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PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

XXVII.

APTERYGOTA.

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THIS paper deals with the Collembola and Thysanura collected in Alaska in June and July, 1899, by Professor Trevor Kincaid, of the Harriman Expedition, with the addition of a few forms collected by him in 1897. These are especially welcome as nothing has been published hitherto concerning the Collembola of Alaska, and because, with three exceptions, all of Professor Kincaid's species are either new or little known. Moreover, they suggest interesting problems in geographic distribution, a subject yet in its infancy, as regards this group. Fourteen forms are here described as follows:

Neanura gigantea Tull.
Neanura ornata sp. nov.
Anurida amorita sp. nov.
Aphorura octopunctata (Tull.)
Aphorura dentata sp. nov.
Isotoma fimetaria (L.) Tull.
Isotoma viridis Bourl., type.
Isotoma viridis Bourl., var. *arctica* Schött.
Entomobrya kincaidi sp. nov.
Tomocerus niger Bourl., type.
Tomocerus niger Bourl., var. *arcticus* Schött.
Tomocerus niger Bourl., var. *americanus* Schött.
Papirius palmatus sp. nov.
Machilis arctica sp. nov.

Types of the above species and subspecies have been deposited in the United States National Museum, and all the Harriman specimens retain the numbers of the original labels.

NEANURA GIGANTEA Tull.

(Pl. IV, fig. 1; Pl. VI, figs. 11–13.)

Anura gigantea TULLBERG, Öfv. k. vet. Akad. förh., XXXIII, no. 5, p. 41, taf. 11, fig. 59, 1876 (Siberia).—SCHÖTT, K. sven. vet. Akad. hand., XXV, no. 11, p. 94, 1894 (Siberia).
Neanura gigantea SCHÄFFER, Fauna Arctica, I, lief. 2, p. 240, 1900.

General color of alcoholic specimens indigo blue, with conspicuous blackish tubercles (fig. 1); living examples pruinose (Tullberg). Head twice as broad as long, with twelve large tubercles, including those bearing the eyes, arranged as in fig. 1. Eyes (fig. 11) five on either side. Postantennal organs (figs. 11, 12) each composed of more than 100 clavate papillæ forming a rosette. Antennæ half as long as the head, conical, with segments related in length as 4 : 3 : 2 : 6; basal and second segments half as long as broad; third and fourth coalescent; the minute antennal tubercles become successively smaller on each segment. Body oval in dorsal aspect; the number of large tubercles on each successive segment is, respectively, 6, 8, 8, 8, 8, 8, 8, 6, 2; the tubercle at either end of each transverse row is behind the others, on the first seven segments; on the seventh, both are also ventral and inconspicuous; on the eighth, four are ventral and two dorsal; the ninth segment is bent under and bears two small tubercles. Legs short and stout; claws (fig. 13) alike, stout, uniformly curving and tapering, strongly unidentate on the inner margin and minutely tuberculate. Cuticula finely tuberculate; large tubercles also reticulate (fig. 11), bearing several long stiff yellow setæ. Maximum length, 5 mm.

Two forms occur: broad ones, in which breadth is to length as 1 : 1.79; and narrow ones, in which the ratio is 1 : 2.27. This difference of proportion is independent of age, as it exists between specimens of equal length; it is found in other species of *Neanura*, and is presumably a sexual distinction.

Twenty-five specimens, St. Paul Island, Bering Sea, 1897.

The original description, although brief, suffices to place this well marked and monstrous species. Tullberg and Schött have recorded it from several localities in Siberia, Yenisei River (Latitude 61° to 73°). Schött also notes the species from the vicinity of St. Lawrence Bay. Tullberg (1876, p. 29) is confident that *Neanura gigantea* does not occur in Nova Zembla, Spitzbergen or Greenland.

NEANURA ORNATA sp. nov.

(Pl. IV, fig. 2; Pl. VI, figs. 14–18.)

White (fig. 2). Head (fig. 14) slightly longer than broad, rounded triangular. Eyes (fig. 14, *e*, *e*, *e*) not more than three on either side, in longitudinal alignment; two are close together and immediately behind the base of the antenna; the third is considerably behind these. The eyes are rudimentary; they lack pigment, and even the cornea, especially of the posterior eye, is frequently indistinguishable. Postantennal organs absent. Antennæ (fig. 15) barely more than half as long as the head, with segments related as 5 : 4 : 4 : 6; basal segment stout, globose, reticulate; second and third globose, slightly or not at all reticulate; fourth conical, reticulate, the minute tubercles successively smaller on the first three segments but of equal size on the second and fourth. The large tubercles which characterize the genus coalesce on the head of this species but are indicated by the arrangement of the setigerous, reticulated areas. Buccal cone as in figure 16. Body segments related in length as 3 : 4 : 5 : 6 : 5 : 5 : 5 : 4 : 2 : 2; apical segment reduced and turned under; the number of large tubercles on each successive segment is, respectively, 6, 8, 8, 8, 8, 8, 8, 6, 2; on the fourth abdominal segment the two paramedian tubercles coalesce, while four are ventral; on the penultimate segment all six coalesce and on the apical segment the two tubercles are ventral. Each tubercle, though but slightly elevated, is defined by its chitinous reticulation and by two to four stiff serrulate setæ of two forms (fig. 17). The minute cuticular tubercles are not hemispherical as in other species of the genus, but are conical (fig. 17) and frequently clustered. Legs short and stout, with stout curving setæ; tibiæ with a subapical pair of appendages (fig. 18), pyriform in outline; claws (fig. 18) alike, apically curving, prominently unidentate at the base of the inner margin. Length, 1.4 mm.

As in *N. gigantea*, there are two forms, probably the sexes; a narrower kind (fig. 2) with abdomen gradually dilating, with average breadth to length as 1 : 2.8, and a broader form, oval-cylindrical, in which breadth : length = 1 : 2.

Type.—Cat. No. 5435, U. S. Nat. Museum.

Described from thirty-five types, Sitka, June, 1899 (No. 71).

Neanura ornata does not closely resemble any described species but recalls in its ocular characters an East Indian species, *N. fortis* Oudm. (Oudemans, 1890, p. 91; Schäffer, 1898, p. 399).

ANURIDA AMORITA sp. nov.

(Pl. IV, fig. 3; Pl. VI, figs. 19–24.)

General color bluish gray, due to the combined effect of indigo blue mottlings with the white ground color (fig. 3). The dorsum of each segment has two parallel broken blackish stripes (fig. 3). Eyes (fig. 19) five on either side, on blackish patches. Postantennal organs oval (fig. 20) or bent, as in fig. 21 (both figures are from the same head), with from thirty to forty elements. Antennæ almost as long as the head; segments related as 12 : 12 : 11 : 10; first three dilated apically; fourth rounded conical, bearing an organ (fig. 22) consisting of three large contiguous bladder-like structures upon a chitinous base. Body (fig. 3) elongated, abdomen gradually dilated. Claws of mid and hind feet (fig. 23) gradually tapering from a broad base, slightly curving, strongly unidentate near the middle of the inner margin; claws of fore feet (fig. 24) smaller and less tapering. Clothing of short dense curving setæ, with a transverse row of long hairs on each segment. Maximum length, 4.1 mm.

Type.—Cat. No. 5437, U. S. Nat. Museum.

Described from thirty-six types, Kukak Bay (No. 70).

This species is most nearly allied to *A. tullbergi* Schött (1891, p. 192; 1894, pp. 91–92, taf. 8, figs. 16–18) which, however, has but twenty-four to thirty-eight elements in each postantennal organ, and more slender, untoothed claws, not to mention differences of minor importance. The curious antennal organ, already found on *A. maritima*, attains a much greater size in *A. amorita*.

APHORURA OCTOPUNCTATA (Tull.).

(Pl. VII. figs. 25–28.)

Lipura octo-punctata Tullberg, Öfv. k. vet. Akad. forh., XXXIII, no. 5, p. 40, taf. 11, figs. 51–53, 1876 (Siberia).—Schött, K. sven. vet. Akad. hand., XXV, no. 11, p. 88, 1894 (Siberia).

Aphorura octopunctata Schäffer, Fauna Arctica, bd. 1, lief. 2, p. 241, 1900.

White. Postantennal organs (fig. 25) elliptical, of about thirty-three to thirty-seven elements. Pseudocelli of the head, fourteen; four behind the base of either antenna (fig. 25) and six, in two transverse rows, on the posterior border of the head. Antennæ shorter than the head, with segments related in length nearly as 7 : 10 : 9 : 12; basal seg-

ment stout, second cylindrical, third petiolate, terminal segment cylindrical with rounded apex; antennal organ (fig. 26) composed of five chitinous finger-like processes. Body cylindrical, its segments related as 23 : 26 : 29 : 25 : 22 : 27 : 27 : 27 : 10. Superior claws (fig. 27) broad, curving, distinctly unidentate near the middle of the inner margin; inferior claws slightly longer, slender, gradually attenuating into a fine filament, untoothed. Anal spines (fig. 28) two, half as long as a superior claw, feebly arcuate, on prominent papillæ. Body sparsely clothed with short curved setæ and occasional longer stiff setæ, the latter becoming more numerous towards the extremity of the abdomen. Length, 2.7 mm.

Three specimens, Sitka, June, 1899 (No. 71).

The Harriman examples of this species agree satisfactorily with the original diagnosis except for lacking a tooth on the inferior claw. The pseudocelli of the body were not studied on account of insufficient material.

A. octopunctata has seldom been recorded. It was described from a single individual taken at Dudinskoe, Siberia (Latitude 69° 25′ N.), by the Nordenskiöld Expedition in 1875 (Tullberg, 1876, p. 40). The Yenisei Expedition of the following year collected examples at Tschulkova, in Latitude 62° 45′ N., and the Vega Expedition of 1878–79 found a single specimen at Irkaipi, in Chukchi Land (Latitude 68° 36′ N. Schött, 1894, p. 88).

APHORURA DENTATA sp. nov.

(Pl. VII, figs. 29-36.)

White (fig. 29). Postantennal organs (fig. 30) elongate, of very many minute papillate elements, underlying which are seventeen or more oval structures (fig. 31). Pseudocelli of the head eight, of which two lie behind the base of either antenna (fig. 32) and the remaining four occupy the posterior border of the head (fig. 29). The areas adjoining the antennæ are more finely tuberculate than the rest of the head. Antennæ slightly shorter than the head, with segments related nearly as 2 : 5 : 4 : 5; basal segment cup-shaped, second and third clavate and petiolate, fourth conical; antennal organ (fig. 33) of five, rarely four, stout conical processes. Body cylindrical (fig. 29); segments related as 10 : 13 : 16 : 13 : 13 : 12 : 14 : 10 : 3; the number of dorsal pseudocelli for each successive segment is, respectively (fig. 29), 4, 8, 8, 4, 4, 4, 6, 6, 0. Superior claws (fig. 34) strongly curved, five-toothed, as follows: paired pseudonychial teeth occur one-third from the base of the claw, a

second pair of lateral teeth is found one-seventh from the apex, and a fifth, or median, tooth is situated as far again from the apex; inferior claws untoothed, slender, gradually attenuating into a filament which extends beyond the superior claw, inner margin roundly and narrowly dilated at base; both claws are basally tuberculate. Anal spines (figs. 35, 36) two, less than half as long as a superior claw, almost straight, separated basally by half their length and not seated upon papillæ. Clothing of short dense curving setæ with occasional long stiff setæ on antennæ and abdomen, the latter more numerous towards the apex of the abdomen. Maximum length, 4 mm.

Type.—Cat. No. 5436, U. S. Nat. Museum.

Sixteen types: ten from Seldovia, Cook Inlet, July, 1899, under stones at tide mark (No. 62), five, Cook Inlet, 1899 (No. 60); one from St. Paul Island, Bering Sea, August 1, 1897.

Although *A. dentata* shares many of its characters with other species, in no other form do they approach a similar combination. The five-toothed claws are most distinctive.

ISOTOMA FIMETARIA (L.) Tull.

(Pl. VII, figs. 37–39.)

? Podura terrestris alba LINNAEUS, Fauna Suecica, Ed. 1, p. 343, 1746.
? Podura fimetaria LINNAEUS, Fauna Suecica, Ed. 2, 1761.
Isotoma alba TULLBERG, Öfv. k. vet. Akad. förh., XXVIII, no. 1, p. 152, 1871 (Sweden).
Isotoma fimetaria TULLBERG, k. sven. vet. Akad. hand., X, no. 10, p. 48, taf. 9, figs. 32, 33, 1872 (Sweden).—TULLBERG, Öfv. k. vet. Akad. förh., XXXIII, no. 5, p. 37, 1876 (Greenland, Siberia).—MACGILLIVRAY, Can. Ent., XXIII, p. 273, 1891.—UZEL, Sitzber. k. böh. Gesell. Wiss., II, p. 66, 1891 (Bohemia).—SCHÖTT, K. sven. vet. Akad. hand., XXV, no. 11, p. 75, 1894 (Siberia).—DALLA TORRE, Die Gattungen und Arten der Apterygogenea (Brauer), p. 9, 1895.—REUTER, Acta Soc. Faun. Flora fenn., XI, no. 4, pp. 28–29, 1895 (Finland).—MACGILLIVRAY, Can. Ent., XXVIII, p. 58, 1896.—SCHÄFFER, Mitt. naturh. Mus. Hamburg, XIII, p. 183, 1896 (Germany).—SCHÖTT, Proc. Cal. Acad. Sc., VI (2), p. 184, 1896 (California).—LIE-PETTERSEN, Bergens Mus. Aarb. (1896), no. 8, p. 18, 1897 (Norway).—MEINERT, Vidensk. Med. naturh. Foren. Kjobenhavn (1896), p. 169, 1897 (Greenland).—LIE-PETTERSEN, Bergens Mus. Aarb., no. 6, p. 13, 1898 (Norway).—SCHERBAKOF, Zool. Anz., XXI, p. 58, 1898 (Russia).—SCHERBAKOF, Materiali, etc., Apteryg., Vicinity of Kief, p. 12, 1898 (Russia).—CARPENTER and EVANS, Proc. R. Phys. Soc. Edinburgh, XIV, p. 251, pl. 8, figs. 3, 4, 1899 (Scotland).—SCHERBAKOF, Zool. Anz., XXII, p. 47, 1899 (Spitzbergen).—CARPENTER, Sc. Proc. R. Dublin Soc., IX. (n. s.), pt. 3, p. 274, 1900 (Franz Josef Land).—SCHÄFFER, Fauna Arctica, I, lief. 2, p. 247 (Massachusetts).

White. Eyes absent. Postantennal organs small, elliptical. Antennæ (fig. 37) subequal to head in length, segments related as 3 : 5 :

5 : 11 ; basal segment stout, cylindrical; second cylindrical; third clavate, apically constricted; fourth subclavate, apically rounded. Body elongate; segments in relative lengths as 2 : 6 : 6 : 5 : 6 : 6 : 5 : 3 : 2. Superior claws (fig. 38) slightly tapering, feebly curved, inner margin excavated, untoothed; inferior claws two-thirds as long, broadly lanceolate, acute, with a longitudinal rib parallel with the inner margin; tenent hairs absent. Furcula appended to the fourth abdominal segment, short, not attaining the ventral tube; dentes nearly twice the manubrium in length, slender, uniformly tapering; mucrones (fig. 39) slender, conspicuously bidentate; apical tooth slightly hooked, second tooth larger, erect. Clothing of numerous short setæ of two kinds, stiff or curving, becoming longer toward the apex of the abdomen. Length 1.6 mm.

Two specimens, Sitka, June, 1899 (No. 71).

The Alaska specimens agree with European examples of the species which I received from Dr. Schäffer, except in having stouter claws and antennæ and in being rather larger. There is less agreement with specimens from Massachusetts, as the antennæ of the Alaskan forms are shorter as compared with them, the claws stouter and the mucrones more slender, with subequal teeth; moreover, the fourth abdominal segment, shorter than the third in the latter specimens, is twice as long as the third in the Harriman examples.

Isotoma fimetaria, well known in northern and middle Europe, is also widely distributed through the Arctic regions, as the above list shows. The species doubtless occurs extensively in the United States also, being recorded from California and having been found by myself in Massachusetts and Ohio.

ISOTOMA VIRIDIS Bourl.

(Pl. IV, fig. 4, type.)

? Podura viridis MÜLLER, Zoologiae Danicae Prodromus, p. 183, 1776 (Denmark).—? GMELIN, in Linné Systema Naturae, Ed. 13, p. 2910, 1788.
Podura viridis BOURLET, Mémoire Podurelles, p. 24, 1843 (France).
? Podura plumbea MÜLLER, Zoologiae Danicae Prodromus, p. 183, 1776.—? O. FABRICIUS, Fauna Groenlandica, p. 211, 1780 (Greenland).
Isotoma viridis BOURLET, Mém. soc. sc. agric. arts Lille, Pt. 1, p. 401, 1839 (France).—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 433, 1844.—LUBBOCK, Monograph Coll. and Thys., p. 169, 1873 (England).—PARONA, Saggio Catalogo Pod. Ital., p. 42, 1878 (Italy); Ann. mus. civ. st. nat. Genova, XVIII, p. 463, 1883.—REUTER, Öfv. finsk. vet. soc. förh., XXXIII, p. 229, 1891 (Siberia).—SCHÖTT, K. sven. vet. Akad. hand., XXV, No. 11, pp. 59–61, taf. 5, figs. 1–5 ; taf. 6, figs. 1, 2, 1894

(Siberia).—DALLA TORRE, Die Gattungen und Arten der Apterygogenea (Brauer), p. 10, 1895.—REUTER, Acta Soc. Fauna Flora fenn., XI, no. 4, pp. 25–26, 1895 (Finland).—MACGILLIVRAY, Can. Ent., XXVIII, p. 58, 1896 (Mass., Tex., N. Y.).—SCHÄFFER, Mitt. naturh. Mus. Hamburg, XIII, pp. 184–186, taf. 3, fig. 80, 1896 (Germany).—LIE-PETTERSEN, Bergens Mus. Aarb. (1896), No. 8, p. 17, 1897 (Norway); *ibid.*, No. 6, p. 12, 1898.—MEINERT, Vidensk. Med. naturh. Foren. Kjobenhavn (1896), p. 169, 1897 (Greenland).—SCHERBAKOF, Zool. Anz., XXI, p. 58, 1898 (Russia); Materials, etc., Apteryg. Vicinity of Kief, p. 7, 1898; Zool. Anz., XXII, p. 47, 1899 (Spitzbergen).—CARPENTER and EVANS, Proc. R. Phys. Soc. Edinburgh, XIV, p. 246, pl. 7, fig. 17, 1899 (Scotland).—WAHLGREN, Öfv. k. vet. Akad. förh., LVI, No. 4, p. 338, 1899 (Spitzbergen); Ent. Tidsk., XX, hft. 2–3, pp. 186–190, 1899 (Sweden).—KIEFFER, Berl. ent. Zeits., XLV, hft. 1–2, p. 113, 1900 (Germany).—SCHÄFFER, Fauna Arctica, I, lief. 2, p. 245, 1900; Jahreshefte Vereins vaterl. Naturk. Württemberg, LVI, p. 256, 1900 (Germany).

Isotoma caerulea BOURLET, Mém. soc. sc. agric. arts Lille, Pt. 1. p. 401, 1839.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 433, 1844.

Isotoma arborea BOURLET, Mém. soc. sc. Agric. arts Lille, Pt. 1, p. 401, 1839.—PARONA, Saggio Catalogo Pod. ital., pp. 40–41, 1878; Ann. mus. civ. st. nat. Genova, XVIII, pp. 462–463, 1883; *ibid.*, 2d ser., VI, p. 143, 1888.

Desoria virescens NICOLET, Recherches Podurelles, p. 59, pl. 5, fig. 12, 1841 (Switzerland).—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 428, 1844.

Desoria cylindrica NICOLET, Recherches Podurelles, p. 60, pl. 6, fig. 1, 1841.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 429, 1844.

Desoria viatica NICOLET, Recherches Podurelles, p. 61, pl. 6, fig. 2, 1841.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, pp. 429–430, 1844.

Desoria pallida NICOLET, Recherches Podurelles, p. 61, pl. 6, fig. 3, 1841.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 430, 1844.

Desoria ebriosa NICOLET, Recherches Podurelles, p. 61, pl. 6, fig. 4, 1841.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 430, 1844.

Desoria annulata NICOLET, Recherches Podurelles, p. 62, pl. 6, fig. 5, 1841.—GERVAIS in Walckenaer, Hist. nat. ins. apt., III, p. 430, 1844.

Desoria fusca NICOLET, Recherches Podurelles, p. 63, pl. 6, fig. 7, 1841.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 431, 1844.

Podura arborea BOURLET, Mémoire Podurelles, p. 24, 1843.

Podura annulata BOURLET, *ibid.*

Isotoma Desmarestii GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 436, pl. 50, fig. 11, 1844.

Heterotoma chlorata GERVAIS, *ibid.*, pp. 421–422, pl. 50, fig. 6, 1844.

Isotoma virescens NICOLET, Ann. soc. ent. France, 2d ser., V, 1847.

Isotoma pallida NICOLET, *ibid.*

Isotoma annulata NICOLET, *ibid.*—LUBBOCK, Monograph Coll. and Thys., p. 175, 1873.—PARONA, Ann. mus. civ. st. nat. Genova, XVIII, p. 463, 1883.

Isotoma fusca NICOLET, Ann. soc. ent. France, 2d ser., V, 1847.—LUBBOCK, Monograph Coll. and Thys., pp. 175–176, 1873.—TÖMÖSVÁRY, Math. term. közlem. Magyar Ak., XVIII, p. 124, 1882 (Hungary).—PARONA, Ann. mus. civ. st. nat. Genova, XVIII, p. 463, 1883; *ibid.*, 2d ser., VI, p. 143, 1888.

Isotoma anglicana LUBBOCK, Trans. Linn. Soc. London, XXIII, Pt. 3, p. 596, 1862; Monograph Coll. and Thys., pp. 171–172, pl. 38, 1873.

Isotoma lineata LUBBOCK, Trans. Linn. Soc. London, XXIII, Pt. 3. p. 597, 1862.

Isotoma palustris var. *unicolor* TULLBERG, Öfv. k. vet. Akad. förh., XXVIII, no. 1, p. 151, 1871.
Isotoma palustris var. *annulata* TULLBERG, *ibid.*
Isotoma palustris var. *viridis* TULLBERG, K. sven. vet. akad. hand., X, no. 10, p. 46, taf. 9, figs. 1–8, 1872 (Sweden, Spitzbergen, Bering Id.).—UZEL, Sitzber. k. böh. Gesell. Wiss., II, p. 63, 1891 (Bohemia).
Isotoma palustris var. *fusca* TULLBERG, K. sven. vet. Akad. hand., X, no. 10, p. 46, taf. 9, figs. 1–8, 1872.—UZEL, Sitzber. k. böh. Gesell. Wiss., II, p. 63, 1891.
Isotoma Belfragei PACKARD, Fifth Rep. Trust. Peab. Acad., pp. 33–34, 1873 (Texas).—MACGILLIVRAY, Can. Ent., XXIII, p. 273, 1891.
Isotoma tricolor (in part) PACKARD, Fifth Rep. Trust. Peab. Acad., p. 34, 1873 (Mass.).—MACGILLIVRAY, Can. Ent., XXIII, p. 274, 1891 (D. C.).
Isotoma purpurascens PACKARD, Fifth Rep. Trust. Peab. Acad., pp. 34–35, 1873 (Texas).—MACGILLIVRAY, Can. Ent., XXIII, p. 274, 1891.
Isotoma plumbea PACKARD, Fifth Rep. Trust. Peab. Acad., p. 35, 1873 (Mass.).—MACGILLIVRAY, Can. Ent., XXIII, p. 274, 1891 (L. I., Ohio).
Isotoma palustris TULLBERG, Öfv. k. vet. akad. förh., XXXIII, no. 5, pp. 34–35, 1876 (Siberia).

Alcoholic specimens are either dark green with pale green legs and furcula, or are dark brown. Dorsum marked (fig. 4) with pale round and oval spots, most numerous on meso- and metanotum. Eyes as in figure 40 (var. *arctica*), eight on either side. Postantennal organs ovate to oval. Antennæ half as long again as the head; segments in relative lengths as 4 : 6 : 6 : 7. Body cylindrical; segments related as 4 : 10 : 9 : 7 : 8 : 10 : 9 : 4 : 2. Superior claws (fig. 41, var. *arctica*) long, slender, tapering, slightly curving, laterally pseudonychiate, inner margin bidentate; inferior claws less than half as long, parallel sided, acute, apically curving; tenent hair unknobbed. Furcula half as long as the body; dentes nearly three times the manubrium in length; mucrones (fig. 42, *arctica*) subequally tridentate; teeth large, blunt, apical tooth falcate, second and third subfalcate and opposite each other. Clothing of dense short curving setæ, with long barbellate hairs on the posterior part of the abdomen. Length 6 mm.

Three individuals, St. Paul Id., 1897; three, Popof Id., 1899 (No. 96).

These agree in every essential respect with European examples of *I. viridis*, forma *principalis*, received from Dr. Schäffer and also with specimens collected by myself in Massachusetts, Ohio and Illinois; the Alaskan forms differ from any which I have seen, however, by being larger and in having no tooth on the inferior claw, with the exception of a single small specimen, 2 mm. long.

It is not surprising to meet *I. viridis* from Alaska, as the species has repeatedly been recorded from the Arctic regions and ranges throughout Europe and the United States.

ISOTOMA VIRIDIS Bourl., var. ARCTICA Schött.

(Pl. IV, fig. 5; Pl. VII, figs. 40–42.)

Isotoma viridis, var. *arctica* SCHÖTT, K. sven. vet. Akad. hand., XXV, no. 11, p. 61, taf. 5, fig. 4, 1894.—SCHÄFFER, Fauna Arctica, I, lief. 2, p. 245, 1900.

The preceding description of the typical form applies equally well to the variety *arctica* with the following modifications: *arctica* is longer, more slender (fig. 5) and is yellow, marked with dark blue; each of the last seven segments bears a dorsal deltoid mark by which the variety may be recognized. Length, 7 mm.

Three specimens, Popof Id., 1899 (no. 96).

The two types of Schött came from Port Clarence, on the American side of Bering Strait. Schäffer gives southern Russia as a second locality.

ENTOMOBRYA KINCAIDI sp. nov.

(Pl. VIII, figs. 43–45.)

Olive green with pale mottlings. Head yellowish, oral region dark. Eye patches widely separated; eyes (fig. 43) eight on either side. Antennæ twice as long as the head, or half as long as the body, with segments related as 3 : 5 : 4 : 6; basal ring blackish; basal segment yellow, dusky proximally, second yellow, third yellow, dark distally; fourth elliptical, yellow with dusky apex. Body fusiform, segments as 4 : 24 : 15 : 10 : 13 : 13 : 40 : 12 : 6 in relative lengths; sides dusky, also the anterior border of the mesonotum, and the posterior borders of the fourth and sixth abdominal segments. Legs yellowish; superior claws (fig. 44) broad, straight, inner margin bidentate, a tooth occurring one-fourth, and another one-half the distance from the apex; outer margin untoothed; inferior claws two-thirds as long, broadly linear, acute, untoothed; tenent hair single, knobbed. Furcula white, as long as the antennæ; dentes slender, one-third longer than the manubrium; mucrones (fig. 45) tridentate, as usual, with an apical hook, a second tooth which is conical, erect, and as long as the width of the dens, and a third, small acicular oblique tooth; three barbellate hairs project far beyond the mucrones. Antennæ, legs and furcula densely clothed with short curving barbellate setæ interspersed with long barbellate hairs, which are longest on the last three abdominal segments; stout clavate barbellate setæ occur between the eye patches, on the occiput and on the anterior borders of meso- and metanotum. Length, 1.9 mm.

Type.—Cat. No. 5509, U. S. Nat. Museum.

Four types, Muir Glacier ("hillside to right"), June 11, 1899 (No. 68).

In coloration *E. kincaidi* is much like *E. griseo-olivata* Pack. ('73, p. 39) but the two species differ sufficiently in structural details. In Packard's species the inferior claws are basally dilated, the mucrones strongly falcate, and the fourth abdominal segment is four times as long as the third.

Next to *griseo-olivata*, *kincaidi* is most nearly allied to *marginata* Tull. and *muscorum* Tull. (not Nic.), European specimens of which have been furnished me by Dr. Schäffer.

Named after Professor Trevor Kincaid, of the University of Washington, who has materially assisted in extending our knowledge of Arctic Collembola.

TOMOCERUS NIGER Bourl.

(Pl. VIII, figs. 46, 47.)

Macrotoma nigra BOURLET, Mém. soc. sc. agric. arts Lille, Pt. I, p. 14, 1839 (France).—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 408, pl. 50, fig. 7, 1844.

Macrotoma ferruginosa BOURLET, Mém. soc. sc. agric. arts Lille, Pt. I, p. 14, 1839.—GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 408, 1839.

Tomocerus celer NICOLET, Rech. Podurelles, p. 69, pl. 7, fig. 9, 1841 (Switzerland); Ann. soc. ent. France, 2d ser., V, 1847.—PARONA, Ann. sc. r. inst. tec. Pavia, tav. 2, fig. 7, 1875 (Italy).

Macrotoma celer GERVAIS, in Walckenaer, Hist. nat. ins. apt., III, p. 407, pl. 50, fig. 7, 1844.

Macrotoma lepida GERVAIS, *ibid.*, p. 409.

Tomocerus lepida NICOLET, Ann. soc. ent. France, 2d ser., V, 1847.

Macrotoma flavescens TULLBERG, Öfv. k. vet. Akad. förh., XXVIII, no. 1, p. 149, 1871 (Sweden); K. sven. vet. Akad. hand., X, no. 10, pp. 36–37, taf. 5, figs. 1-6, 1872.—UZEL, Sitzber. k. böh. Gesell. Wiss., II, p. 48, 1891 (Bohemia).

Tomocerus niger LUBBOCK, Monograph Coll and Thys., pp. 139–140, 1873 (England).—PARONA, Saggio catalogo Pod. ital., pp. 25–26, 1878 (Italy); Ann. mus. civ. st. nat. Genova, XVIII, p. 456, 1883; *ibid.*, 2d ser., VI, p. 139, 1888.—REUTER, Acta. Soc. Fauna Flora, fenn., XI, no. 4, p. 15, 1895 (Finland).—CARPENTER and EVANS, Proc. R. Phys. Soc. Edinburgh, XIV, pp. 236–237, pl. 7, fig. 16, 1899 (Scotland).—SCHÄFFER, Jahreshefte Vereins vaterl. Naturk. Württemberg, LVI, p. 274, 1900 (Germany).

Tomocerus flavescens SCHÖTT, K. sven. vet. Akad. hand., XXV, no. 11, p. 42, 1894 (Norway). — DALLA TORRE, Die Gattungen und Arten der Apterygogenea (Brauer), p. 11, 1895.—SCHÄFFER, Mitt. naturh. Mus. Hamburg, XIII, pp. 204–205, 1896 (Germany).—LIE-PETTERSEN, Bergens Mus. Aarb. (1896), no. 8. p. 11, 1897 (Norway); *ibid.*, no. 6, p. 8, 1898.—SCHERBAKOF, Zool. Anz., XXI, p. 60, 1898 (Russia); Materiali, etc., Apteryg. Vicinity of Kief, p. 20, 1898.—ABSOLON, Studies Morav. Cave Apt., pp. 32–33, 1900 (Moravia).

Cream yellow when denuded of scales. Eyes six on either side, on black patches close behind the bases of the antennæ. Antennæ shorter than the body; basal ring prominent; first segment yellow or purplish; second and third yellow, frequently purplish apically; third often purple throughout; fourth segment purple. Legs yellow, excepting the tibiæ, which are purplish distally; superior claws (fig. 46) long, slender, uniformly tapering, straight, pseudonychiate, inner margin bidentate, or, less than half as often, tridentate; inferior claws half as long, straight, tapering, acuminate, inner margin unidentate near the middle; tenent hair knobbed. Furcula yellow. Dental spines (fig. 47) seven to nine, becoming successively smaller toward the base of each dens until the large proximal spine is reached; the distal spine is more lateral than the rest and there may be two of them on either side; a lanceolate acuminate transparent scale occurs near the proximal spine or spines. Clothing of scales, with numerous clavate setæ on head and legs, interspersed with many long stiff hairs, especially on femora and manubrium; mesonotal collar of stiff setæ, finely barbellate apically; similar setæ occur on the manubrium among the short reclinate bristles; the furcula bears scales above and long plumes beneath. Length, 5 mm.

Twenty-one specimens, Yakutat, June, 1899 (Nos. 57, 69); three, Cook Inlet, 1899 (No. 60); one, Popof Island, 1899 (No. 96); one, Juneau, 1899 (No. 56); four, Sitka, June, 1899 (Nos. 64, 71); three, Berg Bay, June 10, 1899 (No. 72); fifty-five, Muir Glacier, west side, June 12, 1899 (No. 63), comprising intergradations between *niger*, *arcticus* and *americanus*, but consisting principally of typical *arcticus*.

Many of the specimens from which the preceding description was made conformed to authoritative descriptions and figures of the well-known *T. flavescens* (more properly termed *niger*), of Europe, and also agreed with eight examples of the species given me by Dr. Schäffer. Most of the Harriman specimens varied greatly, however, in the characters of accepted specific value—for example, those of the claws and dental spines. These variations, bearing importantly upon the interrelations of three members of the genus, are tabulated below.

Tullberg's (1872, pp. 36–37, taf. 5, figs. 1–6) diagnosis of *T. flavescens* is, "Antennæ corpore non longiores. Spinæ dentium simplices 7–8, intima magna. Unguiculus superior dentibus 2 instructus, inferior lanceolatus. Long. 4 millim." Tullberg adds that the inferior claws are unidentate. With this description compare the following records. The figures after the + signs refer to the number of large spines beside each dental scale.

Teeth of superior claws.				Dental spines.	
Class.	Fore foot.	Mid foot.	Hind foot.	Right dens.	Left dens.
1	2	2	2	5 + 2	7 + 2 Common
2	3	2	2	6 + 1	6 + 1 Occasional
3	3	3	3	7 + 2	6 + 2 Two specimens
4	4	3	3	?	? One specimen
5	4	4	3	8 + 2	8 + 2 " "
6	4	4	4	8 + 2	7 + 2 " "

Excepting these variations, all the individuals are essentially alike and nearly all the variations given are found in one lot of specimens (No. 63, Muir Glacier), among which are also the forms *arcticus* and *americanus*. Individuals of class No. 1 are clearly *niger* (*flavescens*). Those of No. 2 depart from the type in having an extra tooth but are more typical than No. 1 by having but one accessory spine. Having admitted No. 2 as *niger*, how may we exclude No. 3, as regards the claws? The number of spines is normal on the left, and but one too many on the right dens. Considering the numerical variability of the spines, No. 3 could still be called *niger*. Notice, however, that No. 3 is just as evidently a variety of *T. americanus* Schött. His diagnosis (1896, p. 172, pl. 16, figs. 6, 7) provides especially for the three-toothed form. Nos. 4, 5 and 6 are clearly *americanus*, in which Schött himself found great variability and affinities with *flavescens*.

Any distinction between *niger* and *americanus*, then, must be artificial and arbitrary. This is not all, for *T. arcticus* enters the discussion. Schött (1894, pp. 43–44, taf. 3, figs. 8, 9) distinguishes *arcticus* as having (1) four teeth normally on each superior claw (five may occur on any foot, but his statement, "doch scheinen 4 Zähne auf allen das normale zu sein," holds, nevertheless), (2) "Spinæ dentium simplices, septem vel interdum octo, intima parva." The only apparent differences, therefore, between *arcticus* and *americanus* are the absence of a tooth on the inferior claws of *arcticus* and of two large spines beside each dental scale. Now the tooth mentioned was present on most of the Alaskan examples of *arcticus*, although not referred to by Schött, in whose specimens it was very likely absent. As to the accessory spines, one such is indeed mentioned by Schött and several of the Alaskan specimens, which occurred with typical *arcticus* and were unlike it in no other respect, had two well developed accessory spines. Therefore, *arcticus* and *americanus* merge together.

Comparing *arcticus* directly with *niger*, the former, when it has one accessory spine, agrees to that extent with the latter; the teeth on each superior claw of *arcticus* are not known to be less than four, and

are only two in typical *niger;* as I have implied, however, *arcticus* is connected with *niger* through *americanus;* in fact, the variety of *arcticus* with two basal spines might be called *americanus*, were its true relations with *arcticus* not known.

The dental scales also, occurring in no other described species except *T. plumbeus*, are of significant value.

To summarize: *arcticus* varies into *americanus* which, in turn, connects insensibly with *niger*. The first two, then, are properly to be called varieties of *niger* (*flavescens*)—the first described of the three. The question whether *niger* is actually nearest the stem form —a debatable subject, which I have but partially settled—fortunately does not affect the terminology to be adopted.

Although *niger* has long been known to occur throughout Europe under the name of *flavescens*, it has not been hitherto recorded from the Arctic regions.

TOMOCERUS NIGER Bourl., var. ARCTICUS Schött.

(Pl. VIII, figs. 48-52.)

Tomocerus arcticus SCHÖTT, K. sven. vet. akad. hand., XXV, No. 11, p. 43, taf. 3, figs. 8, 9, 1894.—DALLA TORRE, Die Gattungen und Arten der Apterygogenea (Brauer), p. 11, 1895.—SCHÄFFER, Fauna Arctica, I, lief. 2, p. 251, 1900.

Typical *arcticus* is citron yellow, when denuded of scales. Eyes six on either side (fig. 48), as usual. Antennæ over three times as long as the head, or two-thirds the length of the body; segments related as 2 : 3 : 13 : 3; basal ring purple; first two segments yellow, second often purplish distally; last two pale purple. Prothorax concealed; remaining segments related in length as 8 : 6 : 5 : 6 : 9 : 6 : 3 : 2. Legs yellow throughout, or else coxæ and tibiæ purplish; superior claws (fig. 49) rather stout, slightly curved, pseudonychiate; inner margin distinctly quadridentate, as a rule; superior claws of hind feet one-third longer than those of the other feet; inferior claws two-thirds as long as the large claws, lanceolate, acute, inner margin unidentate two-fifths from the apex; tenent hair knobbed. Furcula attaining the ventral tube; segments as 5 : 7 : 1, in relative lengths; manubrium yellow, remainder white. Dental spines (fig. 50) normally six or seven on either side, becoming successively smaller proximally; distal spine more lateral than the rest; two large ovate-lanceolate acuminate transparent scales occur near the manubrium. Clothing as in *T. niger*, type. Length, 3.5 mm.

One specimen, Popof Id., 1899 (No. 96); four, Cook Inlet, 1899

(No. 60); nine, Sitka, June, 1899 (Nos. 64, 71); one, Yakutat Bay, 1899 (No. 69); fifty-five, including intergrades with *niger* and *americanus*, Muir Glacier, west side, June 12, 1899 (No. 63).

In *arcticus* there is a strong tendency toward a double series of dental spines, a peculiarity limited to *arcticus*, so far as I know. The nature of the doubling is shown in fig. 51, in which certain of the proximal spines are each laterally accompanied by an extra spine. The addition of spines begins at the base of the series and proceeds distally; in fig. 52, only the basal spine of the right dens is repeated, the remaining spines being single.

There is no question about the identity of these specimens. Four is the normal number of teeth for a superior claw, as Schött says; on one pair of hind feet I found five on the right and four on the left foot, a variation mentioned by Schött. He neither describes nor figures a tooth for the inferior claw; such a tooth was distinct on most of the Harriman specimens, however, although occasionally obscure or even absent, especially on small individuals. The dental spines, rarely eight, in a normal series, were as often six as seven. The number of spines increases with the size of the individual. I may add that the dental scales disagree with Schött's figure by being acuminate instead of rounded.

The preceding description is based upon nearly typical specimens. To describe the varieties of *arcticus* would be to describe *niger* and *americanus* again, as *arcticus* varies into both those forms. The presence of an accessory spine beside each scale and a slight reduction in the number of teeth for the superior claw, variations which actually occur in the specimens from the Muir Glacier—transform *arcticus* into *niger*. The variations leading into *americanus* are given below and I have already shown (p. 99) that between *americanus* and *niger* proper, no natural distinctions exist.

Since its discovery by the Vega Expedition in 1878–79, *arcticus* has never been recorded. The types occurred in colonies at Pitlekai, Chukchi peninsula, eastern Siberia.

TOMOCERUS NIGER Bourl. var. AMERICANUS Schött.

(Pl. VIII, fig. 53.)

Tomocerus americanus Schött, Proc. Cal. Acad. Sci., VI (2), p. 172, pl. 16, figs. 6, 7, 1896.

Among the many specimens of typical *arcticus* from the Muir Glacier are several which agree with *arcticus* in every respect save that

the dental spines are nine to eleven on either side, there being one or two large additional spines near the dental scale, as in fig. 53. The same varieties, which also occurred frequently with typical examples of *niger*, are evidently *americanus* Schött (1896, p. 172) which, indeed, was described as being a very variable species. The interrelations of *americanus* and *niger* I have discussed on p. 99.

Occurred among fifty-five specimens of *arcticus* and *niger*, Muir Glacier, west side, June 12, 1899 (No. 63); also at Cook Inlet (No. 60) with typical *niger*.

PAPIRIUS PALMATUS sp. nov.

(Pl. VIII, figs. 54–56.)

Pale yellow, laterally washed with purplish, or else blackish-purple, with pale rounded lateral spots; face with a broad median purple stripe. Eyes (fig. 54) eight on either side, on large black patches. Antennæ slightly shorter than the body, purple, paler basally; third segment with six annulations behind the swollen apex; fourth lanceolate, with two annulations below the middle. Superior claws (fig. 55) long, slender, tapering, feebly curving, outer surface unidentate two-fifths from the apex; inner margins with a pair of teeth at about one-fourth, and a second pair at one-half the distance from the apex (only two teeth show in a profile aspect of the claw); inferior claw two-thirds as long as the other, lanceolate, acuminate, with a stout knobbed subapical tenent hair as long as the claw itself, and with a long stiff basal spine borne on the rounded inner margin; an extra long subapical hair occurs on the tibia. Furcula white, attaining the mouth; segments related as 3 : 5 : 2; dentes each with a lateral series of stiff setæ, of which the proximal alone is simple, the others becoming successively shorter and serrately compound (fig. 56); all the setæ are simple, though, in small individuals; mucrones (fig. 56) long, slendar, concave, with twenty to thirty rounded teeth on either margin. Dorsum clothed with numerous short stiff setæ and several long spinous hairs; stiff setæ on antennæ and legs. Maximum length, 2.24 mm.

Type.—Cat. No. 5434, U. S. Nat. Museum.

Described from twenty-four types: thirteen, Sitka, June, 1899 (Nos. 64, 71); six, Yakutat, June, 1899 (Nos. 57, 58); three, Berg Bay, June 10, 1899 (No. 72); one, Kodiak (No. 65); one, Fox Point, July, 1899 (No. 67).

Papirius palmatus is most nearly allied to *P. ater* L. (Tull. 1871, p. 146; 1872, p. 34, taf. 3, figs. 26–36).

MACHILIS ARCTICA sp. nov.

(Pl. v, figs. 6–10; Pl. viii, figs. 57, 58.)

Body (fig. 6) annulated with alternating bands of dark brown and pale yellow. Head colored as represented in fig. 57. Eyes circular in outline, contiguous along one-fifth the inner margin, or for a distance equal to about one-third the diameter of an eye. Antennæ one-quarter longer than the body; hairs white; the basal ring and the following seven segments are, in relative lengths, as 5 : 25 : 10 : 7 : 3 : 4 : 2 : 4; basal ring (fig. 7) yellow, bordered with brown; basal segment cylindrical, twice as long as broad, brown; remaining segments yellow, obscurely banded with brown. Maxillary palpi (fig. 8) seven-jointed, as usual, with segments related as 4 : 5 : 5 : 8 : 8 : 7 : 6; first segment constricted near the base, with a lateral finger-like process and a globose apex; remaining segments simple, cylindrical, yellow, with the following brown markings (fig. 8): A basal patch on segment two, a distinct basal ring on segment four, a diffuse basal ring on segments five and six and a subapical patch on segment five. Labial palpi (fig. 9) with segments related as 3 : 5 5; first segment brown, clavate, with a short apical process; second yellow, cylindrical, three times as long as it is broad; third yellow, strongly clavate. Body slender; the relative lengths of the successive segments, measured along the median dorsal line, are 9 : 18 : 10 : 10 : 9 : 7 : 9 : 10 : 11 : 11 : 11 : 10 : 7; thorax feebly arched; coxæ (fig. 10) brown; trochanter yellow; femur brown, with yellow apex; tibia brown; tarsus brown, basally and apically; claws and cerci brown. Median cercus one-quarter longer than the body, or nearly as long as the antennæ; lateral cerci nearly one-third as long as the median cercus. From a perfect specimen were taken the following measurements of relative lengths: body, 8; antennæ, 11; median cercus, 10; lateral cerci, 3.

The scales are so variable in size and form as to be of no specific value, at least in this species; the cuticular figures, however (fig. 58), will assist in distinguishing this form. Length, 8 mm.

Type.—Cat. No. 5433, U. S. Nat. Museum.

Nine types: three, Muir Glacier ("hillside to right"), June 11, 1899 (No. 68); five, Popof Island, 1899 (Nos. 59, 66); one, Sitka, June, 1899 (No. 61).

I have found no species to which *M. arctica* is closely allied. Its most distinctive characters are the relative lengths of body, antennæ and cerci, the coloration of the head, form and position of the eyes and the color and form of the antennal and palpal segments.

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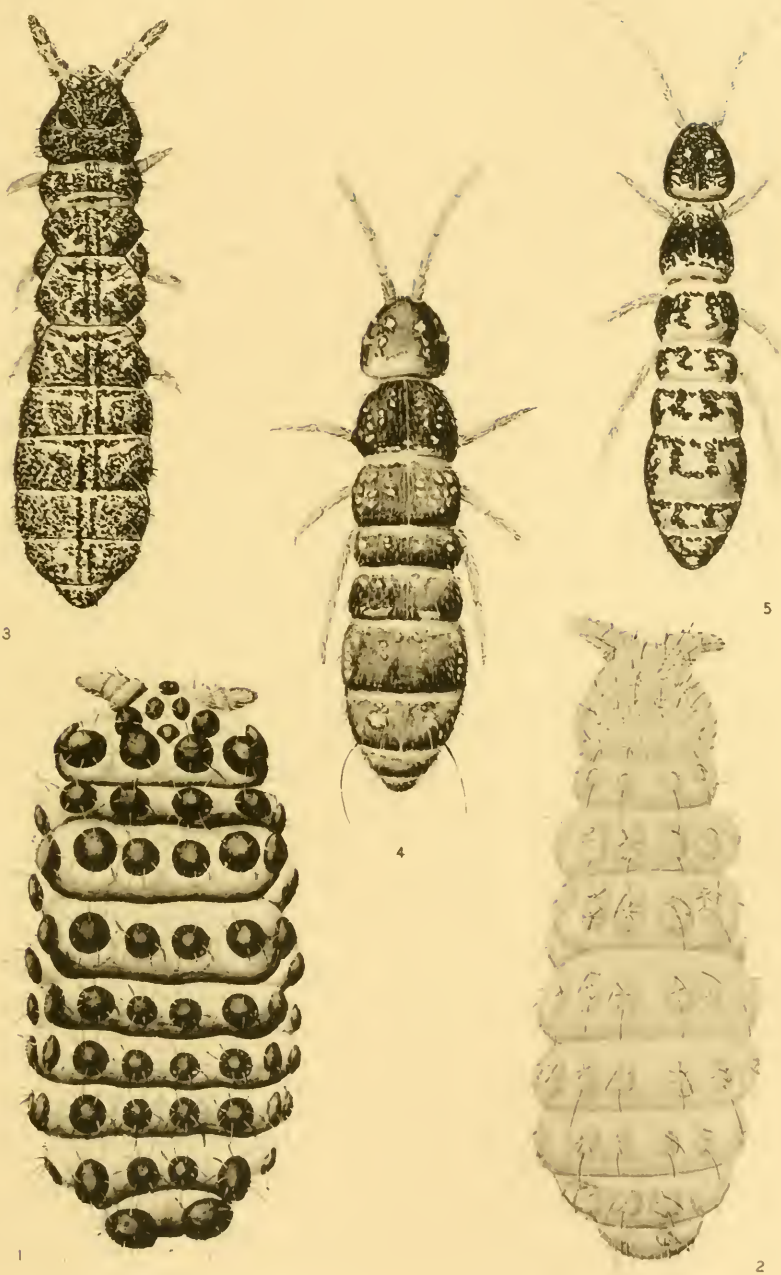
PLATE IV.

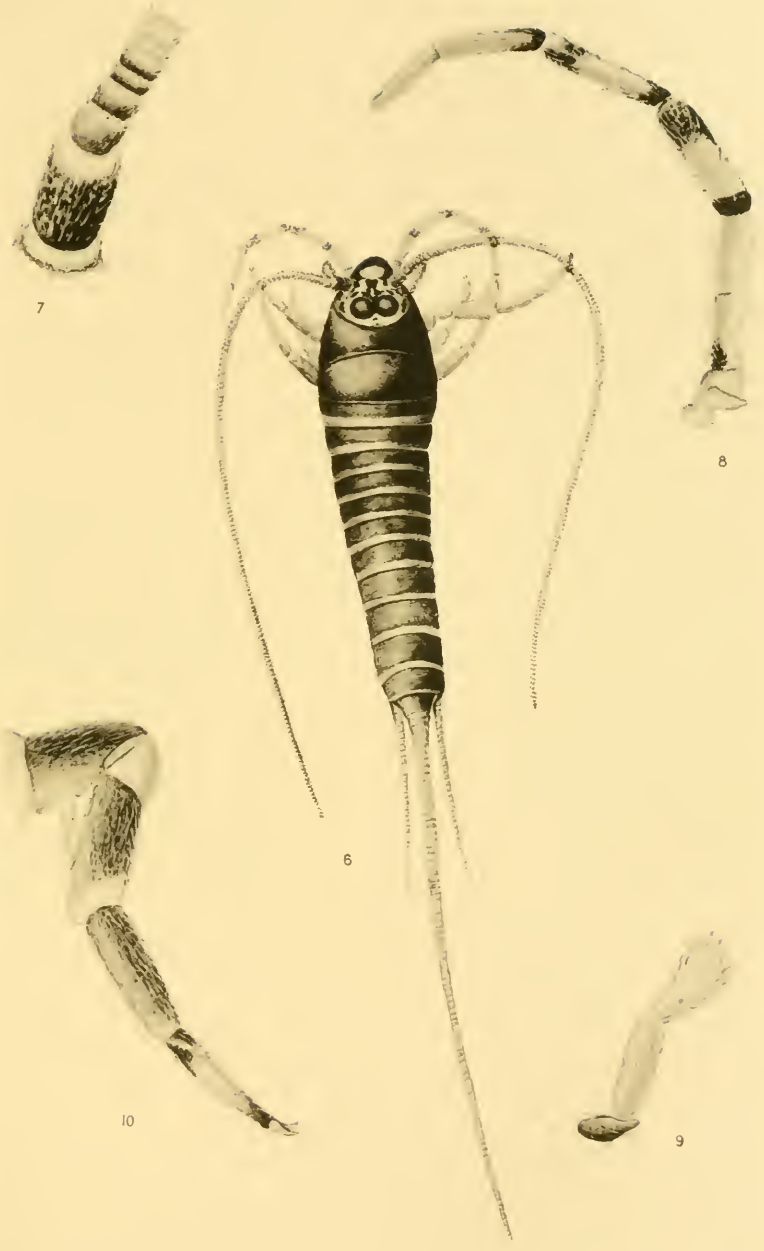
FIG. 1. *Neanura gigantea* Tull. (× 20).
2. " *ornata*, sp. nov. (× 60).
3. *Anurida amorita*, sp. nov. (× 18).
4. *Isotoma viridis* Bourl., type (× 13).
5. " " " var. *arctica* Schött (× 12).



ALASKA APTERYGOTA.

PLATE V.

FIG. 6. *Machilis arctica*, sp. nov. (×8).
7. " " " " antenna (×30).
8. " " " " left maxillary palpus (×30).
9. " " " " right labial palpus (×30).
10. " " " " left mid leg (×30).



ALASKA APTERYGOTA.

PLATE VI.

FIG. 11. *Neanura gigantea* Tull.; eyes of left side (× 127).

12. " " " left postantennal organ (× 434).

13. " " " left aspect of hind foot (× 99).

14. " *ornata* sp. nov.; head; eyes indicated by *e*, *e*, *e* (× 99).

15. " " " " left aspect of left antenna (× 127).

16. " " " " ventral aspect of head (× 60).

17. " " " " metanotal setæ (× 434).

18. " " " " right aspect of left fore foot (× 367).

19. *Anurida amorita* sp. nov.; eyes and postantennal organ of right side (× 200).

20. *Anurida amorita* sp. nov.; left postantennal organ (× 434).

21 " " " " right " " (× 434). (figs. 20 and 21 are from the same individual.)

22 *Anurida amorita* sp. nov.; dorsal aspect of right antennal organ (× 367).

23. *Anurida amorita* sp. nov.; left mid foot (× 200).

24. " " " " right aspect of right fore foot (× 300).

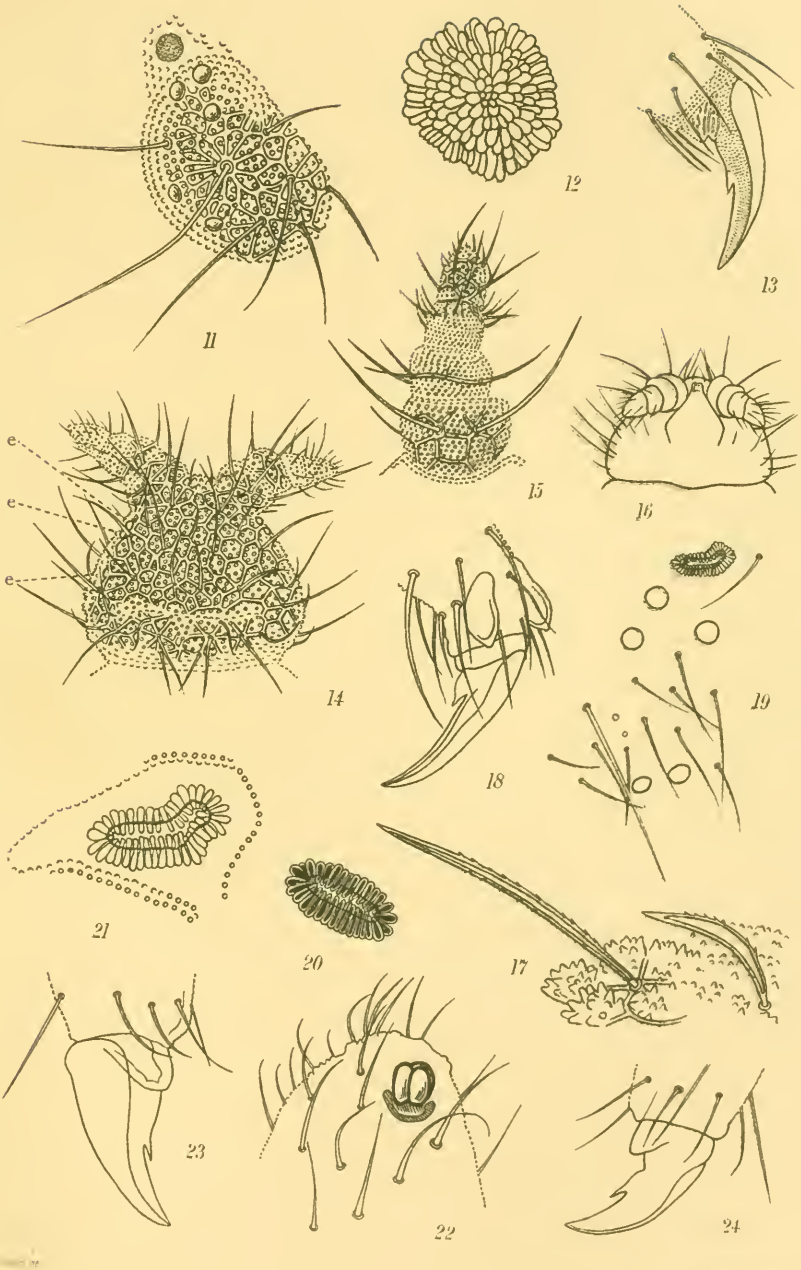


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PLATE VII.

FIG. 25. *Aphorura octopunctata* Tull.; right postantennal organ, etc. (× 367).

26. " " " dorsal aspect of right antennal organ (× 434).

27. *Aphorura octopunctata* Tull.; left aspect of left hind foot (× 367).

28. " " " left aspect of left anal spine (× 357).

29. " *dentata* sp. nov.; represents arrangement of dorsal pseudocelli (× 20).

30. *Aphorura dentata* sp. nov.; right postantennal organ (× 434).

31. " " " " deeper structure of postantennal organ (× 434).

32. *Aphorura dentata* sp. nov.; base of right antenna (× 127).

33. " " " " dorsal aspect of right antennal organ (× 434).

34 *Aphorura dentata* sp. nov.; left aspect of right hind foot (× 200).

35. " " " " dorsal aspect of anal spines (× 200).

36. " " " " right aspect of right anal spine (× 200).

37. *Isotoma fimetaria* (L.) Tull.; antenna (× 60).

38. " " " " left aspect of right hind foot (× 434).

39. " " " " left mucro (× 434).

40. " *viridis* Bourl., var. *arctica* Schött; eyes and postantennal organ of right side (× 200).

41. *Isotoma viridis* Bourl., var. *arctica* Schött; left aspect of left fore foot (× 200).

42. *Isotoma viridis* Bourl., var. *arctica* Schött; right aspect of right mucro (× 434).

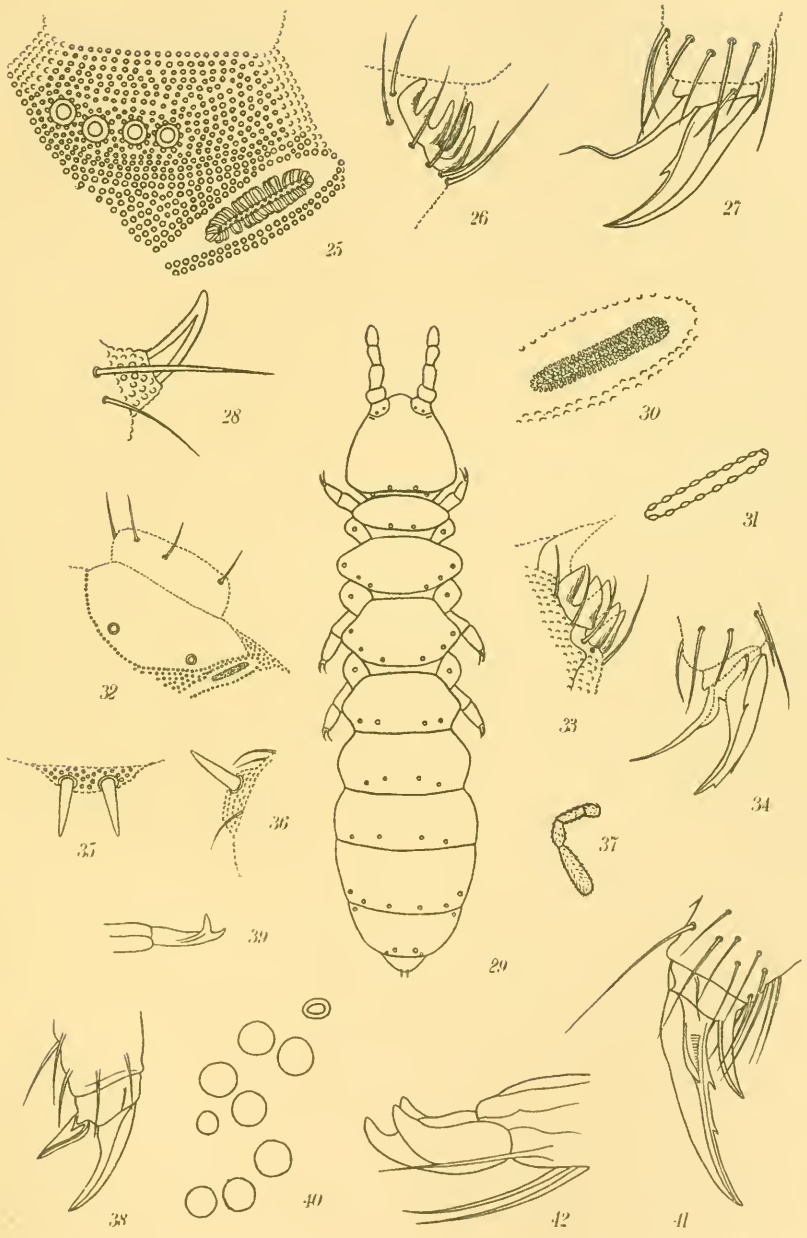

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PLATE VIII.

FIG. 43. *Entomobrya kincaidi* sp. nov.; eyes of right side (× 374).

44. " " " " left aspect of left hind foot (× 434).

45. " " " " left aspect of left mucro (× 434).

46. *Tomocerus niger* Bourl., type; right aspect of right fore foot (× 367).

47. " " " " dental spines (× 200).

48. " " " var. *arcticus* Schött; eyes of right side (× 367).

49. " " " " " " right aspect of left hind foot (× 367).

50. *Tomocerus niger* Bourl., var. *arcticus* Schött; dental spines (× 200).

51 " " " " " " doubled dental spines (× 200).

52. *Tomocerus niger* Bourl., var. *arcticus* Schött; dental spines slightly abnormal (× 200).

53. *Tomocerus niger* Bourl., var. *americanus* Schött; dental spines (× 200).

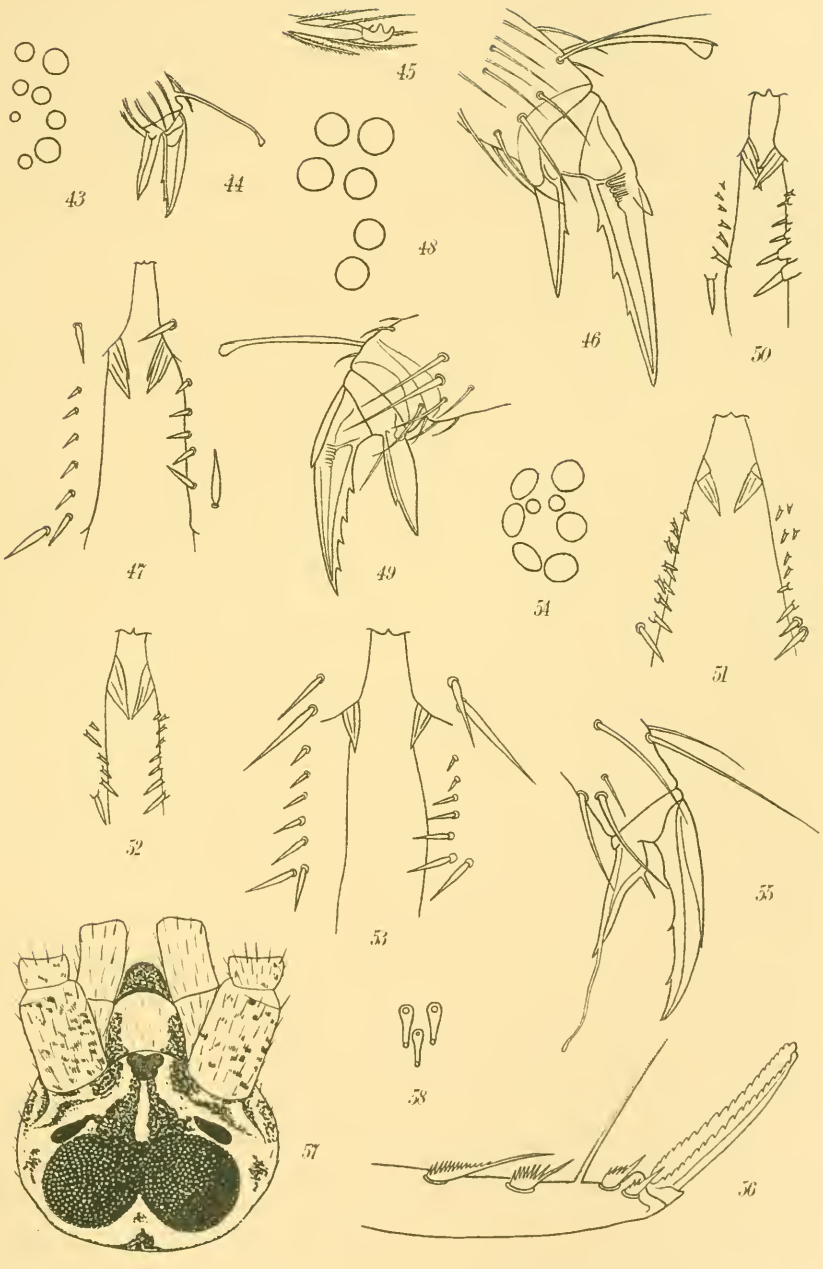
54. *Papirius palmatus* sp. nov.; eyes of left side (× 127).

55. " " " " left aspect of left hind foot (× 367).

56. " " " " left aspect of left mucro, etc. (× 200).

57. *Machilis arctica* sp. nov.; dorsal aspect of head (× 28).

58. " " " " cuticular figure (× 434).



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