 92 | 58 | 68 | 69 | 21 | 21 | 12 |
| Max. | 90 | 114 | 131 | 124 | 80 | 100 | 96 | 27 | 31 | 18 |
| S(n=8) | 4.5 | 5.8 | 9.3 | 9.3 | 7.3 | 10.5 | 9.9 | 2.9 | 3.5 | 1.6 |
| <i>U. nearctica</i> | | | | | | | | | | |
| Mean | 131 | 167 | 184 | 185 | 111 | 136 | 151 | 39 | 45 | 17 |
| Min. | 109 | 139 | 148 | 148 | 89 | 97 | 111 | 27 | 31 | 12 |
| Max. | 153 | 198 | 215 | 212 | 127 | 162 | 177 | 59 | 56 | 21 |
| S(n=12) | 13.9 | 19.2 | 21.1 | 21.0 | 11.7 | 19.9 | 20.0 | 11.0 | 7.8 | 2.7 |

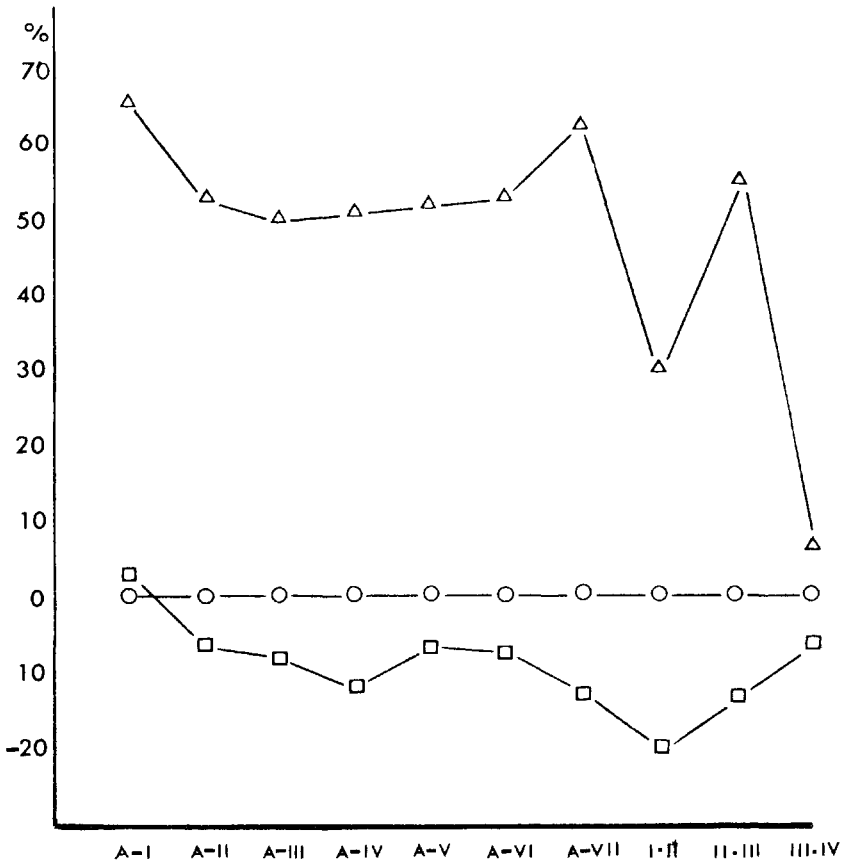


FIGURE 17. Ratio diagram comparing distances between setae on coxae I and II in *Unionicola minor* (○), *U. laurentiana*, n. sp. (□) and *U. nearctica*, n. sp. (△).

875 in *U. crassipes*) when compared to *U. minor* males represented by the baseline. Males of *U. nearctica* differ from *U. crassipes* (when compared to the baseline) in the greater length of: first telofemur (L-I-3) (mean 392 μm ; range 264-516) in proportion to palpal tarsus (P-5) (mean 158 μm ; range 142-192) (cf. mean 367 μm ; range 260-436 and mean 157 μm ; range 120-193 in *U. crassipes*); first tarsus (L-I-6) (mean 425 μm ; range 324-504 in proportion to the first tibia (L-I-5) (mean 403 μm ; range 288-516) (cf. mean 363 μm ; range 276-430 and mean 392 μm ; range 288-460 in *U. crassipes*); third telofemur (L-III-3) (mean 361 μm ; range 240-456) in proportion to the second tarsus (L-II-6) (mean 575 μm ; range 348-708) (cf. mean 345 μm ; range 257-411 and mean 570 μm ; range 425-673 in *U. crassipes*). Males of *U. nearctica* differ also in the greater breadth of CP III+IV (mean 198 μm ; range 162-266) in proportion to its length (mean 244 μm ; range 186-316) (cf. mean 283 μm ; range 207-335 and mean 386 μm ; range 253-455) and the lesser breadth of the genital skeleton (mean 187 μm ; range 132-228) in proportion to the male genital plate length (mean 235 μm ; range 192-288) (cf. mean 213 μm ; range 160-271 and mean 220 μm ; range 180-269 in *U. crassipes*).

In the uniconicolas there are 8 setae on coxae I and II arranged in a pattern as shown in figure 1. The seta near the medial end of coxa I can be recognized in many of the Hydracarina. For purposes of this comparison that seta has been designated seta "A" (fig. 1) and the others numbered I-VII, beginning with the more medial seta along the anterior margin of coxa I and proceeding laterally, then posteriorly in series (data summarized in table 1).

Figure 17 is a ratio diagram comparing the distances between coxae I and II setae. The baseline represents measurements of *U. minor* from Germany and the Netherlands. The other profiles represent the two North American species. Inspection of the profiles indicates that they are indeed different from *U. minor* and different from each other.

The distinctiveness of the North American *U. crassipes*-like mites makes it nec-

essary to re-evaluate the records of those mites. The mites reported by Conroy (1974) were undoubtedly *U. nearctica*. The records of Wolcott (1899) and materials in the Ruth Marshall Collection appear to be a mixture of *U. laurentiana* and *U. nearctica*. It is impossible to tell from Stoll's (1887) description, how his material collected in Guatemala compares with these crassipes-like mites. Viets (1975) suggests that Stoll's species may have been *U. gracilipalpis tenuis*.

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