The Great Lakes Entomologist

Volume 7
Issue 3 -- Fall 1974 *Issue 3 -- Fall 1974*

Article 1

September 1974

North American Species of the Genus Axonopsis (Acarina: Aturidae: Axonopsinae)

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NORTH AMERICAN SPECIES OF THE GENUS AXONOPSIS (ACARINA: ATURIDAE: AXONOPSINAE)[1]

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Members of the genus *Axonopsis* have a broad zoogeographic distribution but are unreported from the Australian region and South America south of Colombia. Species occur in permanent standing waters and streams (including interstitial water). Representatives of four subgenera, *Axonopsis* s. s., *Brachypodopsis, Paraxonopsis* and *Vicinaxonopsis,* have been collected in North America, and a species of the closely related genus *Erebaxonopsis* is also known from interstitial waters in California. The only anomalous aspects of the distributional patterns are the apparent absence of *Hexaxonopsis* (which has a relatively widespread Palearctic range) and the stream (and interstitial) habitat of the North American species of the typical subgenus. The European species occurs only in lakes.

There have been four species (plus an additional two subspecies) previously described by Herbert Habeeb from North America: *Axonopsis setonensis* (Habeeb, 1953); *rivophila, cullasaja* and *pallida* (Habeeb, 1957); *pallida cayuga* (Habeeb, 1961); *cullasaja boreosaja* (Habeeb, 1968). The type material on which these species were based has been privately retained and I have been unable to obtain the loan of specimens. Although both descriptions and illustrations are inadequate, either the collection of topotypic material or an unusual habitat type has made it possible to identify the four full species with a reasonable degree of certainty. I cannot recognize the two subspecies and only short discussions of them are included under the species to which they were assigned.

The concept of the genus *Axonopsis* and its included subgenera has been considerably modified during the last few years and the reader is referred to Cook (1974) for a more detailed discussion. In presenting measurements, those of the holotype and allotype are given first. If a series of specimens is available, the range of variation is given in parentheses following the measurements of the primary types. Holotypes and allotypes will be placed in the Field Museum of Natural History (Chicago).

Especially in the case of *Brachypodopsis,* there are many somewhat closely related species which are often distinguished by a combination of characters. For greater ease in identifying these species the following key is included. For the sake of completeness species in the other subgenera are also placed in the key.

KEY TO THE NORTH AMERICAN SPECIES OF THE GENUS *AXONOPSIS*

1. Anchoral process of the capitulum very long (Fig. 82); P-V approximately same length as P-IV (Fig. 62) . . . . . Subgenus *Vicinaxonopsis* Cook [only known North American species . . . . . *A. californica* Cook]

1′. Anchoral process of the capitulum much shorter than remainder of capitulum; P-V much shorter than P-IV (Figs. 4, 85) 2

2(1′). Two pairs of glandularia platelets located posteriorly between the dorsal and ventral shields (Fig. 78); no glandularia located on ventral shield between anterior edge of genital field and insertions of fourth legs (Fig. 80); ventral side of P-IV without tubercles or thickened setae (Fig. 85). . . . . Subgenus *Axonopsis* Piersig 3

2′. No glandularia platelets located between the dorsal and ventral shields (Fig. 75); one or two pairs of glandularia located on ventral shield between anterior edge of genital field and insertions of the fourth legs (Figs. 68, 77); ventral side of P-IV with a variously developed setal tubercle and at least one of the associated setae thickened (Fig. 4) 4

3(2). Two pairs of glandularia (not counting a pair flanking the excretory pore) located in posterior half of the dorsal shield (Fig. 84) . . . *A. bimaculata* (Cook)

[1]Contribution No. 317 from the Department of Biology, Wayne State University. Supported by a grant (GB-12375) from the National Science Foundation.

3′. One pair of glandularia (not counting a pair flanking the excretory pore) located in posterior half of the dorsal shield (Fig. 78) . . . . . *A. sabulonis,* new species

4(2′). Dorsal shield broadly fused anteriorly with the ventral shield (Fig. 75); one pair of glandularia located on the ventral shield between the anterior end of the genital field and insertions of fourth legs (Fig. 77); male genital field located on a short cauda (Fig. 72) . . . . . Subgenus *Paraxonopsis* Motas and Tanasachi [only known North American species . . . . . *A. pumila,* new species]

4′. Dorsal shield only lightly fused with the ventral shield; two pairs of glandularia located on the ventral shield between the genital field and the insertions of the fourth legs (Fig. 68); no cauda development in either sex . . . . . Subgenus *Brachypodopsis* Piersig 5

5(4′). Three pairs of genital acetabula 6

5′. Four pairs of genital acetabula 9

6(5). Dorsal shield bearing a well developed median ridge (Fig. 1); suture lines between first and second coxae continuing to midline to form a distinct U-shaped structure (Fig. 3, arrow A) . . . . . *A. pallida* Habeeb

6′. Dorsal shield with either a very low median ridge or none (Fig. 10); suture lines between first and second coxae extending towards the midline but not as distinct as in the above species (Figs. 13, 18) 7

7(6′). Ventral side of P-II with a very pronounced bulge (Fig. 4); distal segments of first leg very stocky (Fig. 9) . . . . . *A. dapsila,* new species

7′. Ventral side of P-II with only a slight bulge (Figs. 14, 15); distal segments of first leg much less stocky than in above (Figs. 12, 19) 8

8(7′). Dorsal shield with a low median ridge (Fig. 20); posterolateral edges of dorsal shield comparatively rounded; (occuring in streams in California and Oregon) . . . . . *A. occidentalis,* new species

8′. Dorsal shield without a median ridge (Fig. 11); posterolateral edges of dorsal shield comparatively narrowed; (occuring in a lake in Florida) . . . . . *A. lacustris,* new species

9(5′). Dorsal shield bearing four pairs of glandularia posterior to the postocularia (Figs. 21, 31) 10

9′. Dorsal shield bearing three pairs of glandularia posterior to the postocularia (Figs. 34, 38) 11

10(9). Ventral shield more or less rounded posteriorly (Fig. 23); second pair of acetabula located decidedly posterior and lateral to the first pair in the female (Fig. 23); confined to Eastern North America . . . . . *A. rivophila* Habeeb

10′. Ventral shield more or less narrowed posteriorly (Fig. 29); second pair of acetabula located almost directly lateral to the first pair in female (Fig. 29); (confined to Western North America) . . . . . *A. amnicola,* new species

11(9′). Distoventral portion of P-II with a distinct projection which is well delineated from the remainder of the segment (Figs. 35, 55) 12

11′. Distoventral portion of P-II lacking the distinct projection described and illustrated above (Figs. 44, 45) 13

12(11). Anterior and posterior color patches of dorsal shield widely separated (Fig. 38); (inhabiting lakes and ponds) . . . . . *A. setonensis* Habeeb

12′. Anterior and posterior color patches of dorsal shield joined by a median bridge of lighter pigment (Fig. 52); (inhabiting streams) . . . *A. ozarkensis,* new species

13(11′). First three pairs of genital acetabula forming a concave arc (or more rarely a straight line) on their respective sides (Figs. 46, 49, 54) 14

13′. First three pairs of genital acetabula forming a convex arc on their respective sides (Figs. 41, 58, 64) 15

14(13). Posterior portion of dorsal shield with a pronounced median ridge (Fig. 34) . . . . . *A. beltista,* new species

14′. Dorsal shield lacking a median ridge (Fig. 47) . . . . . *A. ohioensis* Cook

15(13′). Dorsal shield completely lacking ridges (Fig. 56) . . . . . *A. arpeda,* new species

15′. Dorsal shield with well developed lateral ridges (Figs. 61, 65) 16

16(15′). Lateral ridges of the dorsal shield coalescing posteriorly and continuing to posterior end as a short median ridge (Fig. 70) . . . . . *A. gennada,* new species

16′. Lateral ridges not coalescing posteriorly (Figs. 43, 61, 65) 17

17(16′). Glandularia of the dorsal shield widely separated from each other; posterior glandularia located well posterior to the posterior muscle scars (Fig. 43, arrow A) . . . . . *A. eremita,* new species

17′. Glandularia of the dorsal shield not so widely separated from each other; posterior glandularia located more or less lateral to the posterior muscle scars (Fig. 65, arrow A) 18

18(17′). Posterior color patch of the dorsal shield extending farthest forward in median region (Fig. 65) . . . . . *A. cullasaja* Habeeb

18′. Posterior color patch of the dorsal shield extending farthest forward near lateral edges (Fig. 61) . . . . . *A. floridensis,* new species

Subgenus **AXONOPSIS** Piersig

AXONOPSIS (AXONOPSIS) BIMACULATA (Cook)
(Figs. 79, 84)

Pseudaxonopsis bimaculata Cook, 1963. Amer. Midland Nat., 70:122.

Male: Dorsal and ventral shields broadly fused anteriorly; lateral eyes well developed; length of body 384μ, width 312μ; width of dorsal shield 273μ; dorsal shield bearing four pairs of glandularia, one pair of which flank the excretory pore at extreme posterior end (Fig. 84); two pairs of elongated glandularia platelets and a pair of small gland platelets lying in the integument between the posterior portions of the dorsal and ventral shields; dorsal shield without ridges; color pattern of dorsum indicated in Figure 84, pigment heavy; capitular bay deep; no glandularia located on the ventral shield between the anterior end of the genital field and the insertions of the fourth legs; structure of the venter, except for genital field, similar to that shown in Figure 80; structure of genital field similar to that of the following species (Fig. 83); width between outer edges of most lateral pair of acetabula 126μ; four pairs of acetabula; suture line between genital field and remainder of ventral shield moderately distinct.

Dorsal lengths of the palpal segments: P-I, 27μ; P-II, 48μ; P-III, 31μ; P-IV, 100μ; P-V, 29μ; Figure 79 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ; I-Leg-5, 62μ; I-Leg-6, 69μ; proximal end of I-Leg-5 lacks the pronounced ventral projection shown in Figure 81; swimming hairs present on all but the first pair of legs.

Female: Described in detail in the paper cited above. The female venter is similar to that illustrated in Figure 80 but the posterior two pairs of acetabula are not as large.

Habitat and Distribution: The female holotype was collected in a gravel bar in the King's River, Carrol County, Arkansas. The male specimen described above was collected on rocks in a stream near junctions of routes 73 and S278, Jackson County, Florida, November 9, 1970.

Discussion: In spite of habitat differences the male specimen seems to agree well with the expected morphology. However, until a longer series of specimens is available to provide a known range of variation, the identification should be regarded as tentative.

AXONOPSIS (AXONOPSIS) SABULONIS, new species
(Figs. 78, 80, 81, 83, 85)

Female: Dorsal and ventral shields broadly fused anteriorly; lateral eyes moderately well developed; length of body 433μ (425μ-464μ), width 327μ (319μ-349μ); width of dorsal shield 293μ (293μ-319μ); dorsal shield bearing three pairs of glandularia, one pair of which flank the excretory pore at extreme posterior end (Fig. 78); two pairs of elongated glandularia platelets and a pair of small gland platelets lying in the integument between the posterior portions of the dorsal and ventral shields; dorsal shield without

ridges; color pattern of dorsum consisting of light anterior and posterior pigment patches as shown in Figure 78, but some populations contain individuals in which the pigment has almost completely disappeared; capitular bay deep; no glandularia located on the ventral shield between the anterior end of the genital field and the insertions of the fourth legs; Figure 80 shows the morphology of the ventral shield; width between outer edges of most lateral pair of acetabula 155μ (155μ-169μ); four pairs of genital acetabula; suture line between genital field and remainder of ventral shield very distinct.

Dorsal lengths of the palpal segments: P-I, 38μ (36μ-38μ); P-II, 52μ (48μ-54μ); P-III, 38μ (38μ-39μ); P-IV, 110μ (110μ-116μ); P-V, 31μ (31μ-33μ); Figure 85 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ (55μ-58μ); I-Leg-5, 59μ (59μ-62μ); I-Leg-6, 71μ (69μ-72μ); proximal end of I-Leg 5 with a pronounced ventral projection; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Fig. 83) and only measurements are given; length of body 418μ (418μ-456μ), width 319μ (311μ-349μ); width of dorsal shield 293μ (282μ-319μ); width between outer margins of most lateral pair of acetabula 138μ (138μ-145μ); dorsal lengths of the palpal segments: P-I, 37μ (37μ-39μ); P-II, 47μ (47μ-52μ); P-III, 34μ (34μ-38μ); P-IV, 100μ (100μ-116μ); P-V, 28μ (28μ-31μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 50μ (48μ-52μ); I-Leg-5, 64μ (63μ-66μ); I-Leg-6, 73μ (73μ-83μ); Figure 81 shows I-Leg-5 and 6.

Holotype: Adult female, taken in gravel deposits of a stream east of Griffen (two miles from the Warren County line), Hamilton County, New York, August 30, 1968.

Allotype: Adult male, same data as holotype.

Paratypes: 1 male, found in a gravel bar in a small stream near Limestone, Victoria County, New Brunswick, August 26, 1964; 1 male, 1 female, from a gravel bar in the North Branch of the Meduxnekeag River at Monticello, Aroostook County, Maine, August 28, 1964; 1 female, from bottom gravels in Wytopitlock Stream, Aroostook County, Maine, September 5, 1968; 1 male, taken in gravel deposits of a stream at Perry City, Schuyler County, New York, August 29, 1968; 2 females, found in gravel deposits in Flatbrook two miles south of Bevans, Sussex County, New Jersey, August 16, 1964; 1 female, from gravel deposits in the Cowpasture River five miles northwest of Millboro Springs, Bath County, Virginia, July 24, 1964; 1 male, from bottom gravels in Thompson Creek near McClung, Bath County, Virginia, September 9, 1968; 1 male, collected in a sand and gravel bar in Goose Creek, Russell County, Kentucky, July 14, 1964.

Discussion: This is an interstitial water species which seems to be confined to northeastern North America. Its known range extends from New Brunswick to Virginia and westward into southwestern Kentucky. The present species differs from *bimaculata* in being larger, possessing one less pair of glandularia on the dorsal shield and a proportionally longer P-I (compare Figures 79 and 85). Different populations exhibit varying degrees of integumental pigmentation loss. Some have lightly pigmented anterior and posterior patches as shown in Figure 78 but in others the color is almost absent.

Subgenus **BRACHYPODOPSIS** Piersig

Most North American species of *Axonopsis* belong to this subgenus. Unfortunately, many of the species are rather similar and there is no pronounced sexual dimorphism to aid in separation. Species with both three and four pairs of acetabula are assigned to this subgenus. Those with four pairs of acetabula seem to be a polyphyletic group, having evolved from several unrelated triacetabulate ancestors, and therefore acetabula number cannot be used to further subdivide the subgenus. Important taxonomic characters for the North American species are acetabula number, size and number of ridges on the dorsal shield. The height of the ridges is somewhat variable but when used in conjunction with other characters is highly useful. Other important differences are number of glandularia on the dorsum, presence or absence of a projection on P-II and proportional sizes of the appendage segments. Habitat types and color patterns are very important supplementary characteristics. It is advisable to clear specimens during slide making with KOH

in order to preserve these color patterns. The male genital field is more or less terminal and difficult to illustrate in a strict ventral view because of the foreshortening. Therefore, with rare exceptions, illustrations of the male genital field are posteroventral views. Figures 27 and 28 are posteroventral and ventral views respectively of the male genital field of *A. amnicola* and indicate the apparent differences caused by the variation in angle of view.

AXONOPSIS (BRACHYPODOPSIS) PALLIDA Habeeb
(Figs. 1-3, 5, 6)

Axonopsis pallida Habeeb, 1957. Leaflets Acadian Biol., 15:8.

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 380μ-433μ, width 288μ-329μ; length of ventral shield 373μ-415μ, width 327μ-368μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia; median and lateral ridges of dorsal shield well developed, lateral ridges extending nearly to anterior end of dorsal shield; Figure 1 shows the typical color pattern of the dorsum; two pairs of glandularia located very close together on their respective sides between genital field and insertions of fourth legs; Figure 3 shows the morphology of the ventral shield: lateral edges of ventral shield rounded or somewhat angled as shown in the illustration of a related species (Fig. 13); a well developed suture line (continuation of that between first and second coxae) joining at the midline (Fig. 3, arrow A); three pairs of genital acetabula; width between outer edges of most lateral pair of acetabula 121μ-162μ; gonopore 38μ-41μ in width.

Dorsal lengths of the palpal segments: P-I, 31μ-33μ; P-II, 43μ-49μ; P-III, 27μ-31μ; P-IV, 57μ-68μ; P-V, 23μ-24μ; Figure 5 shows the proportions and chaetotaxy of the palp; distoventral projection on P-II prominent but not always as well developed as illustrated; capitulum 79μ-89μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ-55μ; I-Leg-5, 59μ-72μ; I-Leg-6, 61μ-72μ; Figure 2 shows I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Fig. 6) and only measurements are given; length of dorsal shield 364μ-395μ, width 282μ-304μ; length of ventral shield 357μ-388μ, width 319μ-332μ; width between outer edges of most lateral pair of acetabula 121μ-128μ; dorsal lengths of the palpal segments: P-I, 28μ-31μ; P-II, 43μ-45μ; P-III, 25μ-27μ; P-IV, 55μ-59μ; P-V, 21μ-23μ; capitulum 80μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ-51μ; I-Leg-5, 59μ-61μ; I-Leg-6, 59μ-62μ.

Habitat and Distribution: The type was collected by Habeeb in Mill Creek near Highlands, Macon County, North Carolina in early May 1957. I have taken specimens from the following localities: 1 male, 1 female, collected from submerged sticks in the Cullasaja River one mile north of Highlands, Macon County, North Carolina, May 14, 1961 (the type locality is a tributary of the Cullasaja River); 1 female, taken in sand deposits of a small stream one mile north of Albion, Pushmataha County, Oklahoma, July 9, 1961; 1 female, from gravel deposits in Thompson Creek near McClung, Bath County, Virginia, September 9, 1968; 1 male, found on a submerged stick in the Perdido River, Escambia County, Florida, November 7, 1970; 7 females, collected in matted roots in a small tributary of the Waccasassa River approximately one mile south of Gulf Hammock, Levy County, Florida, November 11, 1970.

Discussion: Although two specimens were taken in collections in which interstitial mites predominated, it is felt this is primarily a reophilic species. It is not uncommon in streams with little vegetation for reophilic species to move into the uppermost bottom layer and be taken along with true interstitial species. The female specimens from the last collection had a much narrower genital field than those from outside Florida, but otherwise were similar. Genital field width of the Florida females varied from 121μ-131μ but varied from 155μ-162μ in specimens from outside Florida. The significance, if any, of these differences is presently not clear.

Habeeb (1961) described a female specimen from Lake Cayuga, Seneca County, New York as a subspecies, *A. pallida cayuga,* and stated it differed from *pallida* in lacking a complete suture line as shown in Figure 3, arrow A. If, as must be assumed from the original description, it has the three well developed ridges on the dorsal shield, this plus its lentic habitat should make it easy to identify. There is a strong possibility this taxon should be given full species ranking.

AXONOPSIS (BRACHYPODOPSIS) OCCIDENTALIS, new species
(Figs. 14, 17-20)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 471μ (463μ-471μ), width 334μ (334μ-349μ); length of ventral shield 456μ (452μ-456μ), width 384μ (384μ-395μ); dorsal shield typically bearing three pairs of glandularia posterior to the postocularia; median and lateral ridges of dorsal shield poorly to moderately developed; lateral ridges not extending near anterior end of dorsal shield; edges of posterior half of dorsal shield more or less rounded; Figure 20 shows the color pattern in the holotype (the two patches joined by a narrow median bridge of pigment in one paratype); two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; Figure 18 shows the morphology of the ventral shield; suture line between first and second coxae extending toward the midline but not as well developed as in the preceding species; three pairs of genital acetabula; width between outer margins of most lateral pair of acetabula 142μ (142μ-156μ); gonopore 46μ (45μ-48μ).

Dorsal lengths of the palpal segments: P-I, 32μ (32μ-34μ); P-II, 46μ (46μ-50μ); P-III, 30μ (30μ-31μ); P-IV, 67μ (67μ-69μ); P-V, 26μ (26μ-27μ); Figure 14 illustrates the proportions and chaetotaxy of the palp; no pronounced projection present on the ventral side of P-II; capitulum 90μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ (55μ-58μ); I-Leg-5, 66μ (66μ-69μ); I-Leg-6, 69μ (68μ-69μ); Figure 19 shows I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Fig. 17) and only measurements are given; length of dorsal shield 445μ (425μ-445μ), width 319μ (312μ-319μ); length of ventral shield 434μ (418μ-434μ), width 364μ (358μ-364μ); width between outer edges of most lateral pair of acetabula 145μ (138μ-145μ); dorsal lengths of the palpal segments: P-I, 34μ (32μ-34μ); P-II, 49μ (49μ-50μ); P-III, 31μ; P-IV, 69μ (67μ-69μ); P-V, 24μ (24μ-26μ); capitulum 89μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ; I-Leg-5, 72μ (72μ-75μ); I-Leg-6, 72μ (72μ-74μ).

Holotype: Adult female, collected in submerged mosses on rocks in the South Branch of the Umpqua River west of Milo, Douglas County, Oregon, August 11, 1961.

Allotype: Adult male, same data as holotype.

Paratypes: 1 female, collected in Moccasin Creek, Tuolumne County, California, October 26, 1970; 1 male, 1 female, from the Navarro River near Paul M. Dimmick State Recreation Area, Mendocino County, California, October 29, 1970.

Discussion: The new species is related to *A. pallida* but differs in being larger, having less well developed ridges on the dorsal shield and a smaller projection on the ventral side of P-II.

AXONOPSIS (BRACHYPODOPSIS) LACUSTRIS, new species
(Figs. 11-13, 15, 16)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 388μ, width 300μ; length of ventral shield 376μ, width 338μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia; lateral ridges of dorsal shield slightly developed but median ridge absent; edges of posterior half of dorsal shield less rounded (more acutely angled) than in preceding species; Figure 11 shows the color pattern of the dorsum; two pairs of glandularia located very close

together on their respective sides between the genital field and the insertions of the fourth legs; Figure 13 illustrates the ventral shield; suture line between the first and second coxae extending towards the midline and well developed (but not to the degree found in *pallida*); three pairs of genital acetabula; width between most lateral pair of acetabula 128μ; gonopore 46μ in width.

Dorsal lengths of the palpal segments: P-I, 31μ; P-II, 47μ; P-III, 33μ; P-IV, 62μ; P-V, 23μ; Figure 15 shows the proportions and chaetotaxy of the palp; no pronounced projection present on ventral side of P-II; capitulum 86μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52μ; I-Leg-5, 66μ I-Leg-6, 64μ; Figure 12 shows I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Unknown.

Holotype: Adult female, collected in Lake Tsala Apopka within the city limits of Inverness, Citrus County, Florida, December 21, 1955.

Discussion: The present species seems closely related to *pallida* and *occidentalis*. It differs from *pallida* in its poorly developed ridges on the dorsal shield and lack of a large projection on P-II. The new species is much smaller than *occidentialis* and lacks a median ridge on the dorsal shield. There is also a difference in habitats. *A. lacustris* is a lake inhabitant, the other two are lotic species.

AXONOPSIS (BRACHYPODOPSIS) DAPSILA, new species
(Figs. 4, 7-10)

Female: Dorsal and ventral shields fused lightly at anterior end; lateral eyes well developed; length of dorsal shield 380μ (364μ-395μ), width 288μ (274μ-297μ); length of ventral shield 369μ (355μ-380μ), width 316μ (304μ-319μ); dorsal shield bearing three pairs of glandularia posterior to the postocularia; lateral ridges of dorsal shield moderately developed, median ridge poorly developed; lateral ridges not extending near anterior end; Figure 10 shows the color pattern of the dorsum; color patches vary from light to almost colorless; two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; Figure 8 shows the structure of the venter; suture line between first and second coxae extending towards the midline but not as well developed as in *pallida* (compare Figs. 3, arrow A and 8); three pairs of genital acetabula; width between outer edges of most lateral pair of acetabula 145μ (138μ-152μ); gonopore 38μ (34μ-38μ) in width.

Dorsal lengths of the palpal segments: P-I, 27μ (26μ-29μ); P-II, 38μ (38μ-44μ); P-III, 24μ (23μ-26μ); P-IV, 54μ (52μ-57μ); P-V, 20μ (18μ-22μ); palpal segments stocky; ventral side of P-II bulging, Figure 4 shows the proportions and chaetotaxy of the palp; capitulum 76μ (73μ-79μ) in length; dorsal lengths of the distal segments of the first leg: I--Leg-4, 44μ (43μ-47μ); I-Leg-5, 55μ (54μ-59μ); I-Leg 6, 55μ (55μ-59μ); Figure 9 shows I-Leg 5 and 6; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in morphology of the genital field region (Fig. 7) and only measurements are given; length of dorsal shield 360μ (350μ-378μ), width 282μ (273μ-299μ); length of ventral shield 354μ (342μ-373μ), width 308μ (304μ-318μ); width between outer edges of most lateral pair of acetabula 132μ (131μ-142μ); dorsal lengths of the palpal segments: P-I, 28μ (25μ-31μ); P-II, 41μ (39μ-46μ); P-III, 24μ (22μ-26μ); P-IV, 54μ (52μ-59μ); P-V, 22μ (19μ-22μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 44μ (42μ-45μ); I-Leg-5, 55μ (52μ-58μ); I-Leg-6, 56μ (56μ-62μ).

Holotype: Adult female, taken in gravel deposits of a stream east of Griffen (two miles from the Warren County line), Hamilton County, New York, August 30, 1968.

Allotype: Adult male, same data as holotype.

Paratypes: 2 males, 1 female, same data as holotype; 5 males, 3 females, same area as holotype on August 19, 1964; 2 females, from bottom deposits in the Aroostook River near Ashland, Aroostook County, Maine, September 2, 1968; 1 male, 2 females, from gravel desposits in Wytopitlock Stream, Aroostook County, Maine, September 5, 1968; 1 female, taken in bottom gravels of the Saco River, Carroll County, New Hampshire,

September 1, 1968; 1 female, taken in a gravel bar in Flatbrook two miles south of Bevans, Sussex County, New Jersey, August 16, 1964; 2 males, from bottom deposits in a small stream on Highway 678 six miles north of Millboro Springs, Bath County, Virginia, July 24, 1964; 3 males, 4 females, from sand bar in Little Back Creek on Highway 39 three miles from the West Virginia border, Bath County, Virginia, July 25, 1964; 1 male, 1 female, from a tributary of the Jackson River near Bacova, Bath County, Virginia, September 9, 1968; 1 female, from a gravel bar in Knapp's Creek near Minnehaha Springs, Pocahontas County, West Virginia, July 22, 1964.

Discussion: The present species is related to *pallida, occidentalis* and *lacustris* but differs most noticeably in its much stockier appendages. *A. dapsila* is definitely an interstitial water species which is in the process of losing integumental pigmentation. As is so often the case in ground water forms, there is a variation in degree of color loss. Even within the same population one finds variation from light color patches to an almost complete lack of pigmentation. The striations shown in Figures 4 and 9 are found in all members of the subgenus but are especially pronounced in the present species.

AXONOPSIS (BRACHYPODOPSIS) RIVOPHILA Habeeb
(Figs. 21-24, 26)

Axonopsis rivophila Habeeb, 1957. Leaflets Acadian Biol., 15:6.

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 319μ-380μ, width 252μ-302μ; length of ventral shield 308μ-365μ, width 288μ-334μ; dorsal shield bearing four pairs of glandularia posterior to the postocularia; dorsal shield either without ridges or with a pair of short, ill-defined ridges posteriorly as shown in Figure 21; Color pattern of dorsum typically as shown in Figure 21 but in some specimens the narrow median bridge of pigment connecting the anterior and posterior patches is absent; posterior end of dorsal shield somewhat projecting; two pairs of glandularia located very close together on their respective sides between the genital field and the insertions of the first legs; Figure 23 illustrates the structure of the ventral shield; suture line between first and second coxae not extending close to midline; four pairs of genital acetabula, these arranged in an arc on their respective sides; second pair of acetabula located posterolateral to the first pair; width between most lateral pair of acetabula 124μ-218μ; gonopore 34μ-39μ.

Dorsal lengths of the palpal segments: P-I, 24μ-29μ; P-II, 39μ-45μ; P-III, 27μ-29μ; P-IV, 60μ-63μ; P-V, 23μ-24μ; ventral side of P-II without a projection; structure of palp similar to that illustrated for the male (Fig. 24); capitulum 83μ-87μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 42μ-46μ; I-Leg-5, 55μ-60μ; I-Leg-6, 62μ-65μ; structure of I-Leg-5 and 6 similar to that illustrated for the male (Fig. 22); swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of genital field region (Fig. 26) and only measurements are given; dorsal shield 316μ-372μ in length, 251μ-304μ in width; length of ventral shield 304μ-364μ, width 289μ-330μ; width between outer edges of most lateral pair of acetabula 114μ-134μ; dorsal lengths of the palpal segments: P-I, 24μ-30μ; P-II, 37μ-43μ; P-III, 23μ-27μ; P-IV, 56μ-64μ; P-V, 23μ-25μ; capitulum 76μ-83μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 42μ-51μ; I-Leg-5, 58μ-66μ; I-Leg-6, 62μ-69μ.

Habitat and Distribution: The type was collected by Habeeb in the Cullasaja River near Highlands, Macon County, North Carolina in early May, 1957. This is a stream inhabiting species which occasionally wanders into the more superficial layers of the intersitial water habitat. I have recollected *rivophila* from the type locality and it was also present in the following collections: 1 female, from a stream in Cedar Falls State Park, Hocking County, Ohio, June 18, 1967; 1 male, from gravel deposits in Russell Creek near Russell Springs, Adair County, Kentucky, June 14, 1964; 1 male, from the North Fork of the Thornton River near Sperryville, Rappahannock County, Virginia, September 8, 1968; 1 male, collected

in gravel deposits of Thompson Creek near McClung, Bath County, Virginia, September 9, 1968; 1 female, from a tributary of the Jackson River near Bacova, Bath County, Virginia, September 9, 1968; 1 male, collected in a stream in Caledonia State Park, Adams County, Pennsylvania, August 20, 1959; 1 male, 1 female, from a stream in Pine Grove Furnace State Park, Cumberland County, Pennsylvania, August 20, 1959; 1 male, 1 female, from a stream in Cowen's Gap State Park, Fulton County, Pennsylvania, May 21, 1961; 1 males, 5 females, from rocks in a small stream near junctions of highways 73 and S278, Jackson County, Florida, November 9, 1970.

AXONOPSIS (BRACHYPODOPSIS) AMNICOLA, new species
(Figs. 25, 27-31)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 410μ (388μ-432μ), width 297μ (289μ-323μ); length of ventral shield 399μ (380μ-418μ), width 334μ (327μ-368μ); dorsal shield bearing four pairs of glandularia posterior to the postocularia; dorsal shield without ridges; color pattern as indicated in Figure 31 with anterior and posterior patches joined by a broad middle bridge of pigment; posterior end of dorsal shield slightly projecting; two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; Figure 29 shows the structure of the ventral shield; suture line between first and second coxae not extending to the midline; four pairs of genital acetabula, these arranged in an arc on their respective sides; second pair of acetabula tending to be located more or less lateral to the first pair in the female; width between outer edges of most lateral pair of acetabula 130μ (130μ-135μ); gonopore 45μ (42μ-46μ) in width.

Dorsal lengths of the palpal segments: P-I, 30μ (28μ-31μ); P-II, 44μ (41μ-45μ); P-III, 29μ (28μ-30μ); P-IV, 63μ (62μ-67μ); P-V, 24μ (24μ-26μ); ventral side of P-II without a projection; structure of palp similar to that illlustrated for the male (Fig. 25); capitulum 85μ (83μ-90μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 49μ (48μ-52μ); I-Leg-5, 62μ (61μ-66μ); I-Leg-6, 69μ (66μ-69μ); structure of I-Leg-5 and 6 similar to that of male (Fig. 30); swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Figs. 27, 28) and only measurements are given; length of dorsal shield 410μ (395μ-425μ), width 304μ (289μ-304μ); length of ventral shield 399μ (399μ-414μ), width 79μ (76μ-80μ); width between outer edges of most lateral pair of acetabula 131μ (131μ-138μ); dorsal lengths of the palpal segments: P-I, 28μ (28μ-30μ); P-II, 43μ (43μ-45μ); P-III, 29μ (29μ-30μ); P-IV, 66μ (64μ-67μ); P-V, 26μ (24μ-26μ); capitulum 83μ (80μ-87μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ (53μ-55μ); I-Leg-5, 66μ (66μ-69μ); I-Leg-6, 72μ (71μ-73μ).

Holotype: Adult female, collected in the South Branch of the Umpqua River near Milo, Douglas County, Oregon, August 11, 1961.

Allotype: Adult male, same data as holotype.

Paratypes: 17 males, 22 females, same data as holotype; 1 female, taken in the Navarro River near Paul M. Dimmick State Recreation Area, Mendocino County, California, October 27, 1970; 1 female, collected in Clear Creek, Shasta County, California, July 30, 1966.

Discussion: The present species, along with *A. rivophila,* is unusual among North American species of the subgenus in that it bears four pairs of glandularia on the dorsal shield posterior to the postocularia (rather than three pairs). The new species is larger than *rivophila,* has a less projecting posterior end of the dorsal shield, more angular posterior end of the ventral shield and difference in color pattern (compare Figs. 21 and 31). *A. rivophila* is confined to streams in eastern North America and *A. amnicola* is presently known only from streams in California and Oregon.

AXONOPSIS (BRACHYPODOPSIS) SETONENSIS Habeeb
(Figs. 35, 37-40)

Axonopsis setonensis Habeeb, 1953. Leaflets Acadian Biol., 1:9.

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 456μ-471μ, width 349μ-365μ; length of ventral shield 445μ-458μ, width 395μ-410μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia; dorsal shield with a pair of lateral ridges; Figure 38 shows the color pattern typically present on the dorsal shield; two pairs of glandularia located very close together on legs; second coxae decidedly angled (Fig. 40, arrow A) and in some specimens this projection is more pronounced than in the specimen illustrated; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 183μ-193μ; gonopore 43μ-48μ in width.

Dorsal lengths of the palpal segments: P-I, 33μ-35μ; P-II, 50μ-53μ; P-III, 30μ-33μ; P-IV, 66μ-69μ; P-V, 25μ-27μ; distoventral portion of P-II with a well developed projection (Fig. 35); capitulum 97μ-100μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 58μ-60μ; I-Leg-5, 73μ-78μ; I-Leg-6, 66μ-69μ; Figure 39 illustrates I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Fig. 37) and only measurements are given; length of dorsal shield 456μ, width 350μ; length of ventral shield 438μ, width 395μ; width between outer edges of most lateral pair of acetabula 166μ; numerous short setae on the genital field; dorsal lengths of the palpal segments: P-I, 35μ; P-II, 52μ; P-III, 31μ; P-IV, 71μ; P-V, 26μ; capitulum 100μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ; I-Leg-5, 83μ; I-Leg-6, 80μ.

Habitat and Distribution: This species is an inhabitant of lakes and ponds. The type was collected by Habeeb in a pond near Millburn, Essex County, New Jersey. I have taken it in the following localities in Michigan: 1 female, collected in Head Lake, Barry County, Michigan, July 12, 1967; 2 females, same area on August 19, 1967; 1 female, from Wall Lake, Barry County, Michigan, June 6, 1951; 1 male, collected in the Hook Point area of Douglas Lake, Cheboygan County, Michigan, July 1, 1952.

Discussion: It is suspected that this species may be more abundant that these few collection records would indicate. Collections in lakes are normally made with a net in which the mesh size is large enough to permit most of the specimens to pass through. I have not seen the type and have no specimens from the type locality or other area in eastern North America. However, the specimens from Michigan agree well with the measurements of the type and any characters illustrated or described by Habeeb. When one also considers the habitat similarity, it is probable they are conspecific. The combination of habitat type, projection on P-II, four pairs of acetabula and widely separated color patches on the dorsal shield are diagnostic.

AXONOPSIS (BRACHYPODOPSIS) OZARKENSIS, new species
(Figs. 50-52, 55)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 440μ (418μ-440μ); width 314μ (314μ-319μ); length of ventral shield 424μ (400μ-424μ), width 364μ (364μ-373μ); dorsal shield with three pairs of glandularia posterior to the postocularia; dorsal shield with a pair of lateral ridges; Figure 52 shows the color pattern of the dorsal shield; anterior and posterior dark patches connected by a wide median bridge of lighter pigment; two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; second coxae more or less rounded in the holotype (Fig. 50, arrow A), but more angular (similar to that in Figure 40, arrow A) in one of the paratypes; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 162μ (162μ-173μ); gonopore 43μ (43μ-49μ) in width.

Dorsal lengths of the palpal segments: P-I, 35μ (31μ-35μ); P-II, 52μ (50μ-52μ); P-III, 31μ (28μ-31μ); P-IV, 66μ (66μ-67μ); P-V, 25μ (24μ-25μ); distoventral portion of P-II with a well developed projection (Fig. 55); capitulum 97μ (92μ-97μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ (54μ-55μ); I-Leg-5, 72μ (72μ-74μ); I-Leg-6, 67μ (65μ-67μ); Figure 51 shows I-Leg-5 and 6; long swimming hairs present on all but the first pair of legs.

Male: Unknown.

Holotype: Adult female, collected in matted plant roots in a small stream seven miles north of Cave City, Sharp County, Arkansas, June 27, 1961.

Paratypes: 2 females, same data as holotype.

Discussion: The present species seems most closely related to *A. setonensis.* It differs in being smaller, having a different dorsal color pattern (compare Figures 38, 52) and in the tendency for the second coxae to be more rounded (compare Figures 40, 50, arrow A). However, in one paratype of the present species the second coxae are also projecting. There is also a habitat difference. *A. setonensis* is a lentic species, *ozarkensis* is a stream inhabitant.

AXONOPSIS (BRACHYPODOPSIS) OHIOENSIS Cook
(Figs. 44, 46-49)

Axonopsis ohioensis Cook, 1967. Ohio Jour. Sci., 67:220.

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 410μ, width 319μ; length of ventral shield 406μ, width 365μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia; dorsal shield without prominent ridges; Figure 47 illustrates the color pattern of the dorsum; two pairs of glandularia located very close together on their respective sides between genital field and insertions of the fourth legs; four pairs of genital acetabula; the first three pairs of acetabula forming a straight line or concave arc on their respective sides (Fig. 49); width between outer edges of most lateral pair of acetabula 155μ, gonopore 45μ in width.

Dorsal lengths of the Palpal segments: P-I, 34μ; P-II, 52μ; P-III, 31μ; P-IV, 70μ; P-V, 25μ; ventral side of P-II without a projection (Fig. 44); capitulum 97μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 60μ; I-Leg-5, 76μ; I-Leg-6, 69μ; Figure 48 shows I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region (Fig. 46) and only measurements are given; length of dorsal shield 403μ-425μ, width 304μ-334μ; length of ventral shield 395μ-426μ, width 350μ-388μ; width between outer edges of most lateral pair of acetabula 149μ-169μ; first three pairs of acetabula forming a straight line or a concave arc on their respective sides (Fig. 46); dorsal lengths of the palpal segments: P-I, 34μ-37μ; P-II, 53μ-55μ; P-III, 31μ; P-IV, 69μ-72μ; P-V, 26μ-28μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ; I-Leg-5, 79μ; I-Leg-6, 76μ.

Habitat and Distribution: Apparently this is a small lake or pond inhabiting species. The holotype was collected by Dr. Andrew Weaver in Shreve Lake, Wayne County, Ohio on November 30, 1962. I have taken a female specimen in Winter's Pond in Pine Hills Scenic Drive, Union County, Illinois, June 20, 1967 and a male specimen from the same locality on March 31, 1970.

Discussion: In the original description it was stated that there was no dorsal color pattern. It now appears the color pattern had been destroyed during the initial slide making. Also, as the type locality was a small lake recently formed by the damming of a stream, there was uncertainty as to whether *ohioensis* was a lentic or lotic species. It now seems certain that standing waters are its typical habitat.

AXONOPSIS (BRACHYPODOPSIS) BELTISTA, new species
(Figs. 32-34, 36, 54)

Male: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 384μ, width 315μ; length of ventral shield 388μ, width

364μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia; dorsal shield with a pair of well developed lateral ridges and a well developed median ridge near posterior end; Figure 34 illustrates the color pattern and ridges of the dorsum; two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; four pairs of genital acetabula; first three pairs of acetabula forming a concave arc on their respective sides (Fig. 54); genital acetabula relatively small; width between outer edges of most lateral pair of acetabula 130μ.

Dorsal lengths of the palpal segments: P-I, 33μ; P-II, 53μ; P-III, 32μ; P-IV, 70μ; P-V, 26μ; distoventral portion of P-II somewhat bulging but without a distinct projection (Fig. 36); dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ; I-Leg-5, 80μ; I-Leg-6, 73μ; Figure 33 illustrates I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Female: Unknown.

Holotype: Adult male, collected from rocks in the Hillsborough River at Hillsborough River State Park, Hillsborough County, Florida, November 12, 1970.

Discussion: The combination of four pairs of acetabula in which the first three pairs are arranged in a concave arc (Fig. 54) and the unusual arrangement of the ridges of the dorsal shield (Fig. 34) are diagnostic.

AXONOPSIS (BRACHYPODOPSIS) ARPEDA, New species
(Figs. 53, 56-58)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 373μ (373μ-392μ), width 274μ (274μ-282μ); length of ventral shield 346μ (346μ-358μ), width 319μ (319μ-342μ); dorsal shield bearing three pairs of glandularia posterior to the postocularia; dorsal shield without ridges; dorsal shield projecting well beyond the ventral shield posteriorly producing the wide area illustrated in Figure 56, arrow A; two pairs of glandularia located very close together on their respective sides between genital field and insertions of the fourth legs; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 143μ (143μ-145μ); gonopore 36μ (35μ-36μ) in width.

Dorsal lengths of the palpal segments: P-I, 29μ (28μ-29μ); P-II, 43μ (41μ-43μ); P-III, 26μ (26μ-28μ); P-IV, 63μ (63μ-66μ); P-V, 26μ (26μ-28μ); ventral side of P-II without a ventral projection (Fig. 53); capitulum 87μ (87μ-89μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ (48μ-50μ); I-Leg-5, 58μ (58μ-61μ); I-Leg-6, 64μ (62μ-64μ); Figure 57 illustrates I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Unknown.

Holotype: Adult female, collected in a gravel bar in the Meramec River at Cook Station, Crawford County, Missouri, July 23, 1960.

Paratypes: 1 female, same data as holotype; 1 newly metamorphosed female, taken from mosses on rocks in a small stream on Highway 143 near State Camp "Sam A. Baker", Wayne County, Missouri, July 8, 1960.

Discussion: The combination of no dorsal ridges plus the wide marginal area at posterior end of the dorsal shield (Fig. 56, arrow A) are diagnostic.

AXONOPSIS (BRACHYPODOPSIS) GENNADA, new species
(Figs. 68-71)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 350μ (342μ-350μ), width 273μ (266μ-273μ); length of ventral shield 334μ (327μ-334μ), width 304μ (293μ-304μ); dorsal shield bearing three pairs of glandularia posterior to the postocularia; lateral ridges of the dorsal shield well developed, these coalescing posteriorly as shown in Figure 70; a solid central area of

pigment present on the dorsal shield; dorsal shield somewhat projecting at posterior end; two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 109μ (109μ-113μ); gonopore 39μ (39μ-40μ) in width.

Dorsal lengths of the palpal segments: P-I, 26μ (26μ-28μ); P-II, 42μ (41μ-42μ); P-III, 27μ (26μ-27μ); P-IV, 57μ (57μ-59μ); P-V, 23μ (22μ-23μ); ventral side of P-II without a projection (Fig. 71); capitulum 80μ (76μ-82μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 47μ (47μ-49μ); I-Leg-5, 59μ (59μ-61μ); I-Leg-6, 62μ (62μ-63μ); Figure 69 shows the proportions and chaetotaxy of I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Unknown.

Holotype: Adult female, collected in matted plant roots in a small stream (tributary of the Waccasassa River) one mile south of Gulf Hammock, Levy County, Florida, November 11, 1970.

Paratypes: 2 females, same data as holotype.

Discussion: The unusual arrangement of the ridges of the dorsal shield, with the lateral ridges coalescing posteriorly and continuing as a short median ridge (Fig. 70) is diagnostic.

AXONOPSIS (BRACHYPODOPSIS) EREMITA, new species
(Figs. 41-43, 45)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 425μ (425μ-441μ), width 327μ (327μ-334μ); length of ventral shield 418μ (418μ-426μ), width 380μ (380μ-382μ); dorsal shield bearing three pairs of glandularia posterior to the postocularia; posterior pair of dorsal glandularia shifted relatively far posteriorly (considerably posterior to the muscle scars–Figure 43, arrow A); a pair of prominent ridges present on the dorsal shield; two pairs of glandularia located relatively close together on their respective sides between the genital field and insertions of the fourth legs; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 145μ (145μ-159μ); gonopore 42μ (42μ-43μ) in width.

Dorsal lengths of the palpal segments: P-I, 35μ; P-II, 55μ (52μ-55μ); P-III, 33μ (33μ-34μ); P-IV, 75μ (75μ-76μ); P-V, 27μ; ventral side of P-II without a projection (Fig. 45); capitulum 103μ (97μ-103μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 58μ (58μ-59μ); I-Leg-5, 73μ (73μ-76μ); I-Leg-6, 69μ (69μ-73μ); Figure 42 shows I-Leg-5 and 6; swimming hairs present on all but the first pair of legs.

Male: Unknown.

Holotype: Adult female, collected in the Withlacoochee River on Route 84 (near the Brooks County border), Lowndes County, Georgia, September 13, 1968.

Paratype: 1 female, taken in the Yellow River, Okaloosa County, Florida, November 8, 1970.

Discussion: This species was taken by panning rocks in the deeply stained, sandy bottomed streams of northern Florida and southern Georgia. It is characterized by the following combination of characters: Lateral ridges on dorsum and posterior shifting of the posterior pair of glandularia of the dorsal shield, four pairs of acetabula and lack of a projection on the ventral side of P-II.

AXONOPSIS (BRACHYPODOPSIS) CULLASAJA Habeeb
(Figs. 60, 63, 65, 67)

Axonopsis cullasaja Habeeb, 1957. Leaflets Acadian Biol., 15:6.

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 369μ-380μ, width 304μ-307μ; length of ventral shield

361μ-380μ, width 342μ-349μ; dorsal shield bearing three pairs of glandularia posterior to the postocularia, the most posterior pair located more or less in a line with the posterior muscle scars (Fig. 65, arrow A); a pair of prominent lateral ridges present on dorsal shield; posterior color patch of dorsal shield extending farthest anteriorly in region of midline (Fig. 65); two pairs of glandularia located very close together on their respective sides between the genital field and insertions of the fourth legs; four pairs of genital acetabula, these arranged in an arc on their respective sides (Fig. 67); width between outer edges of most lateral pair of acetabula 138μ-145μ; gonopore 43μ-45μ in width.

Dorsal lengths of the palpal segments: P-I, 27μ-28μ; P-II, 43μ-45μ; P-III, 29μ-31μ; P-IV, 62μ; P-V, 22μ-24μ; ventral side of P-II without a ventral projection (Fig. 63); capitulum 82μ-83μ in length; dorsal lengths of the distal segments of the first leg; I-Leg-4, 48μ-51μ; I-Leg-5, 64μ-66μ; I-Leg-6, 72μ-73μ; structure of these segments shown in Figure 60; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in structure of the genital field region and only measurements are given; length of dorsal shield 365μ, width 296μ; length of ventral shield 358μ, width 327μ; width between outer edges of most lateral pair of acetabula 138μ; dorsal lengths of the palpal segments: P-I, 26μ; P-II, 42μ; P-III, 27μ; P-IV, 62μ; P-V, 23μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ; I-Leg-5, 64μ; I-Leg-6, 72μ; genital field similar to that of the following species (Fig. 64).

Habitat and Distribution: This is a stream inhabiting species which was originally described from material collected in the Cullasaja River and one of its tributaries (Mill Creek) near Highlands, Macon County, North Carolina in early May 1957. I have taken a male and a female from the type locality (Cullasaja River), May 14, 1961 and a female individual from the North Fork of the Thornton River near Sperryville, Rappahannock County, Virginia, September 8, 1968.

Discussion: Habeeb (1968) described *A. cullasaja boreosaja* from specimens collected in New York (West Branch of Onondaga River, Onondaga County and Dutch Hollow Brook, Cayuga County) stating it differed from the typical form in having the epimera (coxae) longer and narrower and that certain leg segments had an extra swimming hair. This latter character is somewhat variable, with even opposite sides of the same individual having a different number of swimming hairs, and so is a poor taxonomic character. The status of this taxon will remain uncertain until additional material has been taken.

AXONOPSIS (BRACHYPODOPSIS) FLORIDENSIS, new species
(Figs. 61, 64, 66)

Female: Dorsal and ventral shields lightly fused at anterior end; lateral eyes well developed; length of dorsal shield 349μ (342μ-373μ), width 289μ (278μ-297μ); length of ventral shield 246μ (342μ-348μ), width 323μ (304μ-334μ); dorsal shield bearing three pairs of glandularia posterior to the postocularia, the posterior pair of which are located very close to the posterior muscle scars; a pair of prominent lateral ridges present on the dorsal shield; posterior color patch of dorsal shield extending farthest anteriorly in region of lateral edges (Fig. 61); two pairs of glandularia located very close together on their respective sides between genital field and insertions of fourth legs; four pairs of genital acetabula, these arranged in an arc on their respective sides; width between outer edges of most lateral pair of acetabula 128μ (113μ-128μ), gonopore 41μ (39μ-43μ) in width; ventral shield similar to that illustrated for *A. cullasaja* (Fig. 67).

Dorsal lengths of the palpal segments: P-I, 27μ (27μ-28μ); P-II, 43μ (41μ-43μ); P-III, 29μ (28μ-29μ); P-IV, 62μ (60μ-65μ); P-V, 24μ (23μ-24μ); palp similar to that described and illustrated for *A. cullasaja;* capitulum 83μ (80μ-86μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ (48μ-51μ); I-Leg-5, 60μ (60μ-65μ); I-Leg-6, 64μ (64μ-67μ); Figure 66 illustrates the proportions and chaetotaxy of these segments; swimming hairs present on all but the first pair of legs.

Male: Similar to female except in morphology of the genital field region (Fig. 64) and only measurements are given; length of dorsal shield 334μ (330μ-349μ), width 277μ (270μ-281μ); length of ventral shield 327μ (321μ-327μ), width 304μ (304μ-318μ); width between outer edges of most lateral pair of acetabula 121μ (117μ-125μ); dorsal lengths of the palpal segments: P-I, 27μ (27μ-28μ); P-II, 39μ (39μ-42μ); P-III, 28μ (26μ-28μ); P-IV, 57μ (57μ-62μ); P-V, 23μ (21μ-24μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ (48μ-50μ); I-Leg-5, 63μ (62μ-66μ); I-Leg-6, 62μ (62μ-69μ).

Holotype: Adult female, collected in a small stream (tributary of the Waccasassa River) one mile south of Gulf Hammock, Levy County, Florida, November 11, 1970.

Allotype: Adult male, same data as holotype.

Paratypes: 20 males, 34 females, same data as holotype; 3 males, 17 females, from rocks in a stream near junction of highways 73 and S278 (approximately 10 miles from Calhoun County line), Jackson Country Florida, November 9, 1970.

Discussion: A. floridensis is closely related to *A. cullasaja* but differs most noticeably in the color pattern of the dorsal shield (compare Figures 61 and 65).

Subgenus **PARAXONOPSIS** Motas and Tanasachi

AXONOPSIS (PARAXONOPSIS) PUMILA, new species
(Figs. 72-77)

Female: Dorsal and ventral shields broadly fused at anterior end; lateral eye pigment greatly reduced; length of dorsal shield 358μ (293μ-364μ), width 258μ (228μ-258μ); length of the ventral shield 358μ (304μ-364μ), width 273μ (247μ-276μ); dorsal shield bearing two pairs of small glandularia posterior to the postocularia, these flanked by a pair of lateral ridges (Fig. 75); integumental pigmentation absent; one pair of small glandularia present between genital field and insertions of fourth legs; three pairs of genital acetabula; width between outer edges of most lateral pair of acetabula 121μ (104μ-121μ); gonopore 33μ (28μ-34μ) in width; Figure 78 illustrates the morphology of the ventral shield.

Dorsal lengths of the palpal segments: P-I, 24μ (21μ-24μ); P-II, 40μ (35μ-40μ); P-III, 24μ (21μ-24μ); P-IV, 48μ (44μ-48μ); P-V, 21μ (20μ-21μ); structure of palp similar to that shown for the male (Fig. 76); capitulum 76μ (73μ-76μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 38μ (35μ-38μ); I-Leg-5, 42μ (40μ-44μ); I-Leg-6, 56μ (52μ-56μ); swimming hairs absent.

Male: Similar to female except in morphology of the genital field region and for the most part only measurements are given; male genital field located on a short cauda; Figure 72 shows a ventral view of the cauda, Figure 74 gives a posteroventral view of cauda; length of dorsal shield 304μ (289μ-338μ), width 228μ (228μ-255μ); length of ventral shield 308μ (304μ-356μ), width 247μ (243μ-273μ); width between outer edges of most lateral pair of acetabula 104μ (104μ-121μ); dorsal lengths of the palpal segments: P-I, 19μ (19μ-23μ); P-II, 34μ (34μ-38μ); P-III, 23μ (22μ-24μ); P-IV, 48μ (46μ-49μ); P-V, 20μ (20μ-22μ); Figure 76 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 35μ (35μ-37μ); I-Leg-5, 44μ (42μ-45μ); I-Leg-6, 52μ (52μ-54μ); Figure 73 shows I-Leg-5 and 6.

Holotype: Adult female, taken in interstitial waters of a gravel bar in Salmon Creek, Monterey County, California, July 23, 1966.

Allotype: Adult male, same data as holotype.

Paratypes: 6 males, 6 females, same data as holotype; 1 male, 1 female, from a gravel bar in the South Fork of the Trinity River near Forest Glen State Park, Trinity County, California, July 30, 1966; 4 males, 6 females, from a gravel bar in the Van Duzen River on Highway 36 approximately 16 miles east of Bridgeville, Humboldt County, California, July 30, 1966.

Discussion: This is the only member of its subgenus presently known from the New World. It does not seem closely related to any of the previously described species.

Subgenus **VICINAXONOPSIS** Cook

AXONOPSIS (VICINAXONOPSIS) CALIFORNICA Cook
(Figs. 59, 62, 82, 86)

Axonopsis (Vicinaxonopsis) californica Cook, 1974. Mem. Amer. Entomol. Inst., 21:459.

Not redescribed here. The extremely long capitular apodemes (anchoral process) and long pointed P-V (Figs. 62, 82) will easily distinguish it from all other species of *Axonopsis* known from the New World. A closely related species has been taken in Japan. This is an interstitial water species which is presently known from streams in Monterey and Humboldt Counties, California.

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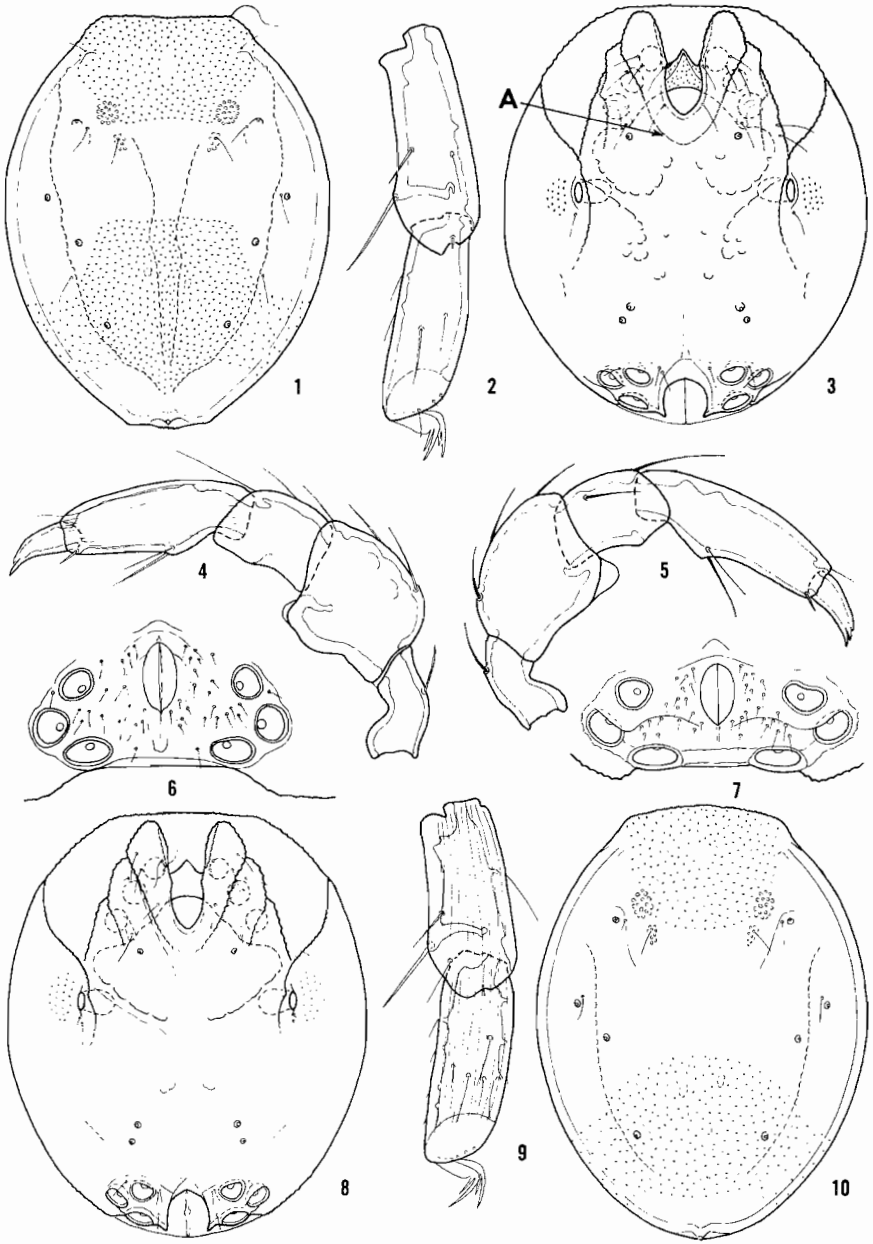
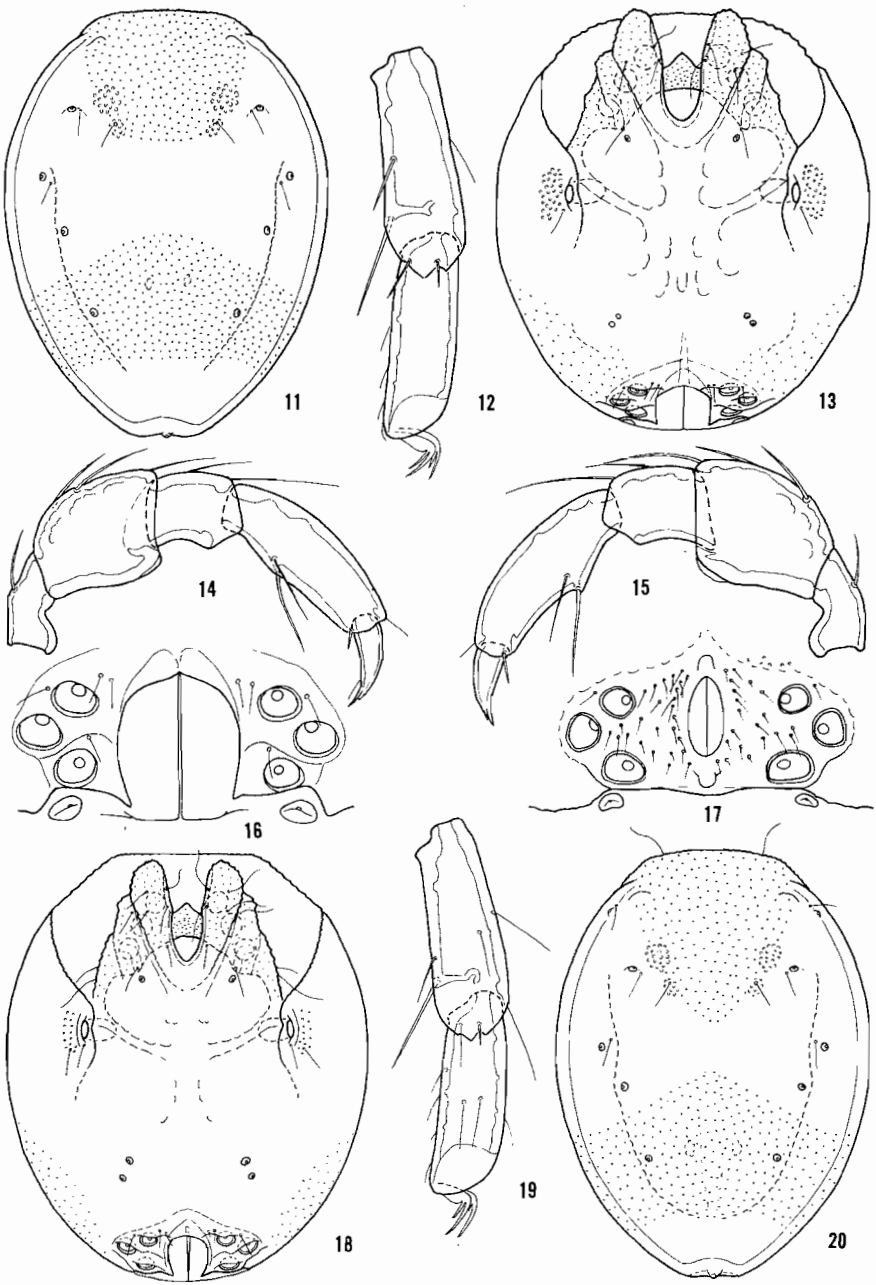


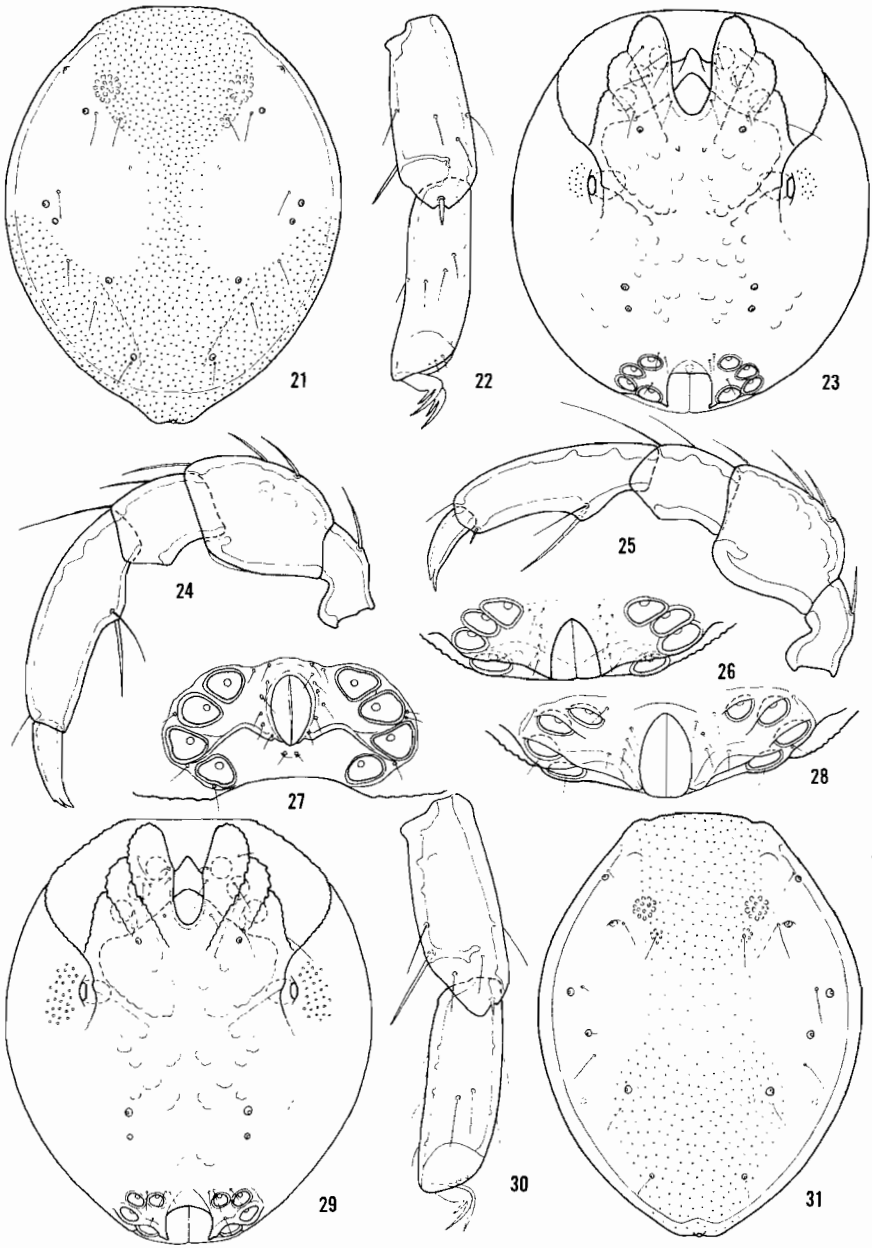
Axonopsis pallida Habeeb. Fig. 1, dorsal shield, female; Fig. 2, I-Leg-5 and 6, female; Fig. 3, ventral shield, female; Fig. 5, palp, female; Fig. 6, posteroventral view of genital field, male.

Axonopsis dapsila n. sp. Fig. 4, palp, female; Fig. 7, posteroventral view of genital field, male; Fig. 8, ventral view, female; Fig. 9, I-Leg-5 and 6, female; Fig. 10, dorsal shield, female.



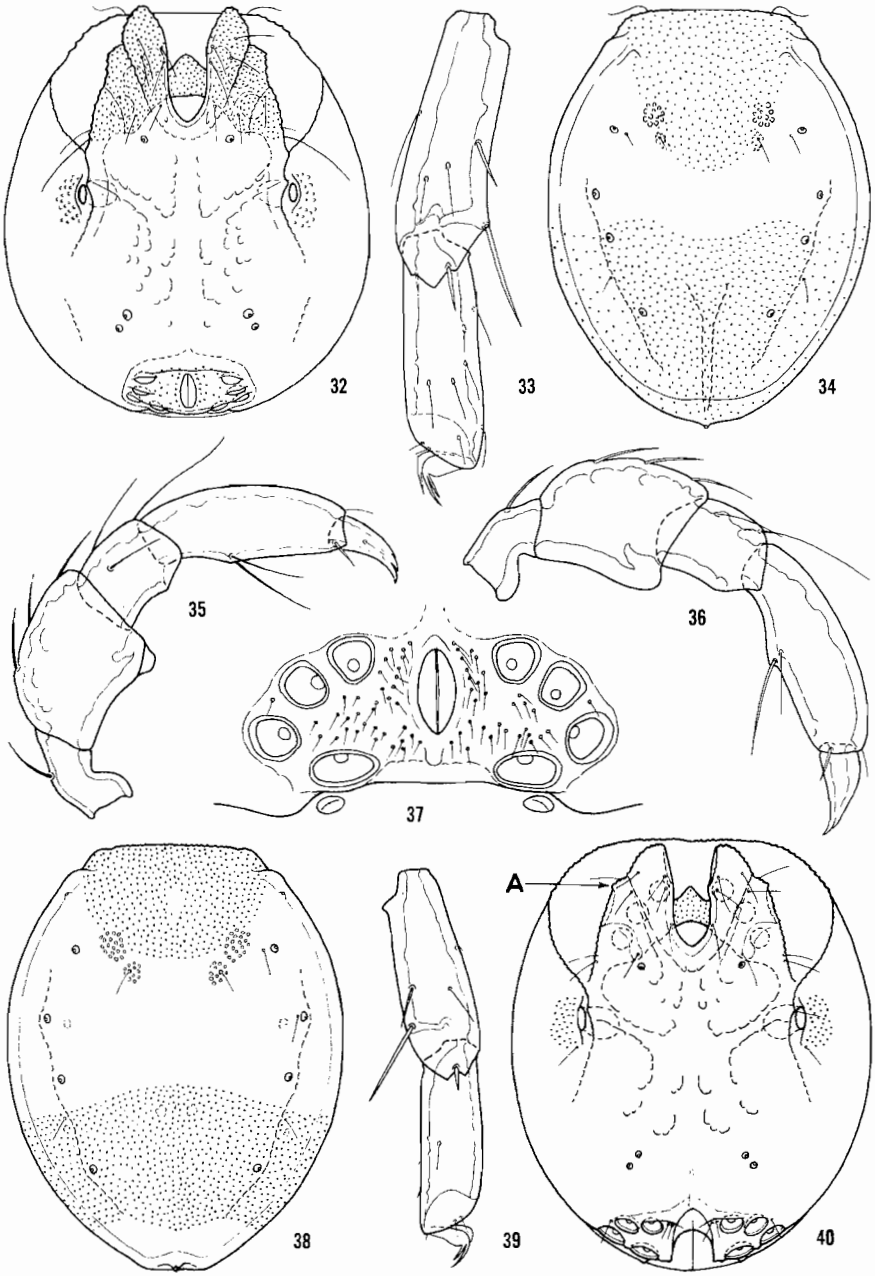
Axonopsis lacustris n. sp. Fig. 11, dorsal shield, female; Fig. 12, I-Leg-5 and 6, female; Fig. 13, ventral shield, female; Fig. 15, palp, female; Fig. 16, posteroventral view of genital field, female.

Axonopsis occidentalis n. sp. Fig. 14, palp, female; Fig. 17, posteroventral view of genital field, male; Fig. 18, ventral shield, female; Fig. 19, I-Leg-5 and 6, female; Fig. 20, dorsal shield, female.



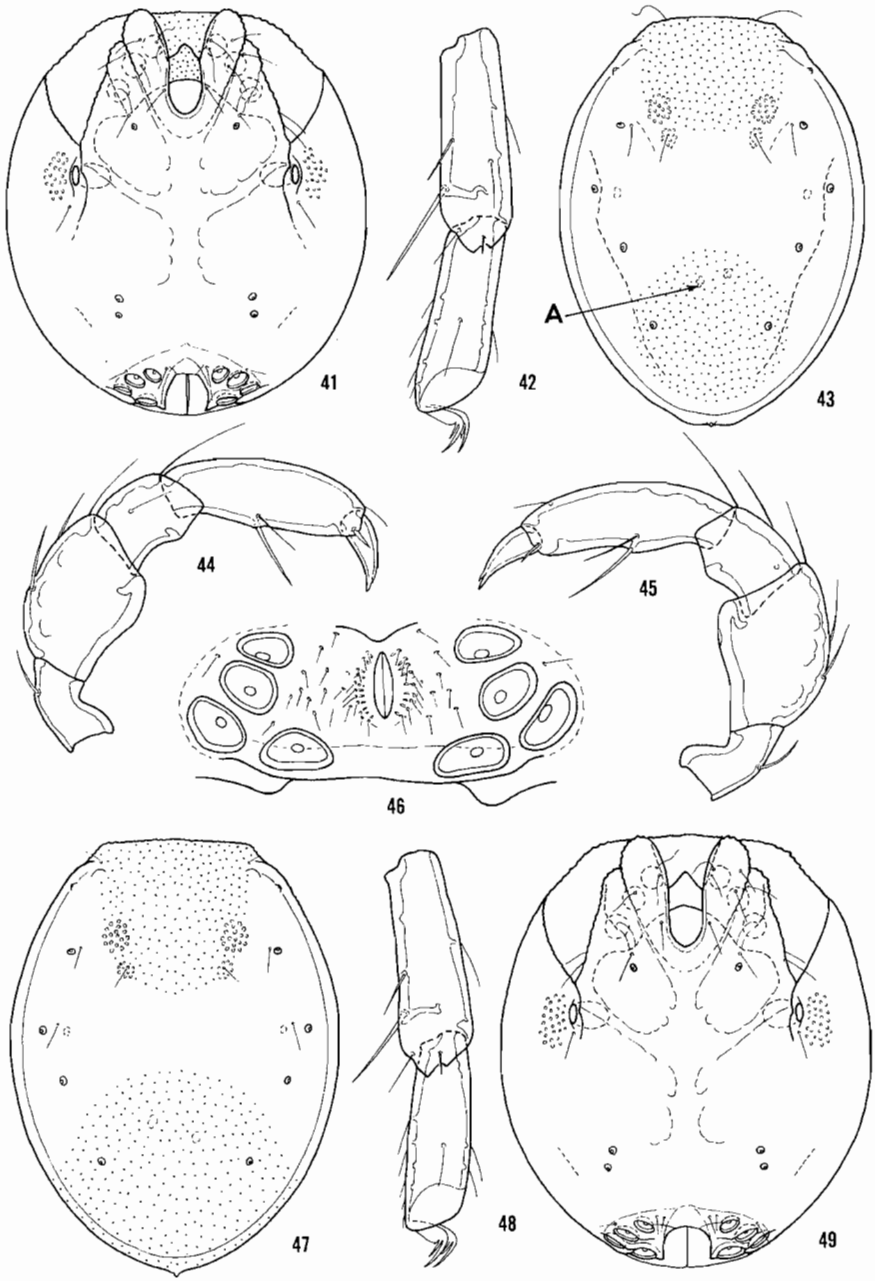
Axonopsis rivophila Habeeb. Fig. 21, dorsal shield, female; Fig. 22, I-Leg-5 and 6, male; Fig. 23, ventral shield, female; Fig. 24, palp, male; Fig. 26, ventral view of genital field, male.

Axonopsis amnicola n. sp. Fig. 25, palp, male; Fig. 27, posteroventral view of genital field, male; Fig. 28, ventral view of genital field, male; Fig. 29, ventral shield, female; Fig. 30, I-Leg-5 and 6, male; Fig. 31, dorsal shield, female.

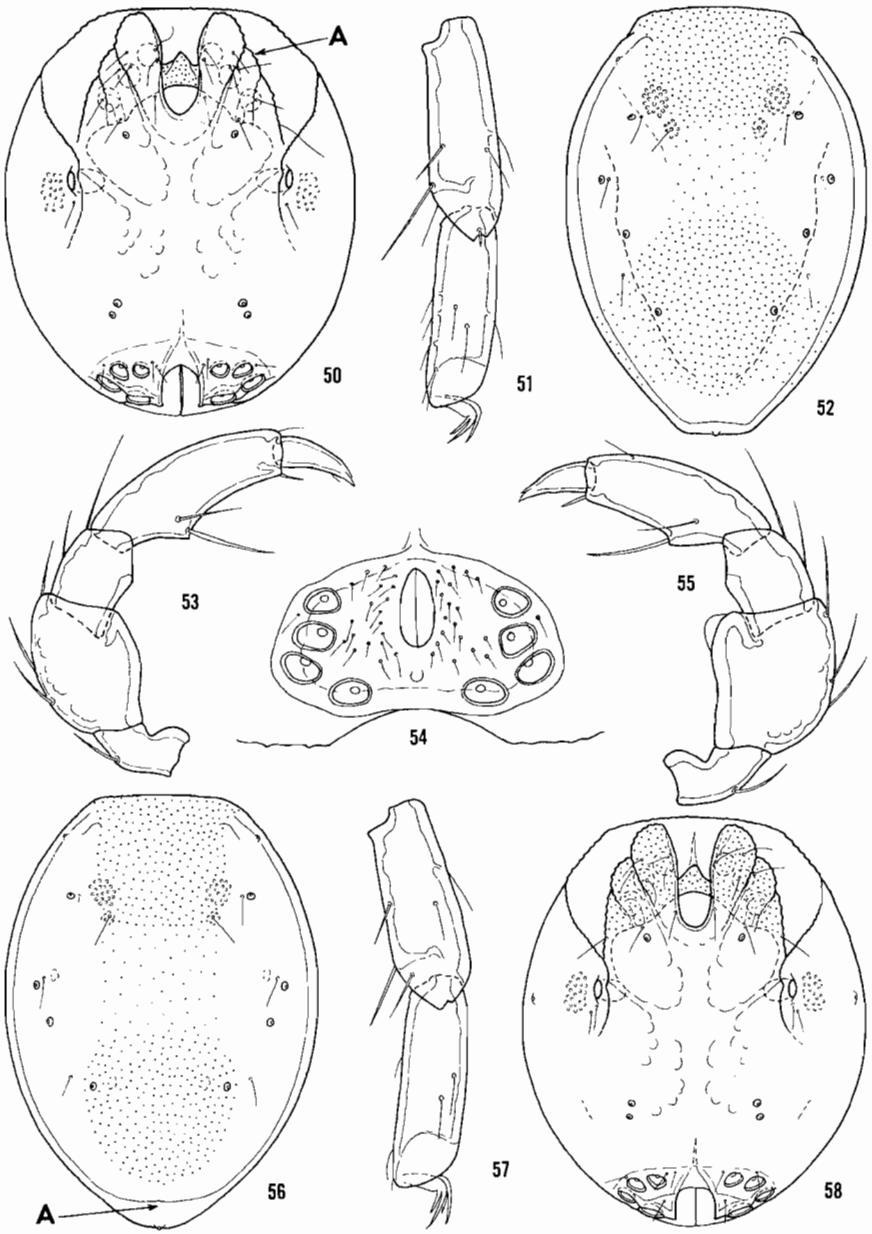


Axonopsis beltista n. sp. Fig. 32, ventral shield, male; Fig. 33, I-Leg-5 and 6, male; Fig. 34, dorsal shield, male; Fig. 36, palp, male.

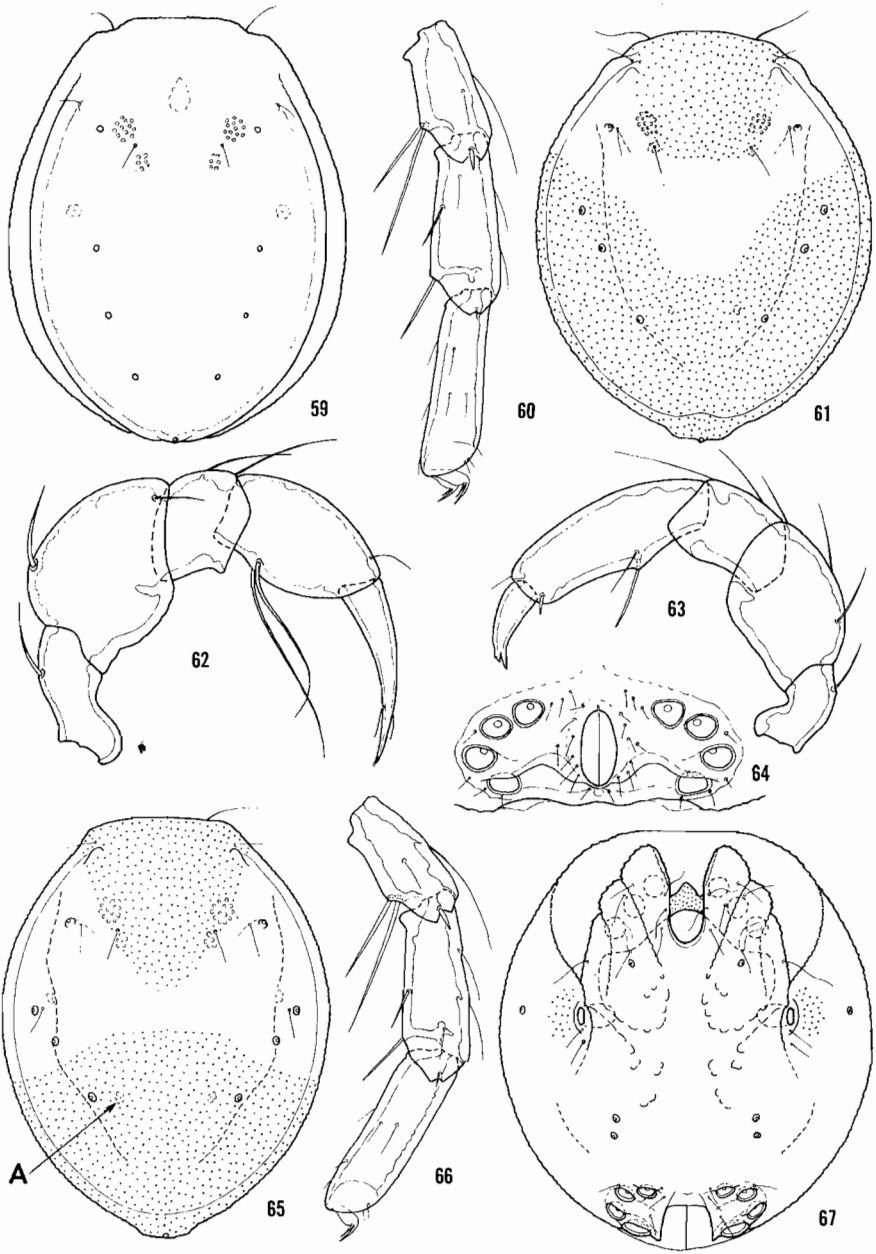
Axonopsis setonensis Habeeb. Fig. 35, palp, female; Fig. 37, posteroventral view of genital field, male; Fig. 38, dorsal shield, female; Fig. 39, I-Leg-5 and 6, female; Fig. 40, ventral shield, female.



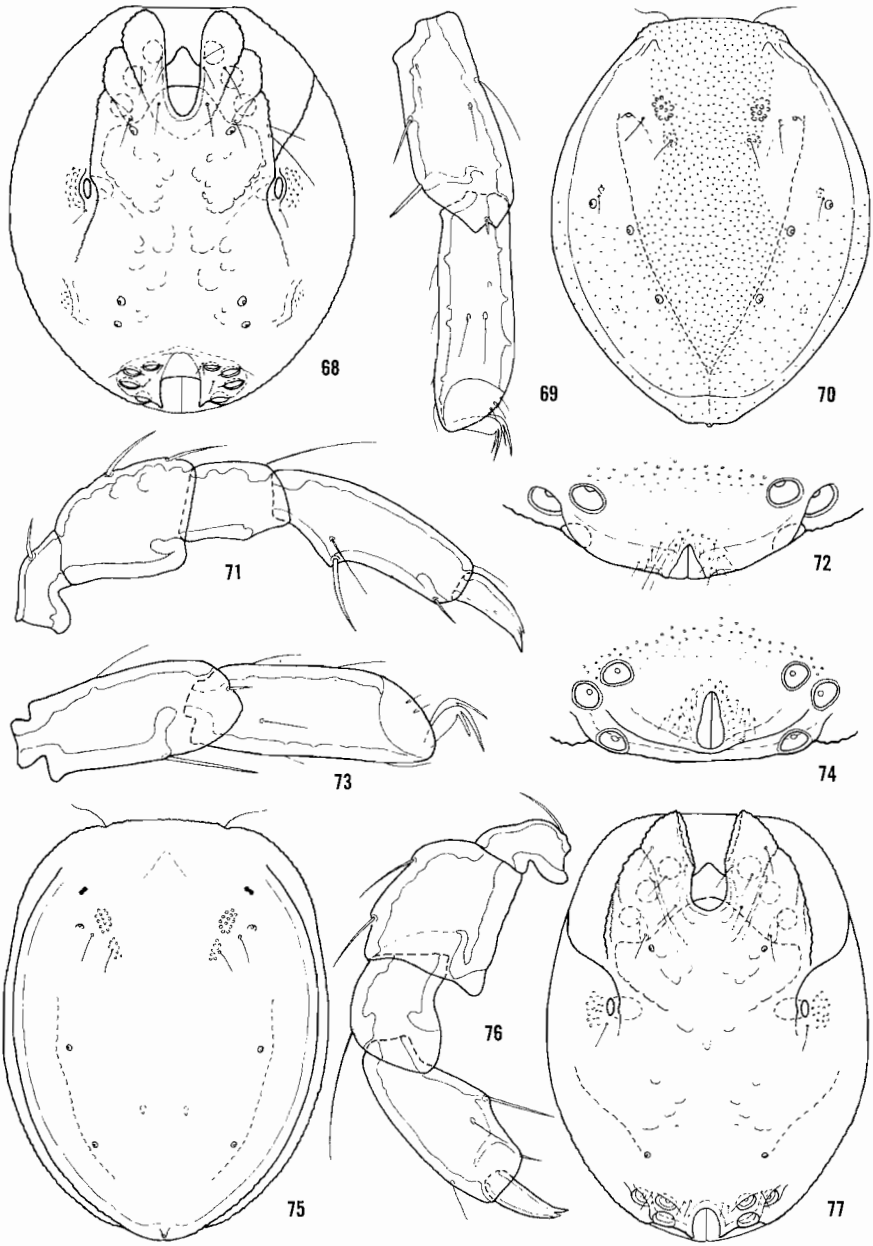
Axonopsis eremita n. sp. Fig. 41, ventral shield, female; Fig. 42, I-Leg-5 and 6, female; Fig. 43, Dorsal shield, female; Fig. 45, palp, female.
Axonopsis ohioensis Cook. Fig. 44, palp, female; Fig. 46, posteroventral view of genital field, male; Fig. 47, dorsal shield, female; Fig. 48, I-Leg-5 and 6, female; Fig. 49, ventral shield, female.



Axonopsis ozarkensis n. sp. Fig. 50, ventral shield, female; Fig. 51, I-Leg-5 and 6, female; Fig. 52, dorsal shield, female; Fig. 55, palp, female.
Axonopsis beltista n. sp. Fig. 54, posteroventral view of genital field, male.
Axonopsis arpeda n. sp. Fig. 53, palp, female; Fig. 56, dorsal shield, female; Fig. 57, I-Leg-5 and 6, female; Fig. 58, ventral shield, female.

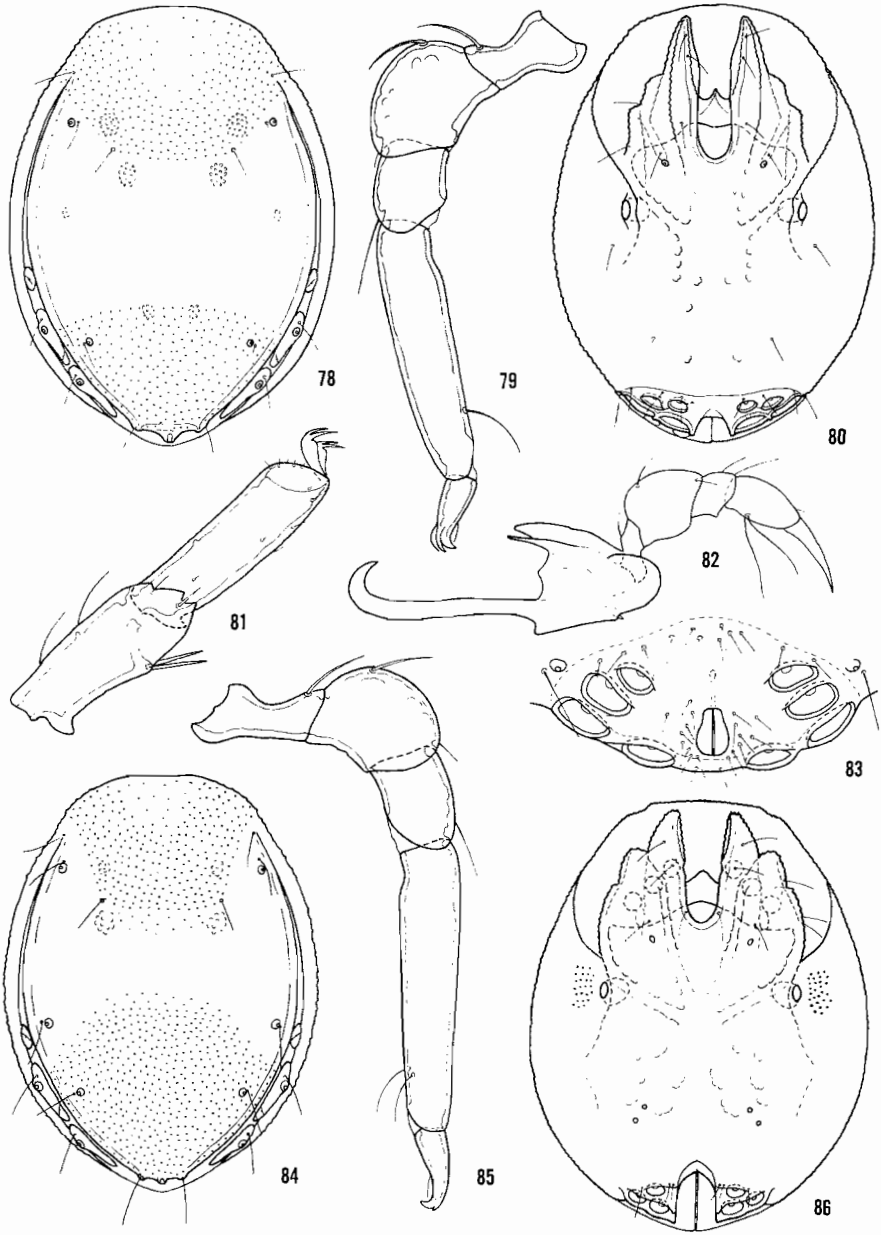


Axonopsis californica Cook. Fig. 59, dorsal view, female; Fig. 62, palp, male.
Axonopsis cullasaja Habeeb. Fig. 60, I-Leg-4, 5 and 6, female; Fig. 63, palp, female; Fig. 65, dorsal shield, female; Fig. 67, ventral shield, female.
Axonopsis floridensis n. sp. Fig. 61, dorsal shield, female; Fig. 64, posteroventral view of genital field, male; Fig. 66, I-Leg-4, 5 and 6, female.



Axonopsis gennada n. sp. Fig. 68, ventral shield, female; Fig. 69, I-Leg-5 and 6, female; Fig. 70, dorsal shield, female; Fig. 71, palp, female.

Axonopsis pumila n. sp. Fig. 72, ventral view of genital field, male; Fig. 73, I-Leg-5 and 6, male; Fig. 74, posteroventral view of genital field, male; Fig. 75, dorsal view, female; Fig. 76, palp, male; Fig. 77, ventral shield, female.



Axonopsis sabulonis n. sp. Fig. 78, dorsal view, female; Fig. 80, ventral shield, female; Fig. 81, I-Leg-5 and 6, male; Fig. 83, posteroventral view of genital field, male; Fig. 85, palp, female.
Axonopsis bimaculata Cook. Fig. 79, palp, male; Fig. 84, dorsal shield, male.
Axonopsis californica Cook. Fig. 82, lateral view of palp and capitulum, female; Fig. 86, ventral shield, female.