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## NOTES ON ALASKAN COLLEMBOLA II. THREE NEW SPECIES OF ARCTIC COLLEMBOLA<sup>1</sup>

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This is the second in a series of papers on the Collembola fauna of northern Alaska. The material on which this paper is based was collected by Dr. Neal A. Weber while holding a contract with the Office of Naval Research and while stationed in the Alaskan Arctic under the support of the Arctic Research Laboratory.

I wish to thank Dr. Marie Hammer and Dr. Harlow B. Mills for their helpful suggestions concerning this work.

### *Schaefferia variabilis*, n. sp.

(Pl. 10, figs. 1-11; Pl. 11 figs. 2, 6, 7)

*Holotype*. Eyes two on either side, pigmented and situated on a lightly pigmented eyespot. No other pigment present. Integument granulate with granulations uniform and moderate in size. Clothing of long, sturdy, straight to slightly curved, and mostly sparsely "ciliate" setae, with scattered smaller curved or straight naked setae. The longer setae on the last three abdominal segments are somewhat longer than those on the remainder of the body.

Antennal segments one through three subequal in width, fourth antennal segment slightly narrower than the third at its base and tapering gently to a blunt point. Antennal segments one through three subequal in length, with the fourth being about one and one-half times as long as the third. Fourth antennal segment with a simple distinct apical, retractile bulb, protected on the ventro-external side by an erect papilla. Dorsally there are many long, mostly straight smooth setae, and five thick blunt, curved "olfactory" setae. Ventrally there are present also a number

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of straight smooth setae, two blunt "olfactory" setae and six small straight truncate to slightly clavate setae, (see Plate 11, fig. 2) which are less than half as long as the normal pointed setae. Third antennal segment with three transverse rows of smooth pointed setae. Third antennal segment with two short roughly boot-shaped pegs, situated in deep integumentary folds, protected on either side by a blunt seta, similar to those on the fourth antennal segment. Antennal segments one and two each with a single irregular transverse row of smooth pointed setae.

Mandibles with well-developed molar plate and four to five blunt apical teeth. Maxillae with four heavy teeth and a number of thin lamellae of varying sizes, the largest two being deeply serrate on their inner edges. Post-antennal organ (P.A.O.) located in a shallow triangular depression and consisting of three or four lobes situated around a roughly hemispherical central boss. The two anterior lobes are in transverse line and the one or two posterior lobes diagonal to this. Small accessory boss present just below and behind the P.A.O. Head clothing as in figure.

First thoracic segment somewhat reduced, possessing only a single transverse row of four setae. The outer two setae are long and ciliate; the dorsal pair are short, smooth, curved, and very thick. Second thoracic segment with three irregular transverse rows of setae. The anterior row somewhat diagonal in position. Third thoracic

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#### EXPLANATION OF PLATE 10

Figs. 1-11. *Schaefferia variabilis*, n. sp. 1. Head, lateral view (holotype). 2. Left fourth antennal segment, dorsal view (holotype). 3. Left anal horn and adjacent abdominal area, lateral view (paratype). 4. Left dens and mucro, from right side (paratype). 5. Left eyes and P.A.O., from above (paratype). 6. Sensory pegs of third antennal segments, showing variation in form. 7. P.A.O. and anterior eye, showing abnormal double accessory boss (paratype). 8. P.A.O. and anterior eye, seen from side of organ (paratype). 9. Single large thoracic seta. 10. Genital plate, male (one-half of setae shown) (paratype). 11. Third antennal segment, sensory organ.

Figs. 12-14. *Pseudanurophorus arctica*, n. sp. 12. Right half of fifth and sixth abdominal segments, dorsal view (holotype). 13. Left P.A.O. and antenna base, dorsal view (paratype). 14. Third antennal segment (setae omitted), showing apical sensory organ, dorsal view (paratype).



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segment with one transverse row of long ciliate setae, in front of which are three smooth short setae.

Abdomen sparsely clothed with setae of all types, tending to form irregular transverse bands over the median portions of abdominal segments one through four, and being more uniformly scattered and somewhat more dense on segments five and six.

Legs comparatively densely setaceous, a single longer pointed seta usually present externally just above the claw. Claw long and narrow, with a single internal tooth about midway between the base and the tip, and a smaller, more basad pair of lateral teeth; no external teeth present. Unguiculus with a broad, internal, basal lamella, and a sharp, pointed apical prolongation extending to beyond the level of the internal tooth.

Furcula with all segments distinct. Manubrium ventrally and dentes internally not as coarsely granulate as remainder of body. Manubrium naked ventrally, and sparsely clothed dorsally with short smooth setae, except for a medio-distal triangular unsetaceous area, and a single long seta at each basal lateral corner. Dens ventrally naked, dorsally with seven setae, the basal and subapical ones being about twice as long as the others. Mucro tapering, slightly expanded at the tip, with the central part of the mucro dorsally granulate. A thin lamella is present on either side of the mucro along the apical three-fourths of the structure. Internally the lamella is a flatly arcuate structure. Externally the lamella is much higher for its basal half and then abruptly narrows to the size of the inner lamella.

Tenaculum quadridentate and lacking setae.

Anal spines two, about three-fourths as long as hind unguis, slightly curved and situated on high separate papillae. Anal spines plus papillae longer than hind unguis.

#### VARIATION

The most striking variation in this species is in the number of lobes in the P.A.O. being quite commonly three on one side and four on the other, as in the holotype. Other specimens have an equal number (three or four) on either

side, with four being the most common number. In no case were more than four lobes observed on one side. Another common variation is the presence of two accessory bosses. In other specimens the boss may be very indistinctly demarcated.

The setae of all parts vary considerably, in all ways. The antennal olfactory hairs are fairly constant, but the short truncate hairs vary from slightly truncate to distinctly clavate and from five to eighteen in number. The sensory rods of the third antennal segment are always bent, but, as shown in the figure, do not always have a marked boot shape. The head and body clothing varies considerably, but the long ciliate setae are fairly constant, although the degree of ciliation and the size vary greatly.

The mucro also exhibits a good deal of variation, with some specimens having the external lamella expanded greatly basally, producing the effect of a distinct lamellar tooth. The anal horns vary in size, but in all cases observed were at least slightly smaller than the ventral edge of the third unguis. The horns plus the papillae are usually subequal to the ventral edge of the claw, but in some specimens were as much as one and one-fourth times as long.

#### RELATIONSHIPS

Although, as Stach suggests, the genus *Schaefferia* is, as presently constituted, probably polyphyletic in its make-up, the present species appears to be quite closely related to the *Schaefferia emucronata* group (Absolon, 1900). The reduced number of eyes, the shape of the P.A.O. and accessory boss, the sparsely ciliate setae, the shape and size of the unguis, as well as the facies, all suggest a very close relationship. While a definite determination of the exact relationships among all the members of the *S. emucronata* complex will await a fairly complete collection of the Holarctic region, I feel justified in calling the present specimens a new species for the following reasons: a) the presence of short truncate hairs on the fourth antennal segment, not mentioned in any form of *S. emucronata* or *S. pouadensis* Delamare-Deboutteville, (1945); b) the much greater development of the furcula; c) different

construction of the third antennal sense organ; d) different pattern of the genital plate of the male (see figure); and e) the unusual shape of the third antennal sensory pegs.

### MEASUREMENTS

All segmental measurements and ratios taken of imbricate areas along the middorsal line, and are exclusive of intersegmental membranes. All measurements in millimeters. Holotype: total length, excluding antennae, 1.35; cephalic diagonal, .26; thoracic segment one, .07; thoracic segment two, .14; thoracic segment three, .15; abdominal segment one, .14; abdominal segment two, .15; abdominal segment three, .14; abdominal segment four, .15; abdominal segment five, .09; abdominal segment six, .08.

Segmental ratios for size range .60 - .66 mm.:

(thoracic segment 2=10)							
	total cephalic		thoracic segment				
	antenna diagonal		2	3			
mean ratio	23	26	10	8.9			
average deviation	1.0	1.0	X	.3			
(abdominal segment 3=10)							
	abdominal segment		segment		hind		
	1	2	3	4	5	6	unguis
mean ratio	6.6	6.9	7.2	9.5	7.1	2.9	.50
average deviation	.5	.3	.4	.3	.9	.3	.04
(antennal segment 3=10)							
	antennal		segments				
	1	2	3	4			
mean ratio	6	11	10	18			
average deviation	.9	.7	X	1.0			
(fore unguis=10)							
	fore	fore	hind	hind			
	unguis	unguiculus	unguis	unguiculus			
mean ratio	10	4.4	11	5.4			
average deviation	X	.5	.4	.5			

Type locality: Umiat, Colville River, Alaska, July 4, 1949, Neal A. Weber, collector. The holotype and fifty paratypes are being deposited in the United States National Museum, Washington, D. C., and thirty-five paratypes are being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

***Pseudanurophorus arctica*, n. sp.**

(Pl. 10, figs. 12-14; Pl. 11, figs. 1, 3-5)

*Holotype.* Body stout, cylindrical, rounded posteriorly, head about as wide as body. Without eyes or pigment. Clothing of scattered short, straight to weakly curved setae with a few longer straight setae, especially on the posterior regions of the body. Common setae of the head are from nine to twelve micra in length and more or less curved. There is also a single row of fifteen micra long setae along the posterior margin of the head.

First thoracic segment is naked dorsally and has a single pair of setae at each leg base, with the superior seta of each pair longer than the inferior. On each leg base of the second and third pair there is a set of four long setae. The remainder of the thorax and the abdomen is clothed mostly with short, curved to straight setae, one-half to three-fourths as long as long setae, with the smaller sizes being much more numerous. Besides these there are a few long setae, arranged as follows: second and third thoracic segment with a single seta at each lateral edge of the setaceous area; first and second abdominal segments each with a single medio-lateral pair of setae, with those on the second segment being slightly longer; third and fourth abdominal segments with four setae each, situated in lateral pairs, the anterior of each pair being slightly longer; fifth abdominal segment with a posterior row of four setae which are longer than any anterior body setae, and a single antero-lateral shorter seta on either side; sixth abdominal segment with eight long setae.

Integument finely and uniformly granulate. Unsetaceous intersegmental membranes large between all segments except the fifth and sixth.

Fourth antennal segment fusiform, third somewhat spheroidal in appearance, and the second and first segments sub-cylindrical in shape. Fourth antennal segment with numerous obtusely pointed "olfactory" hairs, slightly thicker than, and subequal in length to, the normal clothing setae. Sense organ of third antennal segment consists of two blunt rods situated in shallow integumentary folds, the inner being somewhat above the outer.

Mandible with well-developed basal molar plate, well separated from the four or five apical teeth. Mandible externally with a darkened swelling opposite the apical end of the molar plate. Maxilla with two heavy teeth and three thin lamellate plates, serrate on their inner edges. The outer two plates are apparently double at their inner border, and the more dorsal of these plates extends well beyond the rest of the maxilla and ends in two very large serrations.

P.A.O. situated in a shallow depression on the side of the head near the base of the antenna. It is an oval, swollen lobe, about two-thirds as wide as long, and with long axis roughly perpendicular to the long axis of body.

Dorsum of first thoracic segment greatly reduced, lacking setae. Legs without tenent hairs, unguis simple, acuminate, without teeth. Unguiculus pointed, less than half as long as unguis, sides parallel for basal third of its length, then converging directly for apical two-thirds, with the inner side being the more strongly deflected.

Abdominal segments five and six distinctly separated, but with a narrow intersegmental membrane. Furcula and tenaculum lacking. End of abdomen rounded, lacking anal spines or papillae. Anus ventrally directed.

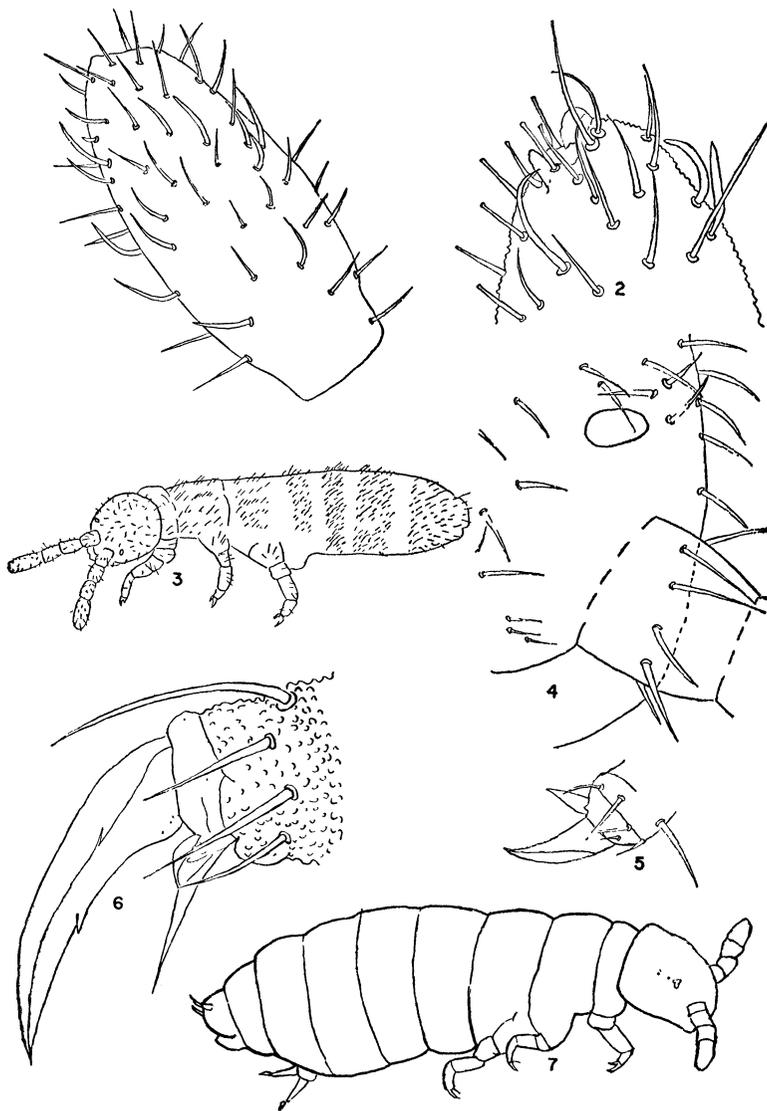
#### VARIATION

The sensory setae of the fourth antennal segment differ only slightly from the normal clothing setae, and vary considerably in number and position. There may be as few as eight or as many as thirteen, with ten the usual number; of these a few are ventral in position (from none to three), the remainder dorsal.

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#### EXPLANATION OF PLATE 11

Fig. 1. *Pseudanurophorus arctica*, n. sp., dorsum of right fourth antennal segment (paratype). Fig. 2. *Schaefferia variabilis*, n. sp., apex of ventral surface of fourth antennal segment (paratype). Figs. 3-5. *Pseudanurophorus arctica*, n. sp. 3. Habitus (paratype). 4. Left antennal base and P.A.O., dorsal view (paratype). 5. Right hind foot (paratype). Figs. 6-7. *Schaefferia variabilis*, n. sp. 6. Right hind foot (paratype). 7. Habitus (setae omitted) (paratype).



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The small setae covering the thorax and abdomen are not arranged in any readily visible pattern. There is a very rough arrangement into transverse rows, but this is neither constant nor very clear. The common situation is for these rows to be as follows: thoracic segment one, none; thoracic segment two, 6; thoracic segment three, 5 or 6; abdominal segment one, 4; abdominal segment two, 4; abdominal segment three, 4; abdominal segment four, 5; abdominal segment five, 5; abdominal segment six, 2. The first row of the fifth segment is usually preceded by a single discreet seta on either side. The length of the longer setae varies considerably, but those on the fifth and sixth segments are usually longer than those on the other segments.

#### RELATIONSHIPS

This species is the first of the genus to be described from North America. While fitting into the generic limits as already set up, it is readily distinguishable from all previously described species. Of these it would appear to be most closely related to *P. binoculatus* Kseneman (1934), and to *P. alticola* Bagnall (1949). It can be distinguished from the former by the lack of eyes and sensory hairs on the fifth abdominal segment, as well as by the swollen nature of the P.A.O. It can be separated from the latter by the shorter, broader P.A.O. and the possession of long setae on the fifth and sixth abdominal segments.

#### MEASUREMENTS

All segmental measurements and ratios are of the setaceous area along the middorsal line, excluding the intersegmental membranes. All measurements in millimeters. Holotype: total length, excluding antennae, .64; cephalic diagonal, .12; thoracic segment two, .05; thoracic segment three, .05; abdominal segment one, .04; abdominal segment two, .04; abdominal segment three, .04; abdominal segment four, .05; abdominal segment five, .04; abdominal segment six, .01; antennal segment one, .01; antennal segment two, .03; antennal segment three, .03; antennal segment four, .04; fore unguis, .014; fore unguiculus, .007; hind unguis, .015; hind unguiculus, .008.

## Segmental ratios:

		(abdominal segment 4=10)							
		total cephalic	thoracic	segment					
		antenna diagonal	1	2	3				
mean ratio		13.4	18.1	4.4	8.8	10.7			
average deviation		.8	1.3	.4	.6	.7			
		abdominal segment					furcula	third	
		1	2	3	4	5	6	unguis	
mean ratio		9.7	9.5	8.8	10	5.9	5.3	11.6	3.5
average deviation		.4	.5	.3	X	.3	.5	.8	.3

## (antennal segment 4=10)

		antennal segments			
		1	2	3	4
mean ratio		6.3	6.8	6.7	10
average deviation		.9	.8	.7	X

## (mucro=10)

		manubrium	dens	mucro
mean ratio		32	25	10
average deviation		4	3	X

## (unguis=10)

		unguis	unguiculus
mean ratio		10	4.3
average deviation		X	.2

Type locality: Point Barrow, Alaska, June 1949, Neal A. Weber, collector. The holotype and forty paratypes are being deposited in the United States National Museum, Washington, D. C. A series of twenty paratypes is being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

**Anurida hammeri**, n. sp.

(Pl. 12, figs. 1-13)

*Holotype*. Color white, pigment completely lacking. Clothing of scattered straight stout setae of varying lengths. Body about four and one-half times as long as wide, deeply

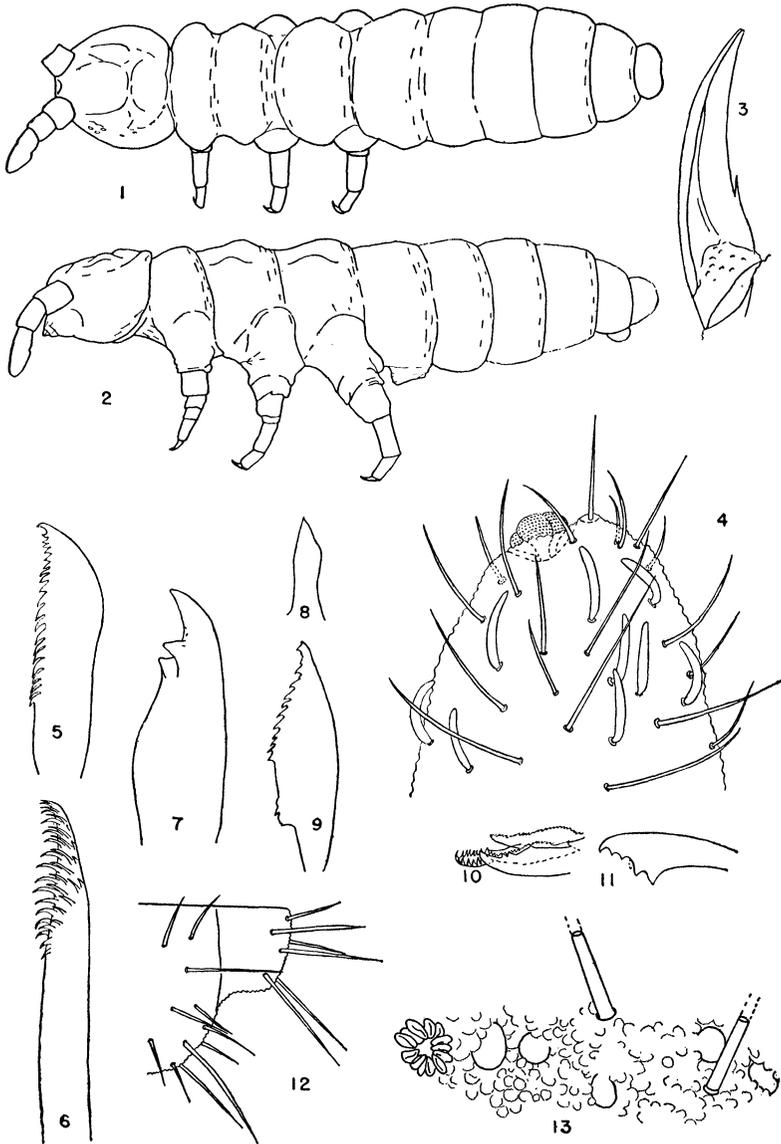
constricted intersegmentally, so as to give a lobed appearance. Abdominal segments almost cylindrical, only slightly compressed dorso-ventrally. Fourth antennal segment with a large apical, distinctly trilobed, retractile bulb, situated in a shallow pit, and nine large, blunt "olfactory" hairs. These hairs are arranged in two groups: one group of six hairs along the dorso-external side, and a second group of three along the dorso-internal area.

Third antennal segment almost completely fused with fourth. Sense organ of third segment consists of two small cylindrical pegs situated side by side in a shallow integumentary fold. Integument granulate, with the granules being large and fairly uniform in size. Antennal segments one through three decreasing in diameter, one being the widest. Segments three and four subequal in diameter. Head viewed from above somewhat heart-shaped. Buccal cone short and blunt. P.A.O. consisting of thirteen papillae packed closely into a circle. Individual papillae as seen from the side are erect triangles with rounded angles; these are packed together to form a low truncate cone. Eyes five in number on each side, pigmentless, arranged as follows: two close together, located just posterior to the P.A.O., the anterior of these somewhat larger than the posterior, and somewhat oval in shape; two others located considerably behind the forward pair and further apart; the fifth is positioned about midway between these pairs, and somewhat dorsad of both. Fourth antennal segment with numerous moderately long, slightly curved, slender setae. One single straight seta on apex on truncate papilla. Third segment with scattered similar setae, plus

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#### EXPLANATION OF PLATE 12

- Figs. 1-13. *Anurida hammeri*, n. sp. 1. Habitus, dorsal view (setae omitted). 2. Habitus, lateral view (setae omitted). 3. Left hind claw (paratype). 4. Right fourth antennal segment, dorsal view (paratype). 5. First lamella of maxilla (paratype). 6. Second lamella of maxilla (paratype). 7. Galea of maxilla (paratype). 8. Basal process of maxilla (paratype). 9. Third lamella of maxilla (paratype). 10. Maxilla, showing all parts in natural position (paratype). 11. Mandible (paratype). 12. Left half of last two abdominal segments, with setae (paratype). 13. Eyes and P.A.O. of right side (paratype).



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a single transverse median row of straight longer setae. First and second segments each with a single median transverse row of long straight setae, slightly thicker and larger than those on the third segment.

Clothing of head straight, sturdy setae of three sizes: the smallest size is subequal to the clothing setae of the fourth antennal segment, but much stouter and more spiniform. These are scattered sparsely and irregularly over antero-dorsal area between antennal bases and over posterior half of the head. Slightly longer setae are scattered irregularly and sparsely over the dorsal and lateral surfaces of the head. The longest setae are approximately four times as long as the shortest and are arranged as follows: a band of seven setae on each side covering the cheek areas of the head; three other setae, two in a straight line between the middle of the antenna base and the rear of the head, and the third about midway between these two and displaced laterally.

Body with sparsely scattered setae of varying lengths which tend to form interrupted transverse bands. Fifth abdominal segment with four setae definitely longer than any anterior body setae arranged along the posterior edge. Sixth segment with eight similar setae, with four somewhat shorter setae located between them.

Furcula, anal horns, unguiculus, and tenent hairs lacking. Claw large, with a single large protruding basal tooth.

Mandibles without molar area equipped with five large teeth, the basal two being larger. Maxillae with galea possessing three teeth and an expanded basal area. Lamella one and three pointed arcuate, with serrate single edges. Lamella two projecting beyond the rest of the maxilla and possessing a multiple pectinate edge for the projecting part.

Male genital plate circular, slightly raised, with twenty short, fairly uniform smooth setae, arranged as follows: eight forming a circlet about the genital aperture, and the remaining twelve filling a roughly lunate area anterior to this group.

## VARIATION

The most striking variation is in the grouping and number of the eyes. The anterior two are often closely approximated or even fused, and in many cases only four eyes are present. The number of papillae in the P.A.O. also varies, from twelve to seventeen. The chaetotaxy of the head and abdomen varies considerably, both in number of setae and in the positions. The size of the setae increases with the size of the specimen. The number and position of the olfactory hairs of the fourth antennal segment vary somewhat (eight to ten), but only in occasional specimens. In a few cases the apical truncate conical area lacks a straight seta. The mouth parts are fairly uniform, the apical two teeth of third maxillary lamella may be elongate, and the large teeth on the mandible may be either two or three.

## RELATIONSHIPS

This species, in the structure of the P.A.O. and in mouth-parts, especially in the form of the second pectinate maxillary lamella, is close to the *A. granaria* (Nicolet, 1847) group. The presence of four or five eyes removes it from all known species of this group. As the eyes in the new species are all without pigment and show other signs of reduction, this species may well represent a transition between the *granaria* group and those species of *Anurida* which are fully equipped with eyes and pigment. The present species appears to be most closely related to the species *granaria* Nicolet and *pseudogranaria* Stach (1949), but can be readily separated from both by the larger number of olfactory hairs on the fourth antennal segment (nine in the present species, as compared with six in *granaria*), by the long setae on the fifth and sixth abdominal segments, and by the similar serrations on the first and third maxillary lamellae.

## MEASUREMENTS

Due to the great flexibility of the integument and the lack of clearly marked imbricate or setaceous areas, attempts to derive satisfactory ratios were fruitless. Thus

the only measurements given are the absolute segmental and other measurements as determined on the holotype. All measurements in millimeters. Cephalic diagonal, .46; thoracic segment one, .16; thoracic segment two, .32; thoracic segment three, .32; abdominal segment one, .24; abdominal segment two, .29; abdominal segment three, .27; abdominal segment four, .30; abdominal segment five, .19; abdominal segment six, .10; antennal segment one, .09; antennal segment two, .09; antennal segments three and four, .21; unguis of third leg along ventral edge, .08.

Type locality: Point Barrow, Alaska, June and July, 1949, Neal A. Weber, collector. The holotype and seven paratypes are being deposited in the United States National Museum, Washington, D. C. Four paratypes are being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

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