

SYSTEMATICS AND BIOLOGY OF THE GENUS *VEIGAIA*
(ACARINA : MESOSTIGMATA) FROM MARYLAND¹

BY

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Members of the genus *Veigaia* are among the commonest mites inhabiting litter and soil of deciduous forests in eastern United States. They are predacious upon Collembola and other small arthropods.

The genus was revised by FARRIER in 1957. FARRIER reported twelve species, five of them new, from North America. Nine of these species could be found in North Carolina. Paleozoic *Veigaia* have been treated by WILLMANN (1936), EVANS (1955), ATHIAS-HENRIOT (1961), BREGETOVA (1961) and SCHWEIZER (1961). The papers by FARRIER and BREGETOVA contain extensive bibliographies.

As a result of a study of ecological differences among closely related species of mites, ten species of *Veigaia* were found in central Maryland (HURLBUTT, 1964). Four of the species were new and are described in the present paper. Observations on the distribution and biology of *Veigaia* are also reported.

METHODS.

Most of the mites treated in this study were taken from deciduous forests adjacent to the Patuxent River. Samples used for recovering mites were subdivided into three subsamples. The top subsample (L & F) included that portion of the litter in which the components were over a centimeter in diameter. Below this a layer 2 1/2 cm. deep of amorphous organic material (the H-layer) was taken. The deepest subsample (A₁) extended about four centimeters below the bottom of the H-layer and usually consisted mostly of mineral soil.

Mites were reared in small open-end vials containing a substrate made of a mixture of nine parts plaster of Paris to one part deactivated charcoal (HUBERT,

1. Part of this investigation was carried out at the University of Maryland during the tenure of a Predoctoral Fellowship from the National Institutes of Health.

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1958). A high humidity in the vials was maintained by having the substrate in contact with wet paper towels. Living Collembola were used as a source of food.

The setae are named according to the system of HIRSCHMANN (1957, 1962). All measurements are in microns. Distances between setae are measured from the center of one seta to the center of the adjacent seta.

Holotypes will be deposited in the collection at the United States National Museum. In an earlier work (HURLBUTT, 1964) the four species here described as new were designated by the first letter of the specific name (*V. "L" = V. locha*, etc.).

DESCRIPTIONS OF SPECIES.

Veigaia partitus (Banks) n. comb.

Gamasus partitus BANKS, 1910. *Proc. Ent. Soc. Wash.* 12 : 4. (Falls Church, Va.; MCZ).
Cyrtolaelaps grandipes BERLESE, 1916. *Redia*, 12 : 298-299. (humus, "Columbia, N. A."; Berlese collection at Florence, Italy). New synonymy.
Veigaia grandipes FARRIER, 1957. *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 34-37.

Through the courtesy of Dr. H. LEVY of Harvard and Mr. D. JOHNSTON of the Ohio Agricultural Experiment Station, I was able to examine the slide bearing the cotypes of *Gamasus partitus*. Twenty-four specimens were mounted on a single slide. One of the specimens was remounted and designated as lectotype.

Lectotype female. Length of anterior dorsal shield 470 μ . Seta s1 lateral to r1. Slitlike pore medial to r1, rounded pore posterior to r1. Seta r5 200 μ , s7 80 μ , i5 46 μ . Posterior dorsal shield 250 μ long along midline, with thirteen pairs of setae. Arrangement of setae asymmetrical. Anteromedial setae (J2) 63 μ long, J2-J2 31 μ . T-shaped sclerotization between J2 and J2. Postero-medial setae 72 μ long.

V2 74 μ , V3 126 μ , other setae on ventral shield short (fig. 15). Medial projection of tectum Y-shaped, lateral projections with six teeth. Long seta on tibia 277 μ .

Overall length of idiosoma about 830 μ , width near middle about 520 μ .

Deutonymph. Anterior dorsal shield 350 μ long, with 19 pair of setae. Posterior edge of shield nearly straight, i5' to i5 90 μ . Seta z2 125 μ long, extending considerably past anterior margin of posterior dorsal shield. Posterior dorsal shield 140 μ long, with r1, r2 or r3 normal setae plus two minute setae. The number and arrangement of the setae on the posterior dorsal shield is often asymmetrical. Sternal shield 240 μ long, without conspicuous grooves. Punctiform organ with seven or eight pores.

Leg IV twice as long as idiosoma, tarsus IV 340 μ , tibia IV 185 μ long. Long seta on tibia IV 220 μ long.

Distribution and biology. *Veigaia partitus* is widely distributed in North America having been collected from Missouri, Wisconsin, Michigan, Ohio, West Virginia, Pennsylvania, Maryland, Virginia, North Carolina, Connecticut and Quebec.

V. partitus is a typical hemiedaphic species being darkly colored, longlegged and swift-moving. The idiosoma is relatively globose in shape. Some of the setae are very long, while others are greatly reduced in length. As might be expected on the basis of its structure, *V. partitus* occurred mainly in the L & F layer. Between September 4, 1959 and September 14, 1961, 267 *V. partitus* were collected from Patuxent Refuge. A total of 227 individuals were from the L & F layer, whereas 38 mites were from the H layer. Only two *V. partitus* were taken from the deepest layer, the A¹ subsample.

Protonymphs, deutonymphs and gravid females were collected at all times of the year. About three-quarters of the females were noticeably gravid. Some individuals contained more than one egg. The eggs were dark in color. Males of *V. partitus* have never been found, and it seems likely that this species reproduces parthenogenetically.

On September 6, 1962 a deutonymph of *V. partitus* was placed in a vial in order to observe its feeding behavior. Between October 25 and October 27 it transformed into an adult. On January 1, 1963 it was noted that the female was gravid and shortly afterwards an egg was laid. However, the egg never hatched and it could not be determined if it contained an embryo. A second egg was laid in March, but this also failed to hatch.

Distinguishing characteristics. The posterior dorsal shield of the deutonymph has less than eight pairs of setae. Posterior shield of female with anteromedial T-shaped sclerotization.

The female of *V. grandipes* illustrated by FARRIER (1957) has an extra small seta on the ventral shield. This seta is not present in the lectotype and is absent from most of the females of *V. partitus* from Patuxent Refuge. In one individual from Patuxent Refuge, however, an extra small seta is present on one side of the shield. FARRIER correctly described, but incorrectly illustrated the median tine of the tectum.

Veigaia bakeri Farrier.

Veigaia bakeri FARRIER, 1957, *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 23-27 (Holotype from Mocksville, N. C.).

Female (measurements based on specimens from Howard Co., Md.). Anterior dorsal shield 460-485 μ from ix to posterior end of incisions. Width at level of s7 420-460 μ , with 21 pairs of simple setae. Seta s1 less than half the length of i1. Seta i4 49-51 μ , very slender at tip. Posterior dorsal shield 250-295 μ long, with 20 pairs of setae. J2-J2 94-106 μ .

Sternal shield 175-185 μ along midline, anterior edge 34-40 μ from tritosternum. VI 49-54 μ , VI-VI 94-114 μ . Punctiform organ with ten pits. V2 46-53 μ , V3 43 μ .

Medial projection of tectum Y-shaped (fig. 14). Lateral projections without teeth. Chelicerae and palps as described by FARRIER (1957).

Tarsus I 200 μ , tarsus IV 300-335 μ , longest seta on tibia IV 177-195 μ .

Male (figs. 6-8). Idiosoma 700 μ long. Sternal shield 300 μ long, v2-v2 95 μ . Seta i1 80 μ , 3 X seta s1. Dorsal shield fused to peritremal and ventrianal shields. Punctiform organ behind coxa IV with ten pores.

Tectum as in figure 6. Moveable chela about 170 μ long, slightly curved distally. Apophysis on femur II saddle-shaped. Tibia II with stout spine next to distally pointing spur. Setae on legs I, III and IV normal.

Deutonymph. Anterior dorsal shield 450-580 μ from i1 to posterior tip, with 19 pairs of setae. Seta i1 2 1/2 \times s1, i3 3 \times s1. Distance from point midway between i5' and i5 1.4 times distance from i5' to i5. Latter distance 77 μ . Posterior dorsal shield with eleven pairs of setae, 80 μ long along midline. Sternal shield without ornamentation.

Tectum as in female. Penultimate segment of chelicera 330-350 μ long. Leg IV (omitting pretarsus) 1.6 \times idiosoma. Tarsus IV 265 μ , tibia IV 150 μ . Long seta on tibia IV 170 μ long.

Distribution. FARRIER (1957) recorded *V. bakeri* from several localities in western North Carolina. In Maryland *V. bakeri* has been collected from a single locality in the extreme northwestern corner of Prince Georges Co., from several localities in Montgomery and Howard counties, near Catoctin Furnace (Frederick Co.) and near Flintstone (Alleghany Co.). Other new records are from Robbinsville, N. C. by J. GREGORY; Comers Rock, Virginia by W. MOSS; Morgantown, Cheat Lake, Terra Alta and Cranestown in West Virginia; and Laurel Hill State Park, Pennsylvania.

V. bakeri occurs in the L & F and H layers. Gravid females have been taken during March, April and May. Nymphs have been found throughout the year.

Distinguishing characteristics. Seta s1 less than half the length of i1, lateral tines of tectum not serrate in females and nymphs, chelicerae long and slender (over 650 μ in female). Apophysis of femur II of male saddle-shaped (fig. 8).

Veigaia locha n. sp.

Holotype female (figs. 1-2, 13). Anterior dorsal shield 445 μ long from i1 to posterior end of incisions. Width at level of s7 445 μ . Twenty-one pairs of simple setae on anterior shield. Seta i1 80 μ , s1 63 μ , i2 94 μ , i3 89 μ , i4 43 μ ,

z2 89 μ , r5 140 μ , z3 66 μ , s7 63 μ . Posterior dorsal shield 240 μ long, with twenty pairs of setae. J2-J2 86 μ .

Sternal shield 155 μ long along midline, anterior edge 40 μ from tritosternum. Distance from v2 to v2 106 μ . Postgenital seta (VI) 46 μ long, VI-VI 80 μ . Punctiform organ with eight pits. Posterior part of ventral shield 132 μ long along midline, with six pairs of setae. V7 21 μ , V2 48 μ , V3 52 μ . Anal shield with five simple setae.

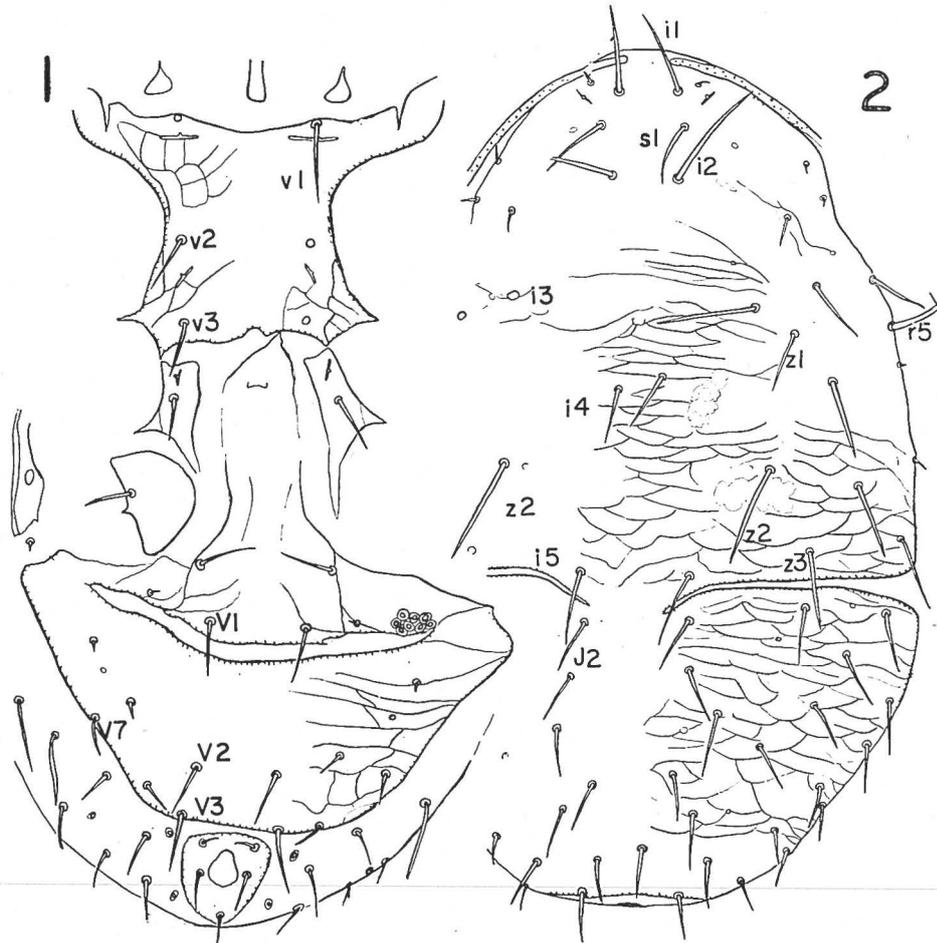


FIG. 1-2. — *Veigaia locha*, holotype ♀. 1. ventral, 2. dorsal.

Medial projection of tectum Y-shaped, jagged. Lateral projections each with about five teeth.

Chelicerae very long and slender. Penultimate segment 400 μ long, distance from dorsal fissure to tip of chela 163 μ . Fixed chela with small tooth anterior to notch, larger tooth 86 μ posterior to notch. Moveable chela 209 μ long from tip to most posterior part, with two low teeth distally.

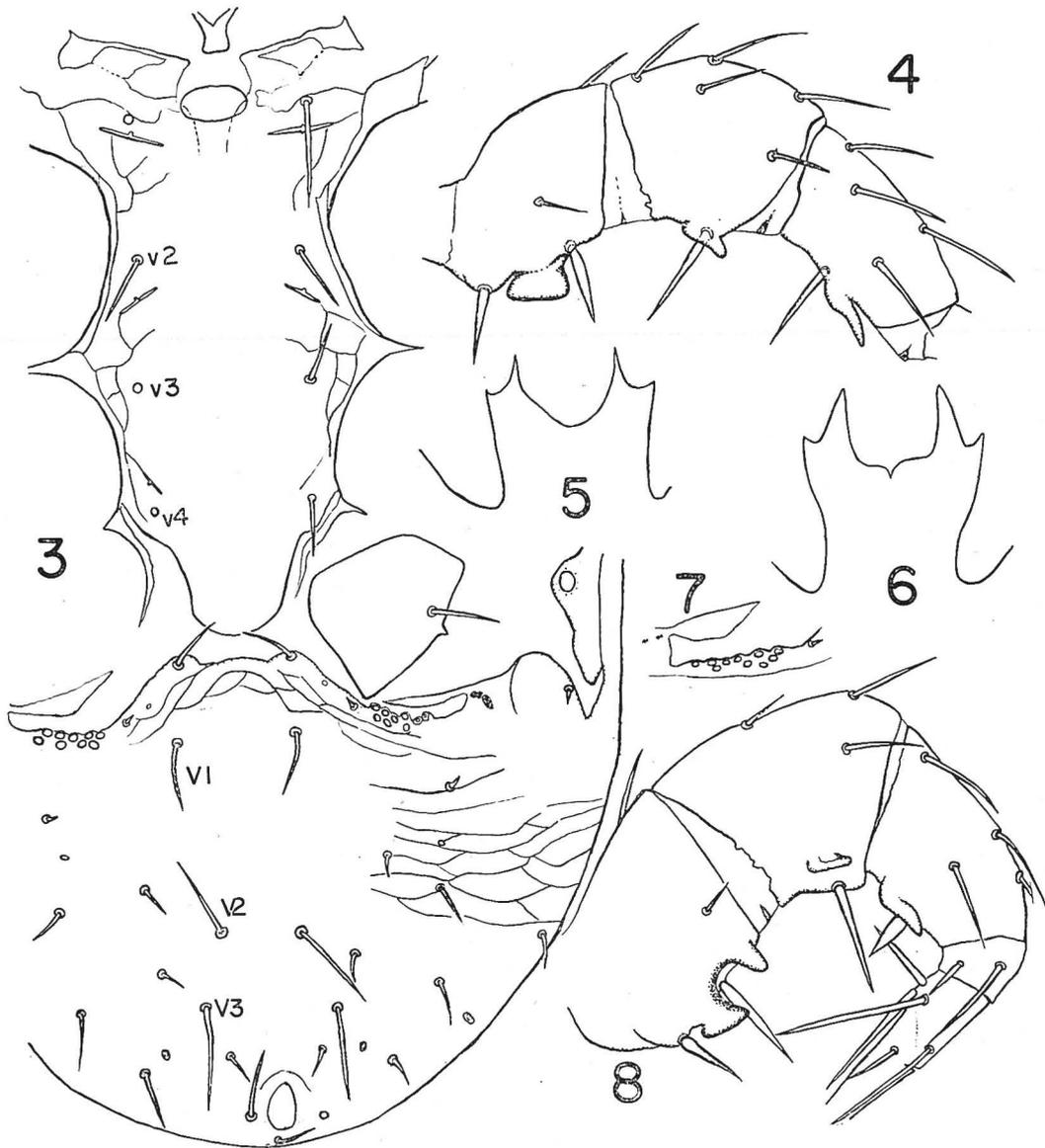


FIG. 3-5. — *V. locha*, ♂♂ from Patuxent Refuge (Bowie), Maryland.
3. ventral, 4. leg II (femur, genu and tibia), 5. tectum.

FIG. 6-8. — *V. bakeri*, ♂♂. 6. tectum, Triadelphia Lake, Md.;
7. punctiform organ, Morgantown, W. Va.; 8. leg II, Howard Co., Md.

Anteromedial seta of palp genu with three prongs, posteromedial seta with 8 prongs directed perpendicular to axis of seta. Medial seta on palp femur widened and serrate distally.

Tarsus I 187 μ , tarsus IV 295 μ , longest seta on tibia IV 172 μ .

Overall length of idiosoma 730 μ .

The type female was collected Nov. 19, 1960 from deciduous litter, Patuxent Wildlife Refuge, Maryland.

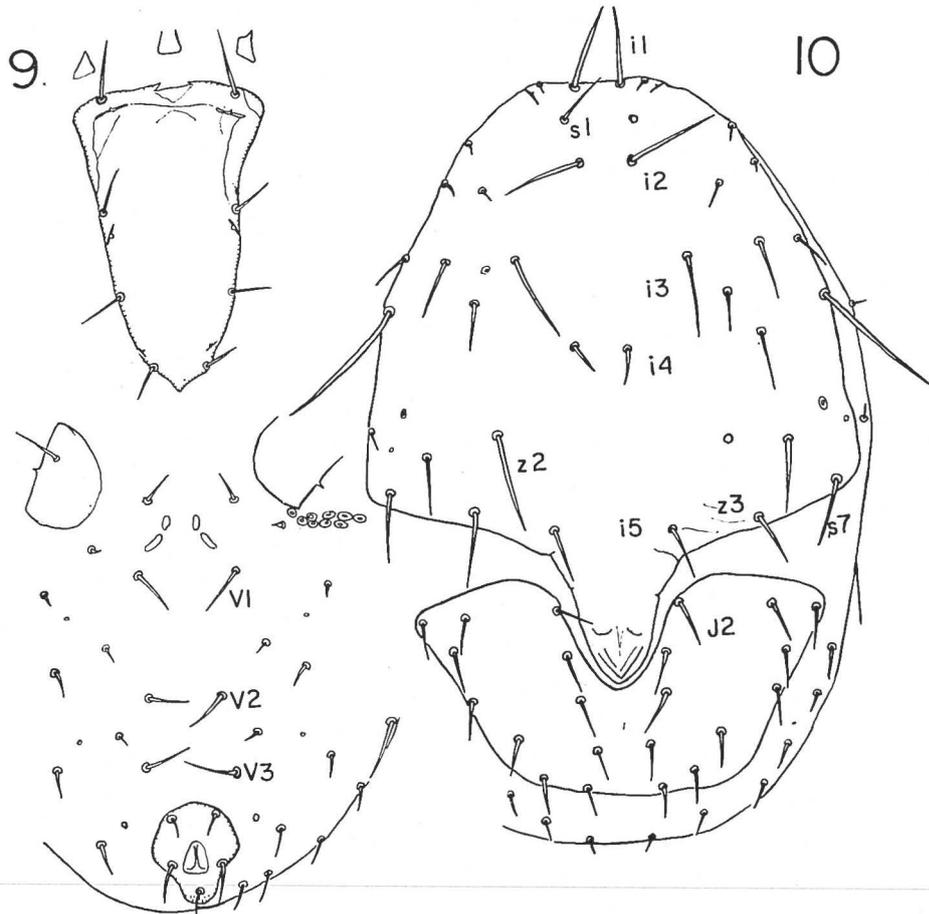


FIG. 9-10. — *V. locha*, deutonymph. 9. ventral, 10. dorsal.

Male (figs. 3-5). Idiosoma 590-640 μ long. Sternal shield 270-280 μ long, v2-v2 83-90 μ . Seta i1 72 μ , less than 1 1/2 times as long as s1. Dorsal shield fused to peritremal and ventrianal shields. Punctiform organ behind coxa IV with nine or ten pores.

Tectum with a deep, concave indentation medially (fig. 5). Moveable chela 140 μ long. Spermatophorentrager L-shaped, distal end bent at 90° angle from

long axis. Distance from end of fixed digit to end of spermatophoretrager 67-73 μ . Setae on legs I, III and IV normal. Hypostome with 10 rows of deutosternal teeth, 5 rows with denticles.

Deutonymph (figs. 9-10). Anterior dorsal shield 415-470 μ long, with 19 pairs of setae. Distance from point midway between 15' and 15 to posterior tip of anterior shield 1.2 to 1.6 times greater than distance from 15' to 15. Latter distance 70-90 μ . Posterior dorsal shield with eleven pairs of setae, 60-82 μ along midline. Middle part of sternal shield without conspicuous grooves. Punctiform organ with nine pores.

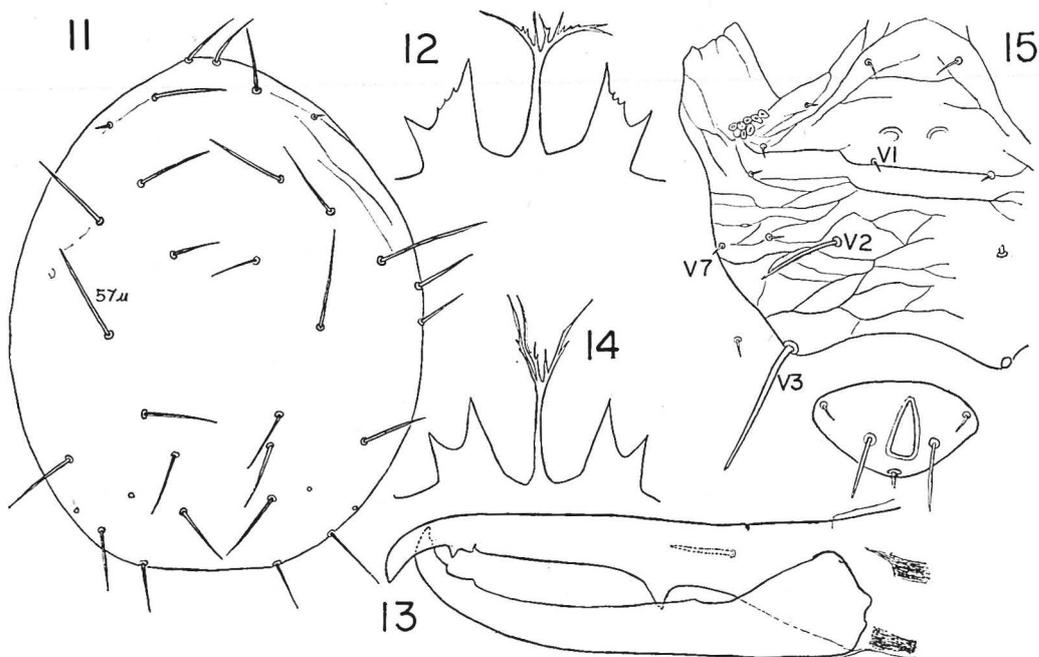


FIG. 11-13. — *V. locha*. 11. reared larva ; 12. tectum, ♀ ; 13. chelicera, holotype ♀.
FIG. 14. — *V. bakeri*, ♀ tectum. FIG. 15. — *V. partitus*, lectotype ♀.

Other stages. Protonymphs were found throughout the year. A reared larva is shown in fig. 11.

Distribution and biology. At Patuxent Refuge *V. locha* was the second most numerous species of *Veigaia* in terms of numbers of individuals. The majority of *V. locha* were recovered from the L & F layer. It was almost never found in the bottom subsample.

Females containing eggs were observed from February until the middle of November. Eggs were obtained from females collected in February, April, May, August and September. Males and nymphs were taken at all times of the year.

Attempts to rear *Veigaia locha* in the laboratory were only partially successful.

Females readily laid eggs, but frequently the eggs did not hatch. As many as seven eggs were laid by a single individual. The eggs were not laid in batches, but were usually laid at least a day apart. In one case, however, the female repeatedly returned to the same bit of bark to lay its egg. In two instances eggs kept at 11° C failed to hatch until removed to room temperature (26° C). Then hatching followed within 24 hours. The length of the larval stage was usually about one day. In only one instance was it possible to rear *V. locha* past the protonymphal stage. On February 22, 1960 an egg was produced by a female collected February 13. On March 2 a protonymph was observed, and between one and two weeks later the deutonymph appeared.

Veigaia locha has been collected in several localities in central Maryland. It has never been found in localities yielding *V. bakeri*. A single *V. locha* was collected one mile east of Welcome, Charles Co., Maryland.

Distinguishing characteristics. *V. locha* keys out to *V. bakeri* in the key of FARRIER (1957). Deutonymphs and adults of *V. locha* can be distinguished from those of *V. bakeri*, because in the latter seta *sr* is less than half the length of *ir*, whereas in *V. locha* the ratio of *sr* divided by *ir* varies from .70 to .83. The lateral tines of the tectum of deutonymphs and females of *V. locha* are serrate (fig. 12); those of *V. bakeri* are smooth (fig. 14). In both species the chelicerae are long and slender, the two teeth on the fixed chela are very low and reduced, and the dorsal fissure is situated several microns anterior to the base of the moveable chela. The total length of the female chelicerae varies from 655-690 μ in *V. bakeri* and from 615-640 μ in *V. locha*. There is a small but definite tooth on the basal third of the moveable chela of *V. bakeri*. Such a tooth is reduced or lacking in *V. locha*.

Males of the two species are contrasted in figs. 4-8. Additional differences based on measurements of females from central Maryland are given below.

	<i>sr</i>	<i>ir</i>	<i>is</i>	<i>z2</i>	<i>z3</i>	moveable chela
<i>V. bakeri</i> (N = 6)	30-46	100-114	97-114	106-112	43-49	220-235
<i>V. locha</i> (N = 14)	51-71	86-94	83-93	83-89	54-66	197-215

Veigaia mitis (Berlese).

Cyrtolaelaps mitis BERLESE, 1916. *Redia*, 12 : 300. (humus, "Columbia, N. A."; Berlese collection at Florence, Italy).
Veigaia mitis FARRIER, 1957. *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 52-56.

MR. D. JOHNSTON has examined the type of *V. mitis* for me. He reports (in litt.) that the type specimen is somewhat shrunken and obscured by debris, but that the genual setae seem to resemble Farrier's drawing. The length of the idiosoma of the type female is 508 μ . Females from Maryland range from 500-530 μ .

FARRIER recorded *V. mitis* from Ohio, New Hampshire and North Carolina. In Maryland it is common in the H-layer and in the L & F layer. It has also been collected from *Tsuga canadensis* mor, Morgan Arboretum, Quebec by V. MARSHALL and deciduous litter from Connecticut, Pennsylvania, West Virginia, Virginia and Tennessee.

Gravid females were found from March until October. Deutonymphs were taken in small numbers from May until January. A female collected March 1, 1962 produced a larva on March 30. A female collected May 2, 1960 produced a larva on May 10.

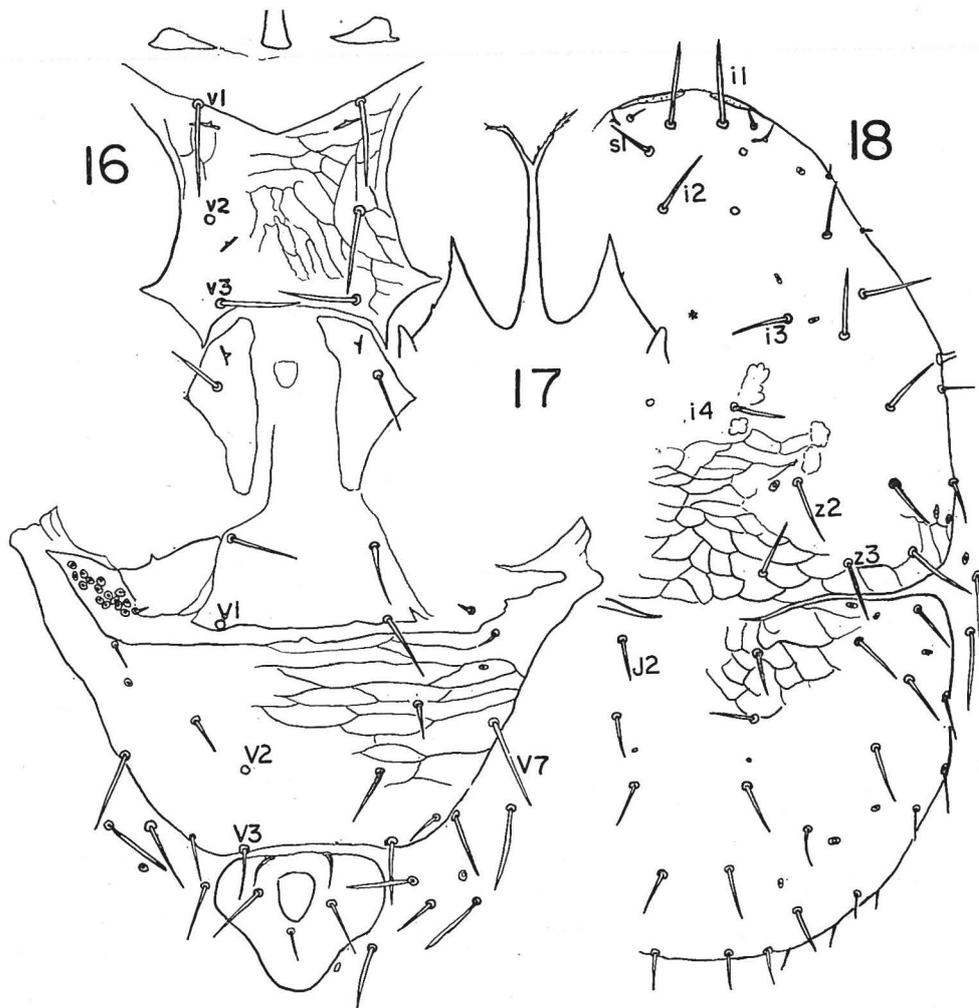


FIG. 16-18. — *V. nodosa*, holotype ♀. 16. ventral, 17. tectum, 18. dorsal.

Veigaia nodosa n. sp.

Holotype female (figs. 16-18, 44). Anterior dorsal shield 515 μ long from i1 to posterior end of incisions. Width at level of s7 440 μ . Twenty pairs of setae on anterior shield, r5 slightly pilose, other dorsal setae simple. Seta i1 86 μ , s1 70 μ , i2 70 μ , i3 60 μ , i4 50 μ . z2 60 μ , r5 95 μ . Posterior dorsal shield 360 μ long, with eighteen pairs of setae. J2-J2 145 μ .

Sternal shield 130 μ long along midline, anterior edge of shield 83 μ from tritosternum. Distance from v2 to v2 120 μ , v3-v3 115 μ . Postgenital seta 57 μ long, V1-V1 140 μ . Punctiform organ with fifteen pits. Posterior part of ventral shield 180 μ long along midline, not fused to epigynial shield, with six pairs of setae. V7 69 μ , V2 45 μ , V3 about 50 μ . Anal shield with five simple setae.

Medial projection of tectum Y-shaped, lateral projections each with one tooth laterally.

Penultimate segment of chelicera 390 μ long, distance from dorsal fissure to tip of chela 150 μ . Arrangement of teeth on fixed chela as in fig. 44, bladeliike projection behind notch, basal half of chela with tooth. Moveable chela 180 μ long from tip to most posterior part, with two teeth, more distal tooth 20 μ from end of digit.

Anteromedial seta of palp genu with three prongs, posteromedial seta with 8 prongs directed perpendicular to axis of seta. Medial seta on palp femur widened and serrate distally.

Tarsus I 215 μ , tarsus IV 300 μ , longest seta on tibia IV 160 μ , pilose distally. Overall length of idiosoma 920 μ .

The type female was collected Nov. 19, 1960 from deciduous litter, Patuxent Wildlife Refuge, Maryland.

Male (figs. 19-20 40-41). Idiosoma 840-870 μ long. Sternal shield 315-325 μ long, v2-v2 120 μ . Dorsal shield fused to peritremal and ventrianal shields. Punctiform organ behind coxa IV with 16 to 18 pores.

Tectum as illustrated. Distance from end of fixed digit to end of spermatophoretrager about 135 μ . Medial surface of femur I with two conspicuous seta-bearing humps. Anteroventral seta of basitarsus IV stout, enlarged basally.

Deutonymph (fig. 21). Anterior dorsal shield 420-450 μ long, with pairs of setae. Distance from point midway between i5' and i5 to posterior tip of anterior shield less than distance from i5' to i5. Latter distance 94-100 μ . Seta r5 72-80 μ long. Posterior dorsal shield with eleven pairs of setae. Anterior margin of posterior dorsal shield slightly concave, 110 to 137 μ long along midline. Middle part of sternal shield without conspicuous grooves. Punctiform organ with 15 to 19 pores.

Distribution and biology. At Patuxent Refuge nymphs were found primarily in the two lower subsamples, the H and A₁ layers (see table 1). Adults occurred in all three layers.

Veigaia nodosa evidently has a single generation per year in central Maryland. Adults first appeared in late November (see fig. 22). On Nov. 17, 1959 eight

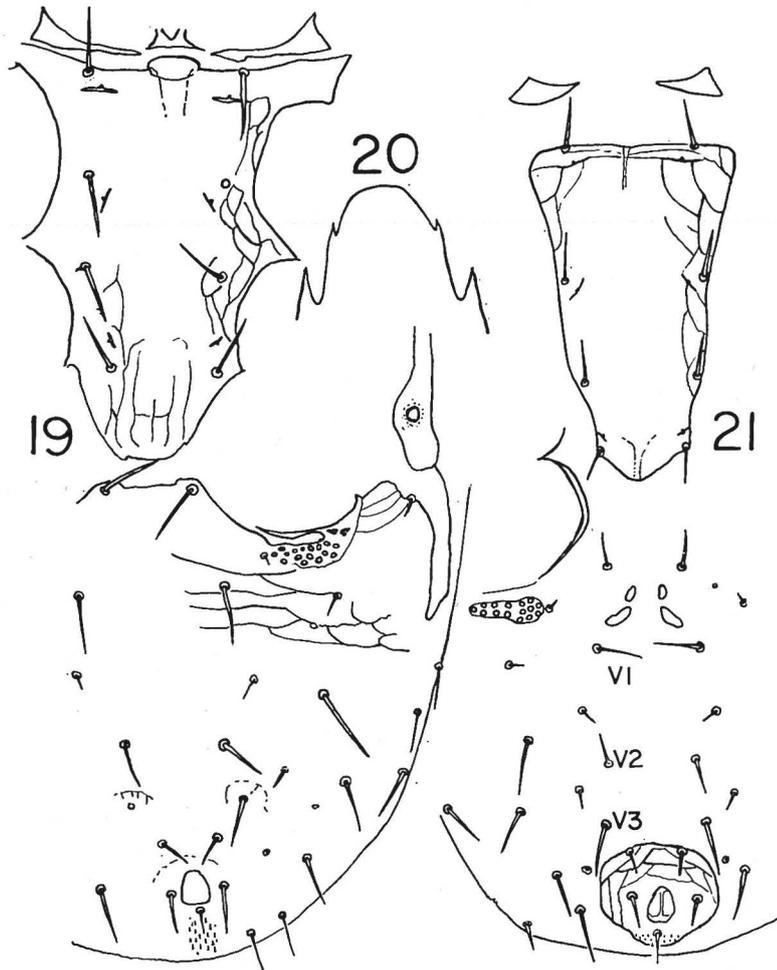


FIG. 19-20. — *V. nodosa*, ♂ from Patuxent Refuge, Md. 19. ventral, 20. tectum.
FIG. 21. — *V. nodosa*, deutonymph.

deutonymphs were collected, but the exoskeleton of an adult male was visible within one of these. On November 19, 1960 one deutonymph and fourteen adults were found. One of the adults was a female to which the deutonymphal exoskeleton was still attached. In December deutonymphs were no longer found, but males and females were present. The first females to appear were not detectably

gravid. By early January the outline of an egg was visible within some of the females. Larvae were never collected, but protonymphs first appeared in late April. During May both protonymphs and deutonymphs were taken. From June until early November only deutonymphs were recovered. Adults were never found during this period.

TABLE I. — Vertical distribution of *Veigaia nodosa* and *V. alba* at Patuxent Refuge, Maryland, Nov. 17, 1959 to Sept. 14, 1961.

Layer	<i>V. nodosa</i>			<i>V. alba</i>		
	Adults	Nymphs	Total	Adults	Nymphs	Total
L & F	69	20	89	8	0	8
H	67	136	203	28	9	37
A ₁	20	41	61	30	23	53
TOTAL	156	197	353	66	32	98

Two females of *V. nodosa* collected from Howard County, Maryland on Feb. 22, 1962 were placed in vials in a refrigerator set at 10° C. On Feb. 25 one of the females produced an egg. The other female laid two eggs between March 9 and March 12. When mounted on March 19 it contained two unlaidd eggs. None of the eggs hatched. One individual collected as a protonymph May 7, 1962, was kept alive for over a year. It transformed from a deutonymph into an adult female on January 15, 1963.

V. nodosa has been found only in central Maryland.

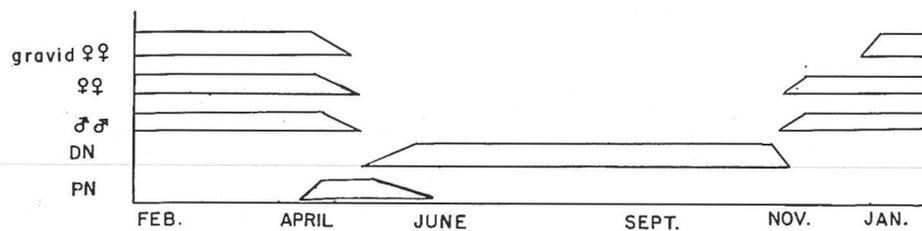


FIG. 22. — Seasonal succession of developmental stages of *Veigaia nodosa* in central Maryland.

Distinguishing characteristics. The male is easily recognized by the presence of seta-bearing humps on femur I.

Veigaia piliseta Farrier (figs. 23-26, 45).

Veigaia piliseta FARRIER, 1957. *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 56-62. (in leaf mold, Yates Pond, N. C.; USNM).

The type female was examined and compared with material from Maryland (table 2). Seta V \times 8 is present in the type. Deutonymphs and adults are easily recognized by the presence of strongly pilose preanal setae. The ornamentation

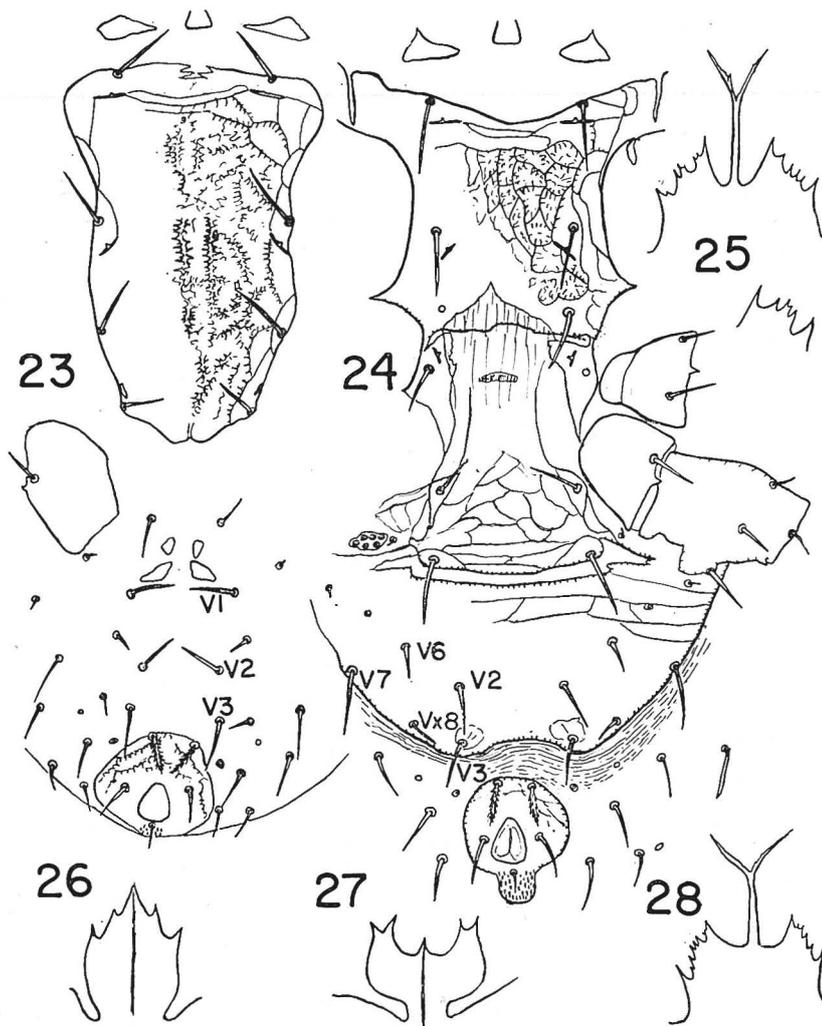


FIG. 23-26. — *V. piliseta* from Patuxent Refuge, Md. 23. deutonymph, ventral. 24. ♀, ventral. 25. ♀, tectum. 26. ♂, tectum.

FIG. 27-28. — *V. alba*. 27. ♂, tectum. 28. holotype ♀, tectum.

of the sternal shield is also characteristic (fig. 23-24). The form of the male tectum differs somewhat from that illustrated by FARRIER (1957).

V. piliseta was the most abundant species of *Veigaia* occurring in a study plot at Patuxent Wildlife Refuge Md. It was common in both the L & F and H layers, and was occasionally found in the A₁ layer. It has also been collected from forests in Montgomery, Howard, Frederick and Alleghany counties.

Protonymphs, deutonymphs and adults were found at all times of the year. Gravid females were plentiful from early March until November. During two successive winters over one hundred females were collected during December and January. With the exception of four females taken January 28, 1961, none was noticeably gravid.

In the laboratory *V. piliseta* was offered several kinds of Collembola. *Folsomia*, *Isotoma* and small *Onychiurus* were killed and eaten. Larger *Onychiurus* were probed but not killed.

Veigaia dendritica n. sp.

Holotype female (figs. 29-31, 46). Anterior dorsal shield 400 μ long from i1 to posterior end of incisions. Width at level of s7 315 μ . Twenty pairs of setae on anterior shield, 15 pilose, other dorsal setae simple or faintly pilose. Seta i1 60 μ , s1 50 μ , i2 50 μ , i3 47 μ , i4 40 μ , z2 50 μ , r5 66 μ . Posterior dorsal shield 240 μ long, with eighteen pairs of setae. J2-J2 123 μ .

Seta v1 situated on anterior margin of sternal shield. Tritosternum 34 μ from anterior edge of shield. Length of sternal shield along midline 157 μ . Distance from v2 to v2 94 μ , v3-v3 100 μ . Sternal shield ornamented with branching longitudinal grooves (fig. 30). Postgenital seta 35 μ long, V1-V1 97 μ . Ventral shield fused to epigynial shield lateral to V1, not fused to peritrematal plate. Punctiform organ with seven pits. Posterior part of ventral shield 105 μ long, with six setae on one side, five on the other. (Most specimens have six pairs of setae). V7 46 μ , V2 31 μ , V3 34 μ long. Anal shield with five simple setae.

Tectum as in fig. 31.

Penultimate segment of chelicera (fig. 46) 295 μ long, distance from base of segment to dorsal fissure 190 μ , distance from dorsal fissure to tip of chela 103 μ . Arrangement of teeth as in *V. alba*. Moveable chela 120 μ long from tip to most posterior part, distal tooth 11 μ from end of digit.

Anteromedial seta of palp genu with three prongs, posteromedial seta with 8 prongs directed perpendicular to axis of seta. Medial seta on palp femur widened and serrate distally.

Tarsus I 160 μ long, tarsus IV 215 μ , longest seta on tibia IV 100 μ , slightly pilose distally.

Overall length of idiosoma 650 μ .

The type female was collected from the H-layer of a deciduous forest near Old Gunpowder Road, 3 miles southwest of Laurel, Maryland.

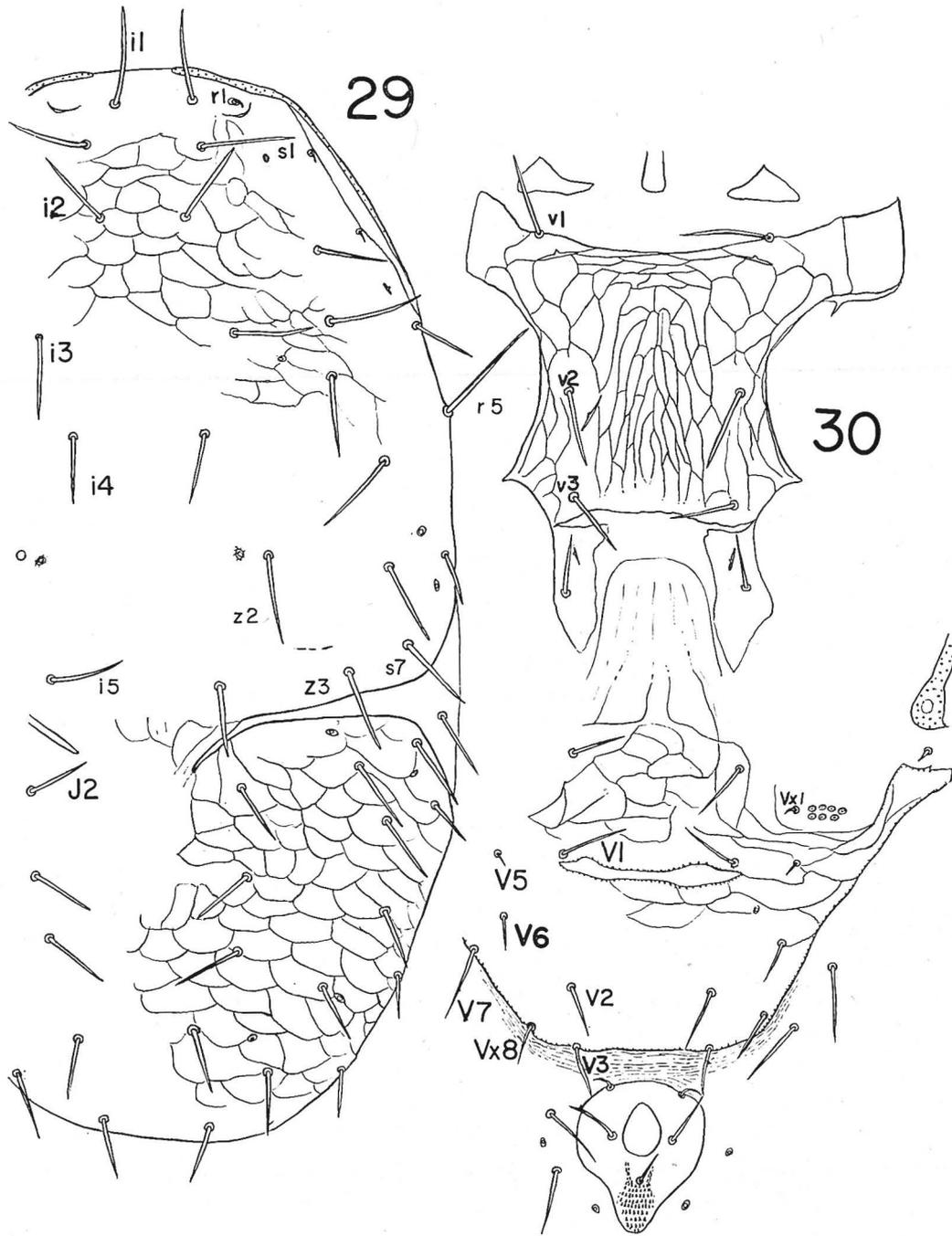


FIG. 29-30. — *V. dentritica*, holotype ♀. 29. dorsal, 30. ventral.

TABLE 2. — *Veigaia piliseta* and related species.

	<i>V. piliseta</i>		<i>dendritica</i>	<i>alba</i>	<i>smithi</i>
	type	Maryland	Maryland	Maryland	type
ADS, length	—	370-405	365-415	335-380	425
PDS, length	—	190-230	210-245	170-185	230
s7-s7	340	305-335	310-323	265-280	—
i1	60	52-61	57-62	50-55	56
s1/i1	.86	.89-1.02	.73-.82	.86-.96	.93
i2	51	45-52	46-50	41-49	49
i3	45	46-54	43-47	44-48	46
z2	50	46-51	46-50	41-48	43
r5	—	66-77	60-67	49-59	—
z2-z3	—	80-89	83-93	71-81	—
sternal shield ¹	143	130-150	143-157	117-123	140
ventrianal ¹	112	94-112	103-115	80-92	100
chelicera ²	—	450-470	425-445	390-430	—
digitus mobilis	—	117-123	112-120	110-115	—
tarsus IV ³	—	205-225	205-217	160-177	215

1. Length along midline.
2. Distance from base of basal segment to tip of fixed digit.
3. Including basitarsus but not pretarsus.

Male (figs. 32-33). Idiosoma 630-650 μ long. Sternal shield 255-265 μ long, ornamented with branching, longitudinal grooves, v2-v2 92-98 μ . Ventrianal shield not joined to peritrematal or dorsal shields, with ten pairs of simple setae. Punctiform organ usually with seven pores.

Tectum as illustrated. Distance from end of fixed digit to end of spermatophoretrager about 90 μ .

Deutonymph (fig. 34). Anterior dorsal shield 350-360 μ long, with twenty pairs of setae. Distance from point midway between i5' and i5 to posterior tip of anterior dorsal shield equal to or less than distance from i5' to i5. Latter distance 80 μ . Posterior dorsal shield deeply indented, ornamented as in *V. alba*, 90-105 μ long along midline. Ventral surface as illustrated. The single pair of platelets behind the genital setae are often indented near the middle.

Distribution. *V. dendritica* appeared to be rare in the study plot at Patuxent Refuge. Over 100 samples were collected, but only five yielded *V. dendritica*. In two localities near the Prince Georges-Montgomery county boundary *V. dendritica* was the most abundant species of its genus. It has also been collected from Ashton, Md. and near Harper's Ferry road, Washington Co., Md. Over 90 % of

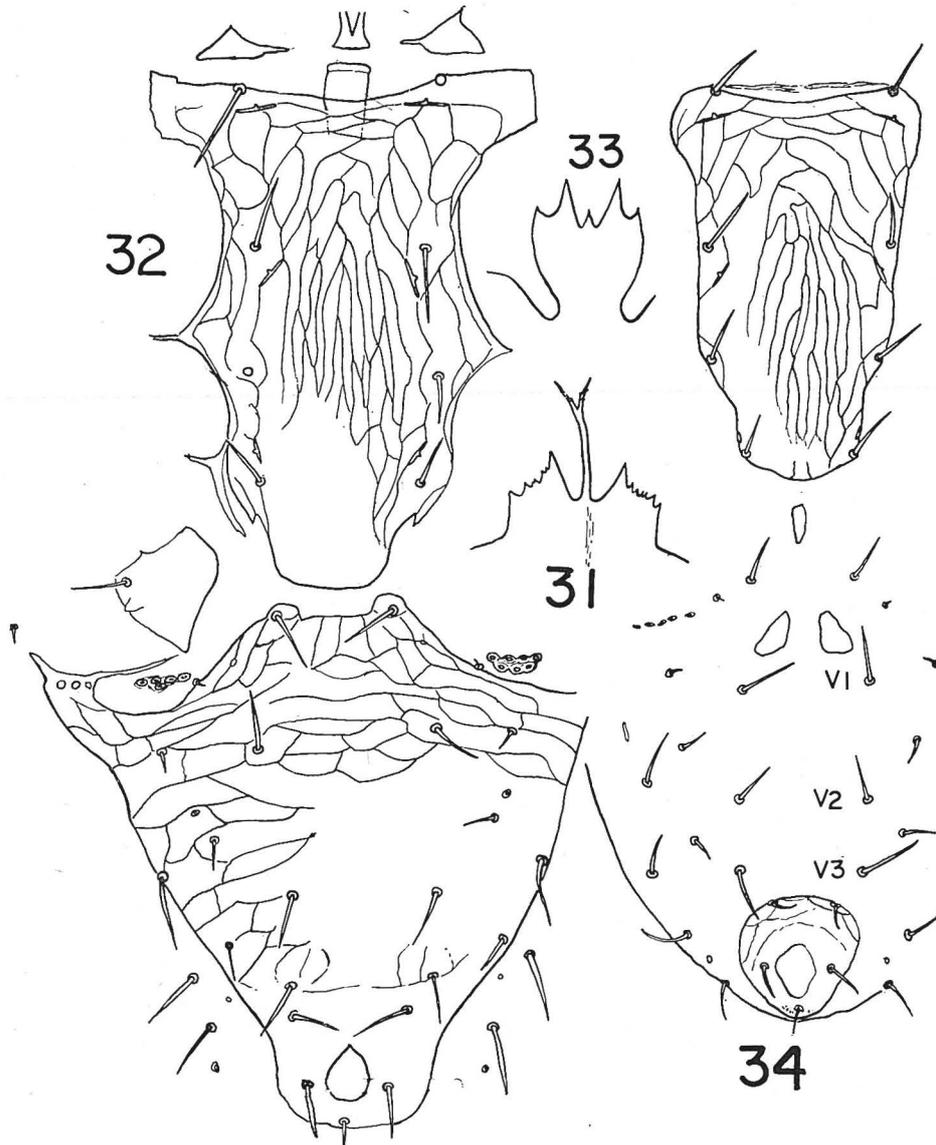


FIG. 31-34. — *V. dendritica*. 31. holotype ♀, tectum. 32. ♂, ventral.
33. ♂, tectum. 34. deutonymph, ventral.

the *V. dendritica* recovered were taken from the H and A₁ layers. Males, females and deutonymphs were collected from January to August. Inadequate sampling is probably responsible for their absence at other times of the year.

Distinguishing characteristics. The ornamentation of the adult and deutonymphal sternal shield is characteristic. The preanal setae are simple, and there

is no basal tooth on the fixed digit. The male is unusual in that the ventrianal shield is not fused to the peritrematal or dorsal shields.

Veigaia alba n. sp.

Holotype female (figs. 28, 35-36, 47). Anterior dorsal shield 350 μ long, from *ix* to posterior end of incisions. Width at level of *s7* 275 μ . Twenty pairs of setae

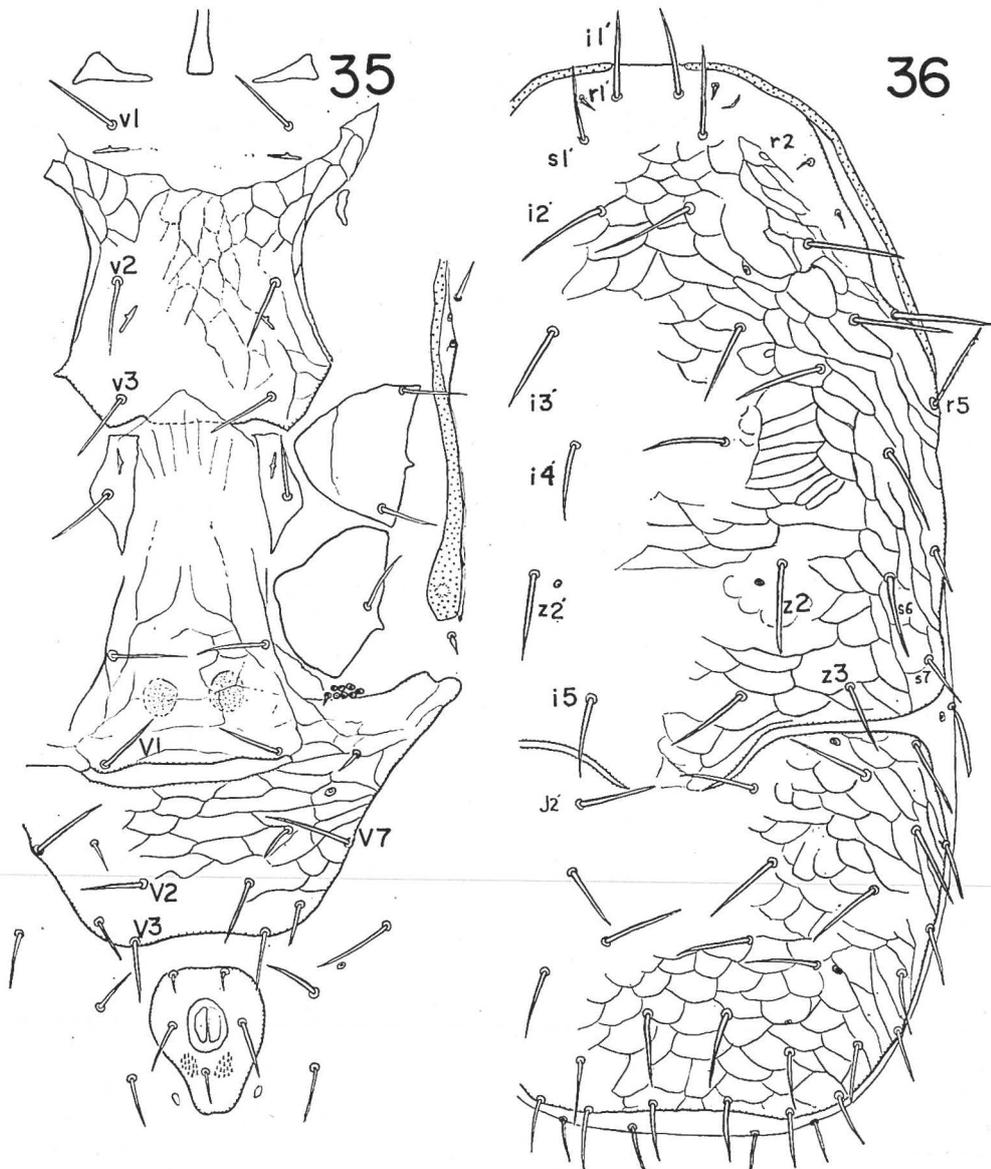


FIG. 35-36. — *V. alba*, holotype ♀. 35. ventral, 36. dorsal.

on anterior shield, r5 pilose, other dorsal setae simple. Seta i1 53 μ , s1 49 μ , i2 48 μ , i3 45 μ , i4 40 μ , z2 44 μ , r5 54 μ long. Posterior dorsal shield 170 μ long, with 18 pairs of setae. J2-J2 88 μ .

Setae v1 and first sternal pores situated on membrane. Tritosternum 66 μ from anterior edge of sternal shield. Length of sternal shield along midline 123 μ . Distance from v2 to v2 80 μ , v3-v3 80 μ . V1 37 μ long, V1-V1 93 μ . Ventral shield fused to epigynial shield lateral to V1, not fused to peritrematal plate. Punc-

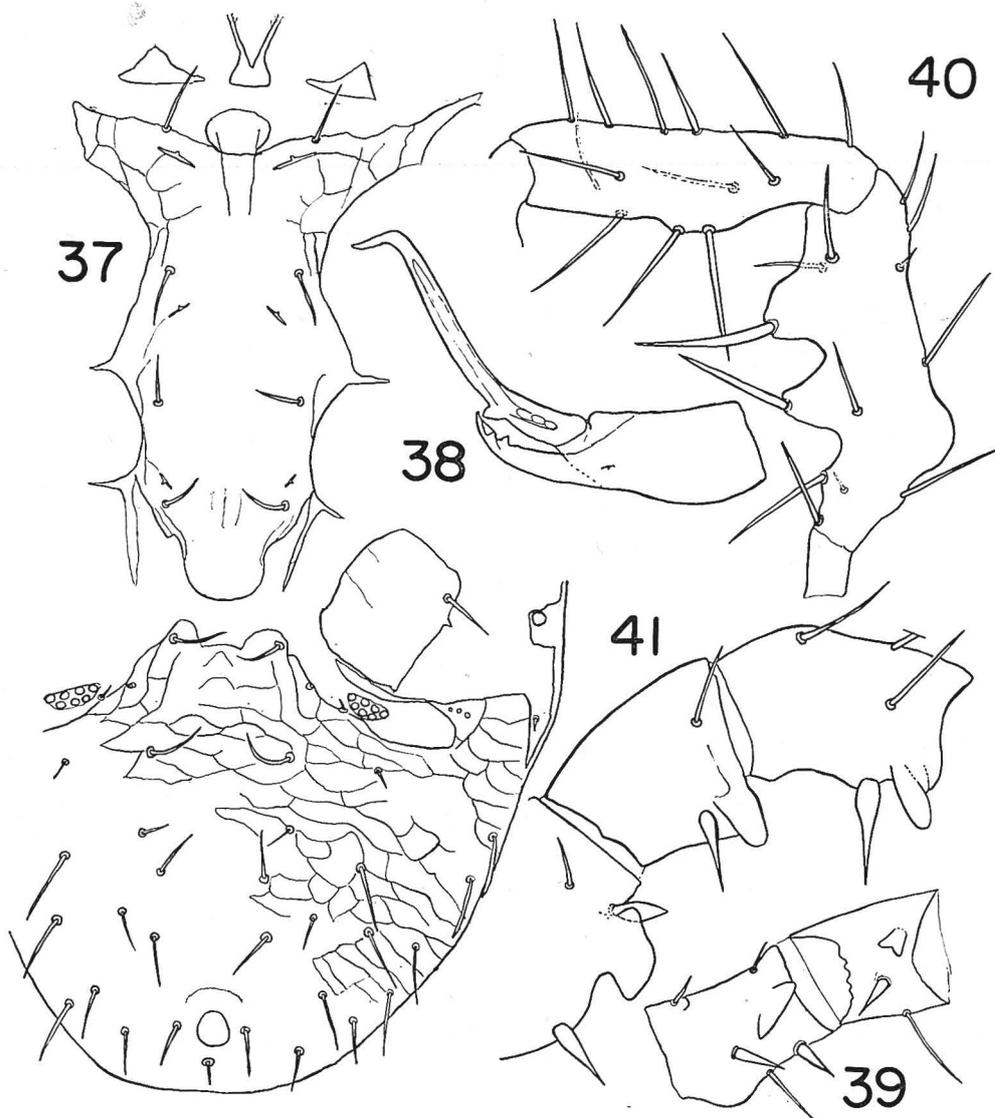


FIG. 37-39. — *V. alba*, ♂. 37. ventral. 38. chelicera. 39. femur and genu, leg II.
FIG. 40-41. — *V. nodosa*, ♂. 40. femur and genu, leg I. 41. femur, genu and tibia, leg II.

tiform organ with 7 pores. Posterior part of ventral shield $83\ \mu$ long, with six pairs of setae. $V_7\ 44\ \mu$, $V_2\ 31\ \mu$, $V_3\ 33\ \mu$ long. Anal shield with five simple setae.

Tectum as in fig. 28.

Penultimate segment of chelicera (fig. 47) $275\ \mu$ long, distance from base of segment to dorsal fissure $177\ \mu$, distance from dorsal fissure to tip of digit $98\ \mu$.

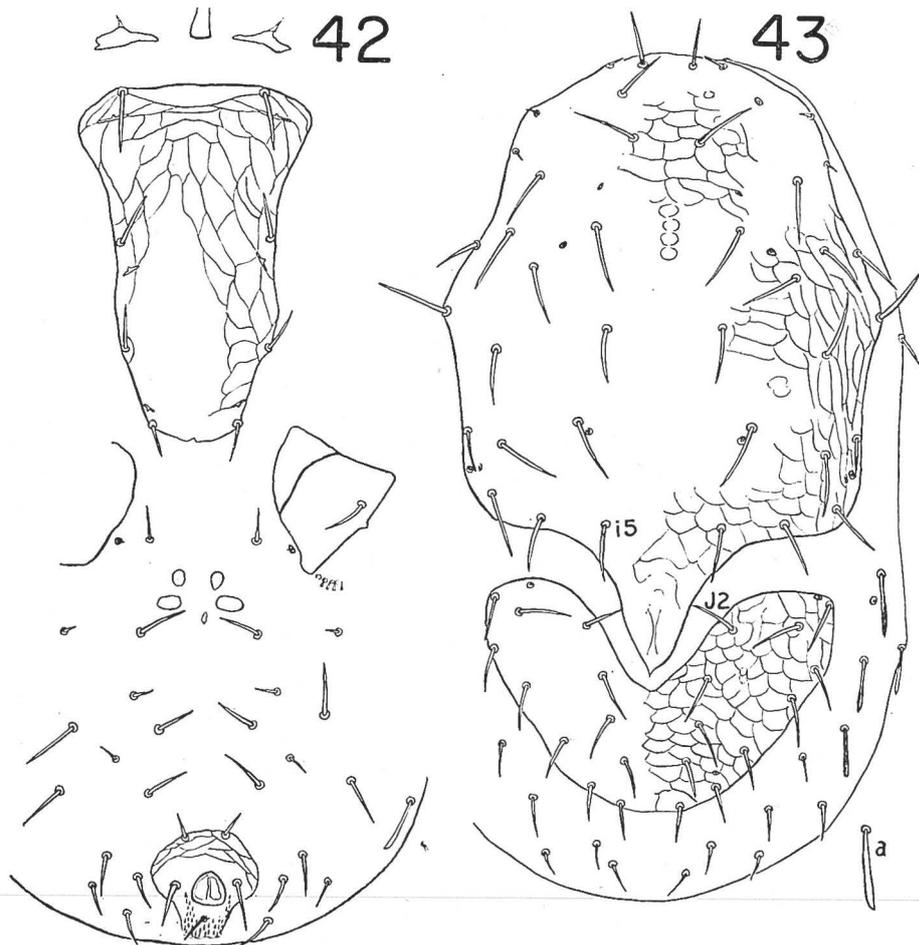


FIG. 42-43. — *V. alba*, deutonymph. 42. ventral. 43. dorsal, a. lateral seta.

Inner edge of fixed digit with minute subapical tooth, a larger tooth $15\ \mu$ from end of digit and a small notch behind the larger tooth. Proximal two-thirds of fixed digit without teeth. Moveable chela $108\ \mu$ long from tip to most posterior part, with two teeth, more distal tooth $11\ \mu$ from end of digit.

Anteromedial seta of palp genu with four prongs, posteromedial seta of palp

genu with 7 or 8 prongs directed perpendicular to axis of seta. Medial seta on palp femur widened and serrate distally.

Tarsus I 150 μ long, tarsus IV 172 μ , longest seta on tibia IV 92 μ , slightly pilose distally.

The overall length of the idiosoma is 570 μ . The type specimen appears tan in color; under the dissecting microscope specimens appear whitish.

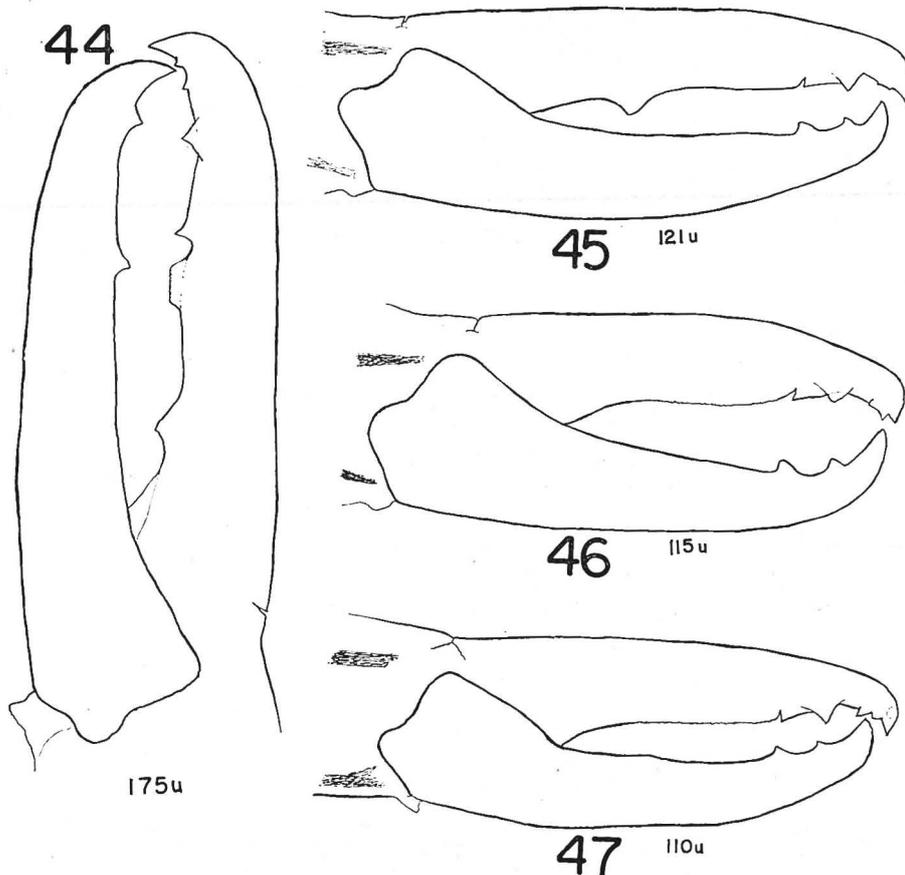


FIG. 44-47. — Female chelicerae.

44. *V. nodosa*, holotype. 45. *V. piliseta*, ♀ from Patuxent Refuge, Md.
46. *V. dendritica*, holotype. 47. *V. alba*, holotype.

The type female was collected from the H-layer, February 15, 1960, Patuxent Wildlife Refuge, Maryland.

Male (figs. 27, 37-39). Idiosoma 550 μ long. Sternal shield 240 μ long, v2-v2 58 μ . Ventrianal, peritrematal and dorsal shields fused posterior to peritrematal seta. Punctiform organ with seven pores.

Tectum five-pointed, lateral points longer than medial point. Spermatopho-

rentrager with the distal part bent perpendicular to main axis. Length from end of fixed digit to end of spermatophorentrager 130 μ . Femur I without conspicuous humps. Leg II as illustrated.

Deutonymph (figs. 42-43). Anterior dorsal shield 330-355 μ long, with twenty pairs of simple setae. Membranous area between anterior and peritrematal plates with one simple seta. Distance from point midway between $i5'$ and $i5$ to posterior tip of anterior shield equal to or less than distance from $i5'$ to $i5$. Latter distance 75-80 μ . Posterior dorsal shield deeply indented, 70-80 μ along midline. Two pairs of platelets behind genital setae.

Distribution. *Veigaia alba* is a typical euedaphic mite. It is slender and is usually pale in color. The legs are relatively short and the setae are short and of nearly uniform length. Over half of the *Veigaia alba* found at Patuxent Wildlife Refuge were collected from the deepest subsample, the A_1 layer. Adults occurred in the upper two layers more often than nymphs (table 1).

This species probably has a single generation per year. From the middle of November until late March only adults were collected. Deutonymphs were found during May, June, October and early November. No adults were collected at these times. For reasons which are not known, very few *V. alba* were recovered during the summer months.

V. alba has been taken from five separate localities bordering the Patuxent River.

Distinguishing characteristics. *V. alba* differs from other species of *Veigaia* in that the area around the first sternal pores is not sclerotized in the female. The first pair of sternal setae and pores are not situated on the sternal shield. In the deutonymph the posterior dorsal shield is equal to or shorter than the distance $i5-i5$.

Veigaia pusilla (Berlese).

Cyrtolaelaps pusillus BERLESE, 1916. *Redia*. 12 : 301. (between dead leaves, Columbia, N. A.; Berlese collection).

Veigaia pusilla FARRIER, 1957. *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 65-67.

FARRIER (1957) reported this small, euedaphic species from Georgia and North Carolina. A single ♀ has been taken from sod at the base of an apple tree, Storrs, Conn. Additional records, all females from deciduous forests, are as follows : H-layer, Howard Co., Md. (2) ; H-layer, Spencerville, Md. (2) ; L & F, Burtonsville Md. (1) ; H-layer, Morgantown, W. Va. (12) ; same locality, L & F (1) ; Wooster, Ohio (1).

Veigaia planicola (Berlese).

Cyrtolaelaps nemorensis var. *planicola* BERLESE, 1892. *Acari, Myriopoda et Scorpiones hucusque in Italia reperta*.

- Veigaia serrata* WILLMANN, 1935. *Bul. Mus. R. Hist. Nat. Belgique.* 11 : 10-11.
Veigaia serra FARRIER, 1957. *N. C. Agric. Expt. Sta. Tech. Bul.* 124 : 65-67.
Veigaia planicola BREGETOVA, 1961. *Paraz. sborn. Zool. Inst. Akad. nauk SSSR* 20 : 54-58.

A single female was collected from soil from a woodland near Fulton, Maryland. *V. planicola* has also been collected from Ohio, Tennessee and Colorado.

BIOLOGY.

The biology of *Veigaia*, like that of most soil-inhabiting Mesostigmata, is poorly known. KARG (1961) studied the feeding habits of *V. nemorensis*. It fed on *Tyrophagus* and immature Oribatei. Collembola listed as prey were *Isotoma notabilis*, *Tullbergia krausbaueri*, *Onychiurus armatus* and *Folsomia fimetaria*. WALLWORK (1959) noted that *V. mitis* fed on immature Oribatei.

In the present study *V. partitus*, *V. locha*, *V. nodosa* and *V. piliseta* were reared in vials and offered small arthropods collected from litter. Collembola, Protura, Pauropoda and prostigmatid mites were accepted as prey by *V. partitus* and *V. locha*. The springtails offered as prey included *Onychiurus*, *Folsomia*, *Isotoma*, *Tomocerus* and *Lepidocyrtus*. The latter two genera have very well developed furculae, and veigaiids rarely succeeded in capturing them. In one instance a male of *V. locha* captured a *Lepidocyrtus* on the seventh attempt. All species of *Veigaia* tested readily killed and ate isotomids.

Predation on Onychiurus. The genus *Onychiurus* includes white, eyeless, slow-moving springtails. Some species possess a pair of small projections called anal horns on the posterior end of the abdomen. The furcula is absent or rudimentary in onychiurids so that they would seem to be easy prey for predacious arthropods. Veigaiids often captured and ate small *Onychiurus*. Reactions to larger *Onychiurus* were variable. Several times a *Veigaia* was observed probing the *Onychiurus* with the first pair of legs or even the mouthparts. The springtail responded by curling up its posterior end, and the *Veigaia* backed away. On three occasions *Onychiurus* exuded drops of white fluid from the dorsal surface of the abdomen a little anterior to the anal horns. In one instance the fluid was produced after being touched with the bristle of a brush. The other times it was produced by the *Onychiurus* after being probed by females of *V. locha*. One time some of the liquid got on the palps of *V. locha*. The latter backed away and seemed to attempt to rub the substance off its palps. Frequently *Onychiurus* hid in pits in the substrate leaving its posterior end protruding from the opening of the pit.

WILSON (1950) and BROWN (1950) noted that dacetine ants preferred Collembola with well developed furculae. Entomobryids and isotomids were accepted as prey, but forms with the furcula rudimentary or absent, such as *Onychiurus armatus* and some of the Poduridae, were not eaten. KARG (1961) observed that

gamasid mites sometimes ate *Onychiurus*. *Pergamasus crassipes* ate two or three *O. armatus* daily. Frequently, however, onychiurids produced adhesive drops which exerted a laming and stupefying effect on predatory mites. The drops are apparently produced by the pseudocelli. KARG suggested that gamasid mites must quickly break through the skin before the pseudocelli function.

Information concerning life histories of Veigaia. Eggs, larvae, protonymphs and a deutonymph of *V. locha* were raised in the laboratory. Eggs were also obtained from *V. partitus* and *V. nodosa*. As yet, none of the species has been reared through a complete life cycle, although *V. nodosa* has been kept alive for over a year. Both *V. alba* and *V. nodosa* appear to have a life cycle of one year in central Maryland. Nymphs occurred from April or May until mid-November (fig. 22). Adults were not found in the summer or early autumn, but from late November until late March only adults were collected.

Males are unknown in *V. partitus*. A female *V. partitus*, reared in isolation from the deutonymphal stage, produced two eggs, but the eggs failed to hatch.

SUMMARY.

Ten species of *Veigaia* were reported from central Maryland. Four of these, *V. locha*, *V. nodosa*, *V. dendritica* and *V. alba*, were described as new. A lectotype of *V. partitus* (Banks) n. comb. was designated and described. The male of *V. bakeri* Farrier was described for the first time.

The feeding behavior and the geographic, vertical and seasonal distribution of *Veigaia* were observed. Two species, *V. nodosa* and *V. alba*, were shown to have a single generation per year. Pauropods, proturans and collembolans of the family Isotomidae were captured and eaten by *V. partitus* and *V. locha*. Small collembolans of the genus *Onychiurus* were eaten, but larger individuals of this genus were usually rejected. On several occasions *Onychiurus* exuded drops of white fluid from the abdomen.

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