The Crane-flies collected by the Canadian Arctic Expedition, 1913-18.

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Introduction.

The collection of crane-flies made by the Canadian Arctic Expedition is quite extensive, and includes about 100 specimens of adults, larvæ, and pupæ. The types and uniques have been placed in the Canadian National Collection; certain of the paratypes and duplicates are retained in the collection of the author. The present report has been divided into two general portions, the first on the taxonomy of the adult flies, the second a consideration of the immature stages and the biological data secured by the collector, Mr. Frits Johansen.

The material represents as satisfactory a collection of Arctic American Tipulidæ as has yet been brought together. The itinerary and general narrative of the Southern Division of the Expedition has been recorded by Dr. R. M. Anderson (1917).[1]

Bibliography.

There have been rather numerous species of crane-flies described from the Canadian Arctic Northwest, the more important reports on these collections being as follows:—

Kirby, Wm., (1824) in the supplement to Capt. Parry's first voyage described *Stygeropis parrii* (Kirby).

Curtis, John (1831) in the appendix to Ross's voyage to the Arctic regions, described *Tipula arctica* Curtis.

Loew, Hermann (1863–1865) in the Centuries of North American Diptera described the numerous species of Tipulinæ collected by Robert Kennicott, now in the Museum of Comparative Zoology at Cambridge. These specimens bear the general label of "H.B.T," only a few of them having any more exact label. In another paper (Proceedings of the Academy of Natural Sciences of Philadelphia, September, 1915, pp. 458–465) I have discussed Loew's species and their present condition.

Osten-Sacken (1859–1869) described most of the Limnobiinæ collected by Kennicott and also (1876) *Tipula besselsi*, from Polaris bay, Greenland, at about 82 degrees north latitude, collected by Dr. E. Bessels in 1872.

Bergroth (1888) described several new species mostly from Sitka, Alaska. Most of these were rediscovered on the Harriman expedition (see Coquillett).

Williston (1893) described *Stygeropis bergrothi* from Alaska. The type was recorded as having been placed in the Kansas University collection, but is not mentioned among the types in Hunter's list (Kansas University Science Bulletin, vol. 8, No. 1. p. 18; 1914) nor have I been able to locate the specimen.

Doane (1900, 1901) described a very few species from Unalaska, his types being in the collection of the United States National Museum.

Coquillett (1900), The Crane-flies of the Harriman Expedition to Alaska, the types are now in the collection of the United States National Museum.

Dietz (1915), two Limnobiine crane-flies collected by Francis Harper in the Athabaska country.

Alexander (1915–date), species collected by Kennicott in the Loew collection but never described by Loew; the types are now in the collection of the Museum of Comparative Zoology. The crane-flies of the Pribilof islands, now in the collection of the United States Biological Survey.

The most important collections from the Arctic Northwest may be considered to be the following: Kennicott's collections, the Harriman Expedition, the Pribilof islands collections, and the present one.

[1] Report of the Department of the Naval Service for the Fiscal Year ending March 31st, 1917. Ottawa: A 1-2, pp. 22-70. Also Summary Report of the Geological Survey, Dept. of Mines, for the calendar year 1913. *Ibid.* 1914, 1915, 1916.

From the above material a good idea of the general facies of the crane-fly fauna of the Canadian Arctic Northwest may be obtained. The species are almost, if not all, forms of dull, sombre colouration—browns or greys—and most of them are of simple, primitive organization. A considerable number show unmistakable signs of degeneracy in the wings, this condition being particularly noticeable in the Pribilof islands, where fully half of the known species have the wings more or less atrophied. In the present collection, two of the Limnobiine forms showed the first stages of wing-atrophy, but all of the ten Tipuline species are full-winged. Some of the species of Arctic Tipulidæ have the head, the thoracic intervals, the pleura, coxæ, etc., clothed with an abundant long, erect pubescence. Many of the Arctic crane-flies seem to be very local in their distribution. Thus the collections from the Pribilof islands show not one of the species taken elsewhere in the Canadian northwest (with the possible exception of *Trichocera*). Similarly, the collections of the Harriman expedition and the present collections show that the species are in large part very local in their distribution, the natural barriers of mountains and large water-bodies having proved a very efficient check upon their dispersal. In the present collection there are a total of sixteen species, only two or three of which have been found elsewhere; of these *Tipula arctica* and *Stygeropis parrii* are rather well-known Arctic American species, and the *Trichocera* is probably Holarctic in its distribution.

The collection that is reported upon in this paper is constituted as follows:—

Rhyphidæ—		
Trichocerinæ—		
Trichocera		1 species.
Tipulidæ—		
Limnobiinæ—		
Limnobiini.	*Dicranomyia*	1 species.
Eriopterini.	*Erioptera*	1 "
Limnophilini.	*Limnophila*	1 "
Pediciini.	*Tricyphona*	2 "
Tipulinæ—		
Tipulini.	*Stygeropis*	2 "
	Nephrotoma	1 "
	Tipula	7 "

The general tendencies of distribution of crane-flies in the high Arctic regions are well shown by the above list, the omnipresent *Trichocera*, a dominance of Pediciine and Tipuline genera, with a smattering of *Limnobiini, Eriopterini* and *Limnophilini*. The extensive tribes *Antochini* and *Hexatomini* (in the strict sense)[1] seem to be entirely lacking so far as known. The *Ptychopteridae* are likewise lacking and the single record for the *Tanyderidæ* (*Protoplasa*) is unsatisfactory.

Adult Flies.

Family **TIPULIDÆ.**

Subfamily **LIMNOBIINÆ.**

Tribe *LIMNOBIINI.*

Genus **Dicranomyia** Stephens.

Dicranomyia Stephens; Catalogue of British insects, vol. 2, p. 243; 1829.

Dicranomyia alascaensis, n. sp.

Antennæ black; halteres short; wings nearly hyaline, with a large, oval, brown stigma; Sc_2 remote from the tip of Sc_1; cell *first* M_2 closed; femora yellow, tipped with brown.

[1] Concerning the status of the tribe *Hexatomini*, read the remarks under the genus *Poecilostola*, page 000.

FEMALE.—Length, 5·5 mm.; wing, 6·8 mm.

Rostrum and palpi black. Antennæ black, the basal flagellar segments enlarged, beyond the fifth oval, the last segment elongate. Head dark-coloured, discoloured in the type.

Thorax dark-coloured, discoloured in the type, probably grey pruinose; pleura grey pruinose. Halteres short, pale at the base, the remainder brown. Legs with the coxæ and trochanters yellow; femora dull yellow, the tips broadly brown, narrowest on the fore femora, broader on the posterior femora; tibiæ and tarsi very light brown, the terminal segments of the latter darkened. Wings nearly hyaline; stigma large, oval, brown; veins brown; venation (Pl. I, fig. 1) Sc_2 remote from the tip of Sc_1 so that Sc_1 alone is about equal to the basal deflexion of Cu_1; Sc_1 ends just opposite the origin of *Rs* ; *r* at the tip of R_1; *Rs* about twice as long as the basal deflexion of R_{4+5}; cell *first* M_2 closed; basal deflexion of Cu_1 at the fork of *M*.

Abdomen dark brown, pruinose, the pleural integument and the valves of the ovipositor yellowish.

Locality: Holotype, ♀, Nome, Alaska, August 24, 25, 1916 (F. Johansen). No. 78.

In the elongate Sc_1 this species suggests *D. halterata* Osten-Sacken, but this is about the only feature that the two species have in common. In other respects it seems closer to *D. aquita* Dietz[1] from Taltson river, Mackenzie district (not Rocker river as stated in the original description), but it is a much smaller fly and the details of both colour and venation are different.

Tribe *ERIOPTERINI*.

Genus **Erioptera** Meigen.

Subgenus **Erioptera** Meigen.

Erioptera Meigen; Illiger's Magazine, vol. 2, p. 262; 1803.

Erioptera (Erioptera) angustipennis, n. sp.

General colouration dark brown with a grey pruinosity; wings very long and narrow.

MALE.—Length, 4·4 mm.; wing, 5·4 mm.

Rostrum and palpi black. Antennæ black, the flagellar segments oval. Head dark grey.

Mesonotum brown, more greyish on the sides; pseudosutural foveæ conspicuous, transverse, black. Pleura dull grey. Halteres rather elongate, brown. Legs dark brownish black throughout. Wings very long and narrow showing the first stages of atrophy although the venation is normal; membrane slightly suffused with brown; stigma indistinct; veins dark brown; venation (Pl. I, fig. 2) the veins are all very elongated due to the great narrowing of the wing.

Abdomen dull grey, the segments indistinctly paler caudally and here with fringes of long golden hairs that are more sparse elsewhere on the surface; male hypopygium with the pleural appendages slender, pointed at their tips.

Locality: Holotype, ♂, Bernard harbour, Dolphin and Union strait, Northwest Territories, August 1–7, 1915 (F. Johansen). No. 1045.

Readily distinguished from all other members of the genus by the long, narrow wings. The second anal vein is straight as in the subgenus *Acyphona* to which group the species may perhaps be better referred.

[1] Canadian Entomologist, vol. 47, pp. 331-332, fig., October, 1915.

Tribe *LIMNOPHILINI.*

Genus **Limnophila** Macquart.

Limnophila Macquart; Histoire Naturelle, Diptera; Suité à Buffon, vol. 1, p. 95; 1834.

Subgenus **Dactylolabis** Osten-Sacken.

Dactylolabis Osten-Sacken; Proceedings of the Academy of Natural Sciences of Philadelphia, p. 240; 1859.

Limnophila (Dactylolabis) rhicnoptiloides, n. sp.

General colouration black, dusted with grey; wings long and narrow, the veins heavily spotted and seamed with brown; *Rs* spurred at its origin.

MALE.—Length, 8–8.8 mm.; wing, 8–9 mm.

Rostrum and palpi dark brownish black. Antennæ black, the first segment elongated. Head narrowed behind, dark coloured with a light grey pruinosity; the whole dorsal surface of the head is beset with short, sharp bristles that are directed forwards.

Thorax dark with heavy, clear, light grey bloom; mesonotal praescutum with four brown stripes, the median pair long and parallel. Halteres with the stem pale, the knobs darker brown. Legs with the large coxæ dusted with grey; trochanters dark; remainder of the legs broken. Wings long and narrow, subhyaline, the veins heavily seamed with greyish brown so that most of the wing-surface appears of this dark colour; venation (Pl. I, fig. 3) the wing of the paratype is longer and narrower than that of the type figured; in both wings of this paratype there is a cross-vein in cell R_2 just proximad of the radial cross-vein; *Rs* spurred at its origin.

Abdomen black, sparsely dusted with grey.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 15, 1915 (F. Johansen), No. 1308. Paratopotype, ♂, July 22, 1915, No. 1064.

The wings of this interesting new species are narrower, proportionately, than either *L. montana* Osten-Sacken of eastern North America or *L. damula* Osten-Sacken of western North America and the sector is spurred at its origin. The species shows decided tendencies toward degeneration of the wings and in this respect approaches *L.* (*D.*) *wodzickii* (Nowicky), the type of the proposed group *Rhicnoptila* (Beschreibung neuer Dipteren,—Verhandlungen der kaiserlich-königlichen zoologisch-botanischer Gesellschaft in Wien, vol. 17, pp. 337–354, Pl. 11; 1867). This last species is an even more degenerate *Dactylolabis* occurring in the high mountainous regions (6,000 to 8,000 feet) of the Hungarian Tatras (western Carpathians) where it frequents granitic cliffs in places where the rock surface is constantly moistened by dripping water. Here the degenerate condition is apparently brought about by the great altitude and the habitat. In the present species the degeneracy is the result of living in the high arctics and is quite comparable to the condition in *L. wodzickii.* In my opinion the name *Rhicnoptila* has no status at all, although the descriptions of the immature stages indicate some notable peculiarities. But whether these conditions are real or due to the insufficiency of Nowicky's description has not yet been ascertained.

Tribe *PEDICIINI.*

Genus **Tricyphona** Zetterstedt.

Tricyphona Zetterstedt; Insecta Lapponica, Diptera, p. 851; 1838.

Tricyphona brevifurcata, n. sp.

Thoracic dorsum pale brownish grey with three conspicuous dark brown stripes; wings with vein R_{4+5} as long or longer than its fork.

MALE.—Length, 10 mm.; wing, about 9 mm.

Rostrum and palpi dark brownish black. Antennæ black, the flagellum broken. Head small, dark brown, somewhat paler laterally.

Mesonotal praescutum pale brownish grey with three dark brown, very distinct, stripes, the median one broadest in front, narrowed behind, and ending before the suture, very narrowly bifid behind; lateral stripes shorter and narrower crossing the suture and suffusing the scutal lobes; scutellum and postnotum dark brown. Pleura dark blue-grey pruinose. Halteres light brown, the knobs darker. Legs with the coxæ sparsely pruinose; trochanters dark brown; remainder of the legs very dark brown, only the fore femora a little brighter at the extreme base. Wings subhyaline; stigma rather indistinct, pale brown; a darker brown spot on the *r–m* crossvein and the basal deflexion of vein R_{4+5}; vein *Cu* indistinctly seamed with darker; veins brown; venation (Pl. I, fig. 4) crossvein *r* near the tip of R_1; vein R_{4+5} a little longer than the very short fork.

Abdomen elongate, blackish, with numerous, scattered, appressed golden hairs; basal tergites with a transverse linear impressed area before mid-length of the segments, these interrupted medially; the sternites are narrowly and indistinctly margined caudally with pale.

Locality: Holotype, ♂, west of Konganevik, Camden bay, Alaska, July 4, 1914 (F. Johansen). No. 432.

This is a very distinct species of *Tricyphona*, having the fork of vein R_{4+5} shorter than in any other American species of the genus. The wings of the type are badly broken, but otherwise the specimen is in good condition.

Tricyphona frigida, n. sp.

Belongs to the *diaphana* group; size small, wing under 8·5 mm.; general colouration greyish, the thoracic dorsum with narrow brown stripes.

Male.—Length, 5·8 mm.; wing, 7·8 mm.

Female.—Length, 7·5 mm.; wing, 7·5 mm.

Rostrum, palpi, and antennæ black. Head grey.

Mesonotal praescutum grey with four brown stripes, the median pair separated by a narrow vitta of the ground colour. Pleura grey. Halteres brown, the knobs a little darker. Legs with the coxæ grey; trochanters brownish grey; femora pale brown, passing into dark brown before midlength of the segment; tibiæ and tarsi dark brown. Wings with a strong brownish tinge, the stigma darker brown; indistinct brownish seams along the sector and the cord; venation (Pl. I, fig. 5) *Rs* strongly arcuated at its origin; *r* close to the tip of R_1; *r-m* about equal to the basal deflexion of R_5.

Abdomen brownish grey; valves of the ovipositor brownish horn-colour. Male hypopygium (Pl. II, fig. 20) with the pleura short and stout, the apical lobe densely beset with acute black spines; pleural appendage yellow, at the tip and on the cephalic face with a few elongated stout bristles; at the base of the pleurites, a sickle-shaped hook ending in a short, subacute tip; below this a smaller curved hook directed caudad. In *T. diaphana* (Pl. II, fig. 21) the condition is quite similar, but the pleurites are even shorter and stouter; the hooklike appendage at the base of the pleurite is scimitar-shaped, at the tip produced into a long drawn out point; the smaller ventral hook is straighter.

It is probable that fresh specimens are not coloured as described above. The type-material is badly discoloured and matted and it is difficult to be sure of the exact condition in fresh or better preserved material.

Locality: Holotype, ♂, Ketchikan, southeastern Alaska, September 10, 1916 (F. Johansen). No. 872. Allotype, ♀, with the type, No. 877.

T. frigida belongs to the group of species that includes *exoloma* (Doane) and *diaphana* (Doane), these three species showing the following group characters:—

Full-winged, the wing or its venation showing no tendencies to atrophy; median cross-vein present, closing cell *first* M_2; cell R_4 very deep so that the

r-m cross-vein connects with vein R_5 rather than with vein R_{4+5} as in most species of the genus.

It is a much smaller species than either *exoloma* or *diaphana* which have the wings measuring over 10 mm. I am inclined to believe that it is this species that Coquillett records as *diaphana* in the Harriman reports, from the following Alaskan localities:—

Localities: One ♂, Yakutat, Alaska, July 21, 1899; one ♂, Berg bay, June 10, 1899; one ♂, Popof island, July 15, 1899.

It may be that this represents a still undescribed species of the group.

I have the following records for *T. diaphana:*—

Localities: One ♀, Pullman, Wash., May 4, 1898 type; five ♂, ♀, Olympia, Wash., March 16, 1896; one ♂, Seattle, Wash.; one ♂, Vancouver, B.C., March 29, 1902.

Subfamily **TIPULINÆ.**

Tribe *TIPULINI.*

Genus **Stygeropis** Loew.

Stygeropis Loew; Berliner Entomologische Zeitschrift, vol. 7, p. 298; 1863.

A small genus of northern and Arctic Tipuline crane-flies, occurring in both hemispheres. The generally accepted belief that this genus is closely related to *Ctenophora* and its allies is entirely erroneous. This is best proved by a study of the immature stages which are very Tipuline in nature, in some respects uniting the *Longurio* and *Tipula* types.

Stygeropis parrii (Kirby).

Ctenophora parrii Kirby; Supplement to Capt. Parry's First Voyage; 1824.

MALE.—Length, 11–13 mm.; wing, 14–15 mm.

FEMALE.—Length, 17·5 mm.; wing, 15·8 mm.

Palpi short, black. Frontal prolongation of the head short, black. Antennæ (Pl. II, fig. 12) black, the first segment elongate, transversely wrinkled; flagellar segments narrow basally, enlarged distally into a blunt serration on the inner face. Head dull black with a sparse yellowish grey bloom, the sides of the vertex clothed with elongate, pale hairs.

Thoracic dorsum light grey with three broad, darker grey stripes, the median one broadest anteriorly; thoracic interspaces with an abundance of long, erect hairs; an indistinct, narrow, blackish, median stripe runs the length of the notum. Pleura grey, the dorso-pleural membrane more yellowish. Halteres brown, the knobs darker. Legs with the coxæ and trochanters dark, the former grey pruinose; femora reddish brown, the tips broadly blackened; tibiæ and tarsi black. Wings with a slight brownish grey tinge, the costal and subcostal cells more brownish; stigma dark brown; obliterative streak before the cord not very distinct; venation (Pl. I, fig. 7) R_{2+3} long, very slightly arcuated at origin; petiole of cell M_1 present but often greatly shortened as in *parrioides.*

Abdomen dark blue-grey, the segments very narrowly ringed with paler on the caudal margin; lateral margins of the tergites broadly paler. Lobes of the male hypopygium conspicuously yellow; female ovipositor with the tergal valves rather high, narrowly blackened at their tips. Male hypopygium having the ninth tergite (Pl. II, fig. 26) large, the caudal margin with a very deep, U-shaped, median notch, the lateral lobes prominent, obliquely truncated; tergite black, the apices of the lobes broadly pale. Ninth pleurite rather extensive, the pleural suture indistinct beneath; outer pleural appendage (Pl. II, fig. 23)

a suboval flattened lobe, dull yellow in colour, slightly broader at the base than at the tip which is obtusely rounded; the outer face of the appendage with sparse, short, scattered hairs; inner pleural appendage (Pl. II, fig. 24) a large, pale brown lobe, flattened, at the tip produced into a long, curved point that is slightly expanded at its tip, the inner face with abundant long, pale hairs. Ninth sternite extensive, a deep split on the mid-ventral line, the margins closely approximated or contiguous.

The following ten specimens are in the collection:

Localities: Nos. 434, 435, 436, and 438, west of Kongenevik, Camden bay, Alaska, July 4, 1914. Nos. 1194, 1195, Collinson point, Alaska, June 22–23, 1914. Nos. 422, 423, 822, and 828, Bernard harbour, Northwest Territories, July 1–14, 1916, and in July-August, 1915.

The most conspicuous differences between this species and the next, *S. parrioides*, are in the dense erect pile of the present species, the clear blue grey colouration, the conspicuous differences in the structure of the antennæ and hypopygium of the male sex, etc.

S. bergrothi Williston[1] is unsatisfactorily described and the type is apparently no longer in existence as was stated earlier in this paper. It is a blackish grey species with the stem of the halteres and the bases of the femora reddish yellow and the wings uniformly tinged with brownish. *S. sordida* Loew (Century 4, No. 42; 1863) has the rostrum black as in the present species and agrees in some other features, but is apparently a different species.

Stygeropis parrioides, n. sp.

Frontal prolongation of the head light brown; antennæ short, the flagellar segments with an inconspicuous transverse ridge before the middle, this bearing a fringe of short, pale hairs; mesonotum greyish yellow with a narrow, dark brown median line, the sternites and pleurites clear, light grey; abdominal tergites with a broad, dark brown, median line; wings reddish brown; petiole of cell M_1 very short or lacking; pile on the body short, not conspicuous as in *parrii*.

Male.—Length, 14–15 mm.; wing, 11–12 mm.

Palpi short, dark brown. Frontal prolongation of the head light brown, short; nasus distinct. Antennæ (Pl. II, fig. 13) dark brown, segment one elongate, transversely wrinkled; segment two cyathiform; segment three elongate, broader distally; segments four to seven broad basally with a transverse row of pale hairs before mid-length of the segments, on the ventral face with one or two small spicules; terminal segments gradually attenuated. Vertex greyish brown, with numerous black bristles that are lacking on the median line; vertex produced forward on the median line into a tongue between the antennal bases; genæ with numerous black, bristle-like hairs.

Mesonotal praescutum yellowish grey, brightest before the pseudosutural foveæ, the three usual thoracic stripes not distinct, only a very narrow dark brown median line running the entire length of the mesonotum. Dorsal pleurites concolourous with the notum; sternal pleurites and sternum clear light grey. Halteres dark brown. Legs with the coxæ clear light grey; trochanters brown; femora brown; tibiæ similar, darker at the tips; tarsi dark brown. Wings with a strong reddish brown tinge, cells *C* and *Sc* more saturated; stigma brown; the membrane along vein *Cu* more greyish; venation (Pl. I, fig. 8) *Rs* elongate; cell M_1 sessile (as in the genus *Nephrotoma*) or very short-petiolate.

Abdominal tergites reddish brown with a broad, distinct, dark brown, median line; caudal margins of the segments less distinctly brownish; a narrow, sublateral, brown line; extreme lateral margins narrowly dull yellow. Sternites somewhat similar, the basal two-thirds reddish brown, the apical third dark

[1] Kansas University Quarterly, vol. 2, p. 64; 1894.

brown; a very narrow and indistinct median brown line. Male hypopygium with the ninth tergite (Pl. II, fig. 27) short, rather tumid, the caudal margin with a broad, U-shaped, median notch, the caudal margin densely provided with short, black hairs; beneath the tergal lobes, between the pleurites, are two small rounded lobes that are densely set with short black bristles. Ninth pleurite extensive, oval, with numerous hairs; outer pleural lobe (Pl. II, fig. 22) almost circular in outline, the outer face with numerous short hairs; inner pleural lobe (Pl. II, fig. 25) of rather simple structure, two armed, the outer arm directed caudad, at its tip forming a blackened chitinized hook; the inner arm is directed proximad and slightly dorsad, the blunt apex bent very slightly cephalad, almost the whole appendage with dense, pale hairs that are short or absent on the apex of the lobe, longest on the inner margin; viewed from above it is seen that this inner arm sends out a lobule on the inner dorsal side before the apex; the dorsal margin of this lobule is narrowly but heavily chitinized. Suture between the ninth sternite and pleurite not very distinct, the sternal region destitute of hairs.

Locality: Holotype, ♂, west of Konganevik, Camden bay, Alaska, June 1914 (F. Johansen). No. 634. Paratopotypes, seven ♂'s, Nos. 635, 636, June 1914; Nos. 433, 437, 439, 440, and 441, July 4, 1914.

Genus **Nephrotoma** Meigen.

Nephrotoma Meigen; Illiger's Magazine, p. 262; 1803.

Nephrotoma arcticola, n. sp.

General colouration black; abdominal tergites with an interrupted orange-yellow stripe on either side of the median line; wings hyaline with the stigma dark brown; a brown cloud at the end of the sector.

Male.—Length, 12·5–13 mm.; wing, 12–13·2 mm.

Female.—Length, 14 mm.; wing, 13 mm.

Palpi black. Frontal prolongation of the head short, black; nasus elongate, black. Antennæ black, the basal enlargement of the flagellar segments not conspicuous (Pl. II, fig. 14). Head broad, black, faintly shiny; the vertex surrounding the antennal bases yellow.

Pronotal scutum black, scutellum yellowish. Mesonotum black, faintly shiny; in some specimens a narrow yellowish line on the praescutum near the suture and a yellowish mark before the pseudosutural foveæ indicate the usual yellowish ground-colour of the thorax in this genus of flies. Pleura black, faintly dusted with grey; dorso-pleural membranes dull yellow, a linear yellowish mark on the side-pieces of the mesonotal postnotum just in front of the halteres. Halteres dark brown, the head somewhat yellowish. Legs with the coxæ dusted with grey; remainder of the legs dark brown. Wings whitish hyaline, the costal and subcostal cells not brighter; stigma small, dark brown; a paler brown cloud at the end of the sector, extending down to cell *first* M_2; indistinct seams along *Cu* and its branches; veins black; venation (Pl. I, fig. 6) *Rs* rather long for this group of flies, a little longer than R_2+_3; cell M_1 sessile or very short-petiolate.

Abdomen greyish black; lateral margins of the tergites very narrowly paler, in some specimens a broad, interrupted, sublateral orange-yellow stripe on either side of the mid-dorsal line. Male hypopygium with the ninth tergite (Pl. III, fig. 28) quadrate, the caudal margin with a small, deep, U-shaped, median notch, the lateral lobes squarely truncated, finely spiculose, the outer lateral angle with a blunt point that is minutely toothed beneath. Outer pleural appendage (Pl. III, fig. 29) an elongate-oval lobe that is produced into a blunt point at the tip; inner pleural appendage chitinized and at its tip produced into a short beak; pleural suture rather long, at its inner end curved slightly

dorsad. Eighth sternite with the caudal margin broadly concave, the lateral angles bearing small tufts of hairs.

The female is similar but of a less heavy build; the abdominal tergites have the same orange-yellow stripes on either side of the broad median area, these most conspicuous on segments three to five where they appear as bright triangles.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 1-14, 1916 (F. Johansen). No. 425. Allotopotype, ♀, July, August, 1915. No. 823. Paratopotypes, five ♂, ♀, Nos. 419, 429, July 1-14, 1916; Nos. 824, 825, and 827, July-August, 1915.

This interesting Arctic *Nephrotoma* belongs to the same group as the Palæarctic *N. pratensis* (Linnæus) and *N. nox* (Riedel) and the *N. penumbra* Alexander from the high mountains of Northeastern North America. I have seen specimens of a species of this same group from Greenland that are close to *pratensis* but seem to represent a new species.

Genus **Tipula** Linnæus.

Tipula Linnæus; Systema Naturæ, edition 10, p. 585; 1758.

The present collection included seven species of this genus, the only described one being the common and apparently widely distributed *Tipula arctica* Curtis. I expected that *T. pratorum* Kirby[1] would be found amongst the material but such was not the case, there being no species having the antennal scape yellow. The only species in this collection with any yellow on the antennæ is *T. diflava* which does not agree at all with Kirby's rather unsatisfactory description.

Tipula johanseni, n. sp.

Antennæ black; head grey, along the inner margin of the eye broadly paler; thoracic dorsum with four dark brown stripes; wings with the tip of vein R_2 pale, subatrophied; crossvein *m* obliterated by atrophy.

Male.—Length, 11·8 mm.; wing, 12·4 mm.

Palpi black. Frontal prolongation of the head dark grey, the nasus short, blunt. Antennæ (Pl. II, fig. 15) black; first segment of the scape relatively short, not as long as the first flagellar segment; flagellar segments rather elongated, the basal swelling oval, shorter than the remainder of the segment. Head dull grey, paler along the inner margin of the eye; sides of the vertex with scattered long, coarse bristles.

Thoracic dorsum dull grey with four dark brown stripes, the median pair narrow, separated from one another by a broad stripe of the ground colour. Pleura dark grey, the dorso-pleural membranes dull yellowish. Halteres rather long, brown, the knobs still darker brown. Legs with the coxæ dull grey and provided with long pale hairs; trochanters black; remainder of the legs broken. Wings light grey, the costal and subcostal cells a little more yellowish; stigma brown; an indistinct dark cloud at the tip of *Rs*; veins dark brown; venation (Pl. I, fig. 11) tip of vein R_2 pale, subatrophied; crossvein *m* obliterated or nearly so.

Abdominal segments blackish, the caudal and lateral margins broadly paler; hypopygium yellow. Male hypopygium with the ninth tergite (Pl. III, fig. 32) not prominent, the sides oblique, the caudal margin very deeply split by a V-shaped median notch that extends almost to the eighth tergite, the lobes thus formed long, subacute. Ninth pleurite extensive, subtriangular, the caudal angle extended out into a short blunt point; outer pleural appendage not prominent, cylindrical to slightly flattened, with long golden hairs; inner pleural appendage greatly compressed. Ninth sternite profoundly incised be-

[1] Fauna Boreali-Americana, Insecta, p. 310; 1837.

neath by a V-shaped notch, beneath the margin of the eighth sternite a small brush of long golden hairs. Eighth sternite unarmed.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 10, 1916 (F. Johansen). No. 213.

Similar to *T. aperta* Alexander (*imperfecta* Alexander, preoccupied) of Labrador in the open cell *first* M_2, but distinct in the dark frontal prolongation of the head, the uniformly dark antennæ, the blackish trochanters and abdomen, etc. In *aperta* the tip of R_2 persists for its entire length and the petiole of cell M_1 is very much longer than in the present species.

This interesting species is dedicated to the collector, Mr. F. Johansen.

Tipula diflava, n. sp.

General colouration grey; antennæ black, the second segment abruptly yellow; abdominal tergites orange with three broad black stripes; wings clouded with brown and grey; male hypopygium with the ninth tergite large, the caudal margin deeply notched medially and with a small acute tooth at the base of the notch.

Male.—Length, 14 mm.; wing, 14·1 mm.

Female.—Length, 20–22 mm.; wing, 17·2–18·3 mm.

Palpi black. Frontal prolongation of the head black, the nasus elongate. Antennæ (Pl. II, fig. 16) with the first scapal segment narrow basally, enlarged distally, black, yellowish at the apex; segment two yellow; flagellum black, the flagellar segments with the basal swelling prominent with about four conspicuous bristles. Head black, dark grey pruinose.

Thorax grey, the mesonotal praescutum with three broad darker grey stripes, the middle one split by a line of the ground-colour; hairs on the thoracic interspaces short, pale, not conspicuous. Halteres yellow, the knobs dark brown, the apices a little brighter. Legs with the coxæ dark grey; trochanters brown; femora brownish yellow broadly tipped with black; tibiæ and tarsi dark brown. Wings subhyaline, clouded with brown and grey; cells *C* and *Sc* yellowish; stigma dark brown; a dark brown spot at the origin of *M*, origin and end of the sector; apex of the wing brownish grey, interrupted by cell $R^5/_5$ which is nearly hyaline; conspicuous, brownish grey clouds along vein *Cu*, in the middle and end of cell *M* and including most of cell Cu_1; apices of the anal cells largely grey; in the male the pattern is the same but paler; venation (Pl. I, fig. 9), pattern omitted.

Abdomen with the first tergite black; second to sixth orange, with three broad black stripes, a narrow median one, broadening out behind and two sublateral stripes; on the caudal margins the black stripes tend to be confluent interrupting the orange; terminal segments largely blackish; lateral margins of the tergite pale yellowish; hypopygium mostly blackish; sternites largely black. Male hypopygium (Pl. III, fig. 34) with the ninth tergite (Pl. III, fig. 33) extensive, the caudal margin with a very deep V-shaped notch, at the base of which is a tiny tooth that sends a carina cephalad onto the dorsum of the sclerite; lateral lobes thin, rounded at their apices. Ninth pleurite complete, moderately large; outer pleural appendage elongate, flattened-cylindrical, pale, with a dense covering of long hairs; inner pleural appendage flattened into an extensive blade, the margin with sharp teeth.

The female is similar but larger; valves of the ovipositor slender, elongate, acicular, not at all like the *arctica* type where the tergal valves are flattened transversely with the outer margin toothed and the sternal valves are very minute.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 12, 1915 (F. Johansen). No. 790. Allotype, ♀, Herschel island, Yukon Territory, July 1916. No. 838. Paratype, ♀, with the allotype. No. 839.

Tipula arctica Curtis.

Tipula arctica Curtis; Description of the insects brought home by Commander J. Clark Ross. Appendix to Ross's Voyage to the Arctic regions, p. lxxvii, Plate A, fig. 15; 1831.

MALE.—Length, 13–17 mm.; wing, 13·5–17·5 mm.

FEMALE.—Length, 20–21·5 mm.; wing, 16–17 mm.

Palpi dark brown. Frontal prolongation of the head rather elongate, blue-grey; nasus stout. Antennæ (Pl. II, fig. 17) deeply serrate, each segment of the flagellum deeply incised beneath, the apical enlargement being only a little smaller than the basal swelling but not provided with verticils. Head blue-grey.

Mesonotal praescutum dull grey with three broad blue-grey stripes, the median one often narrowly split by a vitta of the ground-colour; these stripes are sometimes narrowly margined with brown; the thoracic interspaces with numerous black setigerous punctures; remainder of the thorax blue-grey including the coxæ of the legs. Halteres brown, the knobs darker. Legs with the femora reddish yellow broadly tipped with dark brown; tarsi dark brown. Wings subhyaline with conspicuous brown and grey markings, cells *C* and *Sc* a little more yellowish; a small brown spot at the origin of *Rs*; stigma large, sending a cloud down the cord to cell *first* M_2; greyish brown clouds in the anal cells, at the base of cell *Cu*, at midlength and at the end of *M* and in the apex of the wings; venation (Pl. I, fig. 10).

Abdominal tergites in the male with segment one, black; two to four, reddish yellow with broad sublateral stripes and an indistinct median stripe brownish grey; remaining segments dark brownish grey; sternites two to four, reddish yellow, broadly darkened laterally; terminal sternites brownish grey; the segments of the abdomen are very narrowly and indistinctly margined with paler. Male hypopygium with the ninth tergite (Pl. III, fig. 35) small with a deep and broad rounded caudal notch, the dorsum rounded into a saucer, the lateral lobes with four or five blunt teeth. The inner pleural appendage is illustrated (Plate III, fig. 37).

The female is similar to the male in most respects, but the abdomen is differently coloured being dull grey with a broad, dark brown, interrupted, dorso-median stripe; the basal tergites a little brightened on either side of the dorso-median line; abdomen not excessively elongated as in the related *T. longiventris;* dorsal shield jet-black, shiny; tergal valves of the ovipositor brownish black. The ovipositor (Pl. III, fig. 43) has the dorsal shield elongate, a little longer than the tergal valves of the ovipositor; these tergal valves have about fifteen teeth along the outer lateral margin; the sternal valves are very reduced as in this group of species, acicular, the pair forming a sublyriform organ (Pl. III, fig. 40).

This was the most abundantly represented species in the collection including nearly one-half of the material, as follows:—

Localities: West of Konganevik, Camden bay, Alaska, July 4, 1914 (F. Johansen). Four ♂'s, Nos. 196–199. Port Epworth, mouth of Tree river, Coronation gulf, Arctic Canada, July 16, 1915 (J. J. O'Neill). Two ♂'s, Nos. 102 and 104; one ♀, No. 103. Bernard harbour, Northwest Territories, June 21, 1915, one ♂, No. 1328; July 4, 1915, one ♀, No. 1076; July 7, 1915, one ♂, one ♀, Nos. 1233, 1234; July 12, 1915, two ♀, Nos. 756, 789, one ♂, No. 757; July 19, 1915, ♂, ♀, Nos. 1266, 1267; July 22, 1915, ♂, ♀, Nos. 1062, 1063; July-August, 1915, six ♂, ♀, Nos. 829–834; July 1–14, 1916, seven ♂, ♀, Nos. 420, 421, 424, 426, 427, 428, and 430.

Unless stated otherwise the material was taken by Mr. Johansen. Pupæ are pinned with Nos. 197, 199, and 834.

The immature stages of this interesting crane-fly will be considered on pages 18 and 19, under the second part of the report, on the immature stages.

Most species of the genus *Tipula* hold the wings outspread or divaricate in a position of rest. Apparently but few hold them folded incumbent over the abdomen. Two excellent photographs by Mr. G. H. Wilkins, taken at Bernard harbour in July, 1915, show that *T. arctica* falls in this latter group of species. These illustrations show the female fly crawling about over the Arctic vegetation, possibly searching for a place in which to oviposit. (Plate VI).

Tipula hewitti, n. sp.

General colouration grey; mesonotal præscutum with three broad brown stripes; halteres tipped with yellowish orange; legs with the femora dull brownish yellow, broadly tipped with dark brown; wings very indistinctly marked with greyish clouds; male hypopygium with the ninth tergite very narrowly notched medially, the lateral lobes almost contiguous.

MALE.—Length, 13 mm.; wing, 15 mm.

Palpi black. Frontal prolongation of the head short, dark grey; nasus broad, prominent. Antennæ black, the first segment of the scape dusted with grey; flagellum broken. Head grey, the disk of the vertex more brownish; vertex produced cephalad between the antennal bases into a flat tongue that is deeply split by a median groove.

Mesonotum grey, the præscutum with three dark brown stripes, the middle one very broad in front, rapidly narrowed to near the suture, indistinctly split by a grey median vitta; lobes of the scutum with a linear brown line. Pleura grey, the dorso-pleural membrane dull brownish. Halteres brownish yellow, the knobs dark brown tipped with dull yellowish orange. Legs with the coxæ grey; trochanters dark brown; femora dull yellow, the tips broadly dark brown; tibiæ and tarsi dark brown. Wings dull grey; the costal and subcostal cells more yellowish; stigma brown; a yellowish spot beyond the stigma in cell *second* R_1; indistinct grey clouds along vein *Cu;* venation: petiole of cell M_1 short; crossvein *m-cu* obliterated by the fusion of Cu_1 on M_{3+4}.

Abdomen dark greyish black, the terminal tergites ringed with paler, the lateral margins indistinctly paler. Male hypopygium with the ninth tergite (Pl. III, fig. 36) large, subquadrate, the caudal margin nearly transverse with a very narrow median notch, the adjacent lobes slightly produced caudally at their inner angle and almost touching one another. Ninth pleurite complete; outer pleural appendage (Pl. III, fig. 30) elongate-oval, the apex broadly rounded, the basal two-thirds dusky, the apical third yellowish. Ninth sternite with a deep median notch.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 1–14, 1916 (F. Johansen). No. 418.

I take great pleasure in dedicating this species to Dr. C. Gordon Hewitt, the Dominion Entomologist, to whom I am indebted for many favours.

Tipula subpolaris, n. sp.

MALE.—Length, 13·5 mm.; wing, 13·6 mm.

In most respects very similar to *T. hewitti,* but the male hypopygium is quite different. Unfortunately the type is badly discoloured. The antennæ (Pl. II, fig. 18) have the flagellum black, the individual segments moderately elongated, the basal enlargement being about half as long as the rest of the segment. Tibial spurs long and slender. Basal abdominal tergites with indications of orange on the sides of the median black line. Male hypopygium with the ninth tergite (Pl. III, fig. 38) black, the caudal margin with a broad U-shaped notch. Ninth pleurite complete, black, broadly margined with yellowish; outer pleural appendage subelongate, narrowed toward the apex, dusky basally, passing into rather bright yellow beyond.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July-August 1915 (F. Johansen). No. 826.

This species is certainly close to *T. hewitti*, but I cannot make the two agree. Unfortunately each species is represented only by the unique male type and I do not care to remove the abdomen to submit the male genitalia to the critical study that some day may be necessary. More material from the Arctic north-west would probably decide the status of these two species which are closely allied but which certainly appear to be distinct.

Tipula besselsoides, n. sp.

General colouration grey; antennæ rather short, black; body clothed with conspicuous erect hairs; femora light yellowish, tipped with black; ninth tergite of the male hypopygium with a small, U-shaped notch, the lateral lobes rounded.

MALE.—Length, 12 mm.; wing, 15·5 mm.

Palpi black. Frontal prolongation of the head greyish black; nasus prominent. Antennæ (Pl. II, fig. 19) black; first segment of the scape long and slender, clothed with numerous outspreading hairs; flagellar segments very short, the basal swelling of the individual segments being about equal to the remainder of the segment. Head broad, eyes rather small, widely separated; vertical tubercle low; head dark grey with scattered setigerous punctures.

Thorax dark grey, the præscutum with three indistinct, darker grey stripes; thoracic interspaces with an abundant coarse, black hair. Halteres dull brownish yellow. Legs with the coxæ grey clothed with numerous long pale hairs as in *besselsi* O.S.; trochanters dark; femora light brownish yellow, the tips broadly black; tibiæ light brown, the tips broadly black; tarsi dark brown. Wings nearly hyaline, the subcostal cell more yellowish; stigma brown, oval; apex of the wings a little darkened; veins dark brown; obliterative streak extending from before the stigma into cell M_4; venation: crossvein *m-cu* not far beyond the fork of *M*.

Abdomen dark grey, the segments conspicuously ringed with pale yellowish; lobes of the hypopygium yellow. Male hypopygium with the ninth tergite (Pl. III, fig. 39) rather extensive, the caudal margin somewhat rounded and with a deep, U-shaped, median notch; at the inner margin of the lateral lobes a small tubercle; entire sclerite black, clothed with numerous short, appressed hairs; suture between the tergite and sternite well-defined. Ninth pleurite small, incomplete, the suture indicated only beneath; outer pleural appendage (Pl. III, fig. 31) a small, suboval flattened lobe, pale brownish yellow, the outer face with abundant long pale hairs; inner pleural appendage (Pl. III, fig. 42) elongate, chitinized, at the base a rounded knob clothed with long, delicate pale hairs, the outer margin with four stout bristles. Penis-guard a long, straight chitinized point, gradually narrowed from the base to the acute apex.

Locality: Holotype, ♂, Bernard harbour, Northwest Territories, July 1–14, 1916 (F. Johansen). No. 422. Paratopotype, ♂. No. 417.

This species bears a strong superficial resemblance to *T. besselsi* Osten-Sacken in the grey colouration with conspicuous long, erect pile; the legs are differently coloured and the hypopygium of the male is very differently constructed in the two species. It also resembles *Stygeropis parrii* (Kirby) superficially in colouration and the erect pile, but the verticillate antennæ and nearly hyaline wings of the present species offer easy points for separation.

Tipula subarctica, n. sp.

Related to *T. pribilofensis* Alexander; general colouration dark; abdomen reddish brown with a dark median stripe on both the tergites and sternites; ninth tergite of the male hypopygium prominent with flattened, acute, lateral arms; eighth sternite produced caudad into a broad, flattened, shovel-like, median lobe.

MALE.—Length, 12·5 mm.; wing, 14 mm.

Head discoloured. Antennæ broken.

Pronotal scutum dark, the scutellum dull yellowish. Mesonotal præscutum dark coloured, almost black in the type, but badly discoloured, the thoracic stripes, if present normally, being obliterated; normal specimens are almost certain to be very dark grey. Pleura blackish, grey pruinose; dorso-pleural membranes dull yellow. Halteres brown, the knobs darker. Legs with the coxæ black, grey pruinose; trochanters brown; femora reddish brown, the tips narrowly and indistinctly darkened; tibiæ brown, the apices blackened; tarsi dark brown. Wings nearly hyaline, the costal and subcostal cells concolourous with the rest of the wing; veins brown; wings in the vicinity of the stigmal region injured; venation: R_2 persistent for its entire length; the *m-cu* crossvein inserted just beyond the fork of *M*. The fly is full-winged.

Abdominal tergites reddish brown with a broad, black, median stripe; ninth tergite black; sternites dull brown with an interrupted blackish median stripe. Male hypopygium with the ninth tergite (Pl. III, fig. 41) very large and prominent, black, chitinized, the caudal margin with an acute, V-shaped, median notch, finely denticulate, the lateral angles produced far caudad into flattened ears. Ninth pleurite incomplete, the suture indicated beneath, an acute dorso-caudal arm of the pleurite runs beneath the tergal lobes. Eighth sternite with a broad, shovel-shaped, median lobe extending caudad and dorsad, its caudal margin evenly and gently notched and provided with short, delicate hairs. Eighth tergite completely concealed beneath the seventh tergite.

Locality: Holotype, ♂, west of Kongenevik, Camden bay, Alaska, July 4, 1914 (F. Johansen). No. 442.

This interesting new species is related to *T. pribilofensis* Alexander from the Pribilof islands off the western coast of Alaska. It is an entirely distinct species, being full-winged and the male hypopygium quite differently constructed although both species have the curious spoon-like elongation of the eighth sternite. I have seen another species of the same group from Kamchatka, eastern Siberia *Tipula kamchatkensis* Alexander.

Very recently I have received from Prof. Hine another specimen in much better condition. This specimen may be considered as paratypical and the following additional characters should be noted:

Male:—Length, 14 mm.; wing, 13 mm.

Frontal prolongation of the head dark purplish brown above, more yellow laterally. Antennæ rather long, the scape a very little paler than the dark brownish black flagellum; flagellar segments rather deeply incised beneath. Head light grey, a small brownish blotch on the disk of the vertex. Eyes small; genæ prominent.

Mesonotal stripes very indistinct, brown, ground-colour of the mesonotum, light grey. Pleura light grey, the dorso-pleural membranes light yellow.

Paratype, ♂, Katmai, Alaska, July, 1917 (J. S. Hine).

Specimen in the collection of Prof. Hine.

Family **RHYPHIDÆ.**

Subfamily **TRICHOCERINÆ.**

Genus **Trichocera** Meigen.

Trichocera Meigen; Illiger's Magazine, vol. 2, p. 262; 1803.

At the present time this genus of flies offers almost insuperable taxonomic difficulties. Some twenty-five or thirty species have been proposed, but that very many of these are synonyms of others is unquestioned. It seems now that the only hope of straightening this apparently hopeless tangle is for some

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European student to critically study the existing types and compare the authenticated Palæarctic species with a great series from America and elsewhere. If this is done it may be that the correct synonymy can be determined. It is scarcely possible for an American worker to attempt the problem, at least under present European conditions, chiefly because of the impossibility of studying the types of the European species still existant and the added difficulty of obtaining authentically named specimens of the European species, the European specialists, apparently, being as much in doubt concerning the true status of the group as are the American workers.

Until a very recent date the genus *Trichocera*, together with the related genus *Ischnothrix* Bigot, from Cape Horn, was included as a member of the Tipulid tribe, Limnophilini. A critical study of the immature stages by Johannsen, Keilin, de Meijere, Malloch, and others has shown the utter impossibility of such an assignment and it seems better to give it subfamily rank in the family Rhyphidæ.

Trichocera sp.

The present collection included three specimens of *Trichocera* sp., from Bernard harbour, Northwest Territories, June 18, 1915, collected by F. Johansen; two males, Nos. 1301 and 1302 and a female, No. 1300 D.

Immature Stages.

The present collection of Canadian Arctic crane-flies included a surprising amount of life-history material. This was of very great interest since our knowledge of the younger stages of any Arctic crane-flies is almost negligible. Unfortunately, very little of the material had been reared and consequently the placing of the species has been attended with considerable doubt and difficulty. As a rule it scarcely pays to describe or figure undetermined larvæ or pupæ unless they show conspicuous points of difference in their structure, have a peculiar habitat, or else, as in the present case, come from a region where practically nothing is known concerning the early stages. These Arctic crane-flies, especially of the Tipuline group, are sometimes as beautifully patterned in the larva as they are dull and obscure in the adult. The biological data that were supplied by the collector are incorporated with each species concerned.

HEXATOMINI.

In another paper, not yet published, I have endeavoured to correlate the present classification of crane-flies, based entirely on a study of the adult flies, with a critical survey of all the immature stages that I could obtain. Among other things this study seems to indicate that the tribe Hexatomini is not as clearly set off from the related groups as a study of the adults alone would imply. Several of the groups that have hitherto been considered subordinate groups of the genus *Limnophila*, such as *Ulomorpha*, *Lasiomastix*, *Dicranophragma*, *Poecilostola*, etc., all seem now to be more properly referable to the Hexatomini, or at least closely allied to *Eriocera*, *Penthoptera*, etc. The present species has not been reared and its true affinities must be left in doubt, but I believe that the reference given below will be not entirely erroneous.

Poecilostola supposition.

This is a small group of flies including seven or eight species of the Palæarctic region with representatives occurring in Japan. Although no adults of this group of flies or, indeed, any of its relatives have yet been taken in the Canadian Arctic I feel very little hesitation in referring the present larva to the neighbourhood of this genus. It may belong to the subgenus *Phylidorea* Bigat of the genus *Limnophila* Macquart.

Locality: One large larva taken in the melted ponds in the tundra at Demarcation point, Alaska, May, 1914 (F. Johansen).

Length, 19·5 mm.; diameter, 2·4 mm.

Form cylindrical, the anterior segments narrower, the abdominal segments just before the cauda swollen. Body with a covering of short and delicate appressed hairs. Head-capsule of the long narrow structure of the tribe; mandibles (Pl. V, fig. 55) long, sickle-shaped; maxilla (Pl. V, fig. 54) with the outer lobe projecting from the oral opening when the head is completely retracted. Colouration uniform light yellow throughout. Spiracular disk (Pl. IV, fig. 44) small, with four lobes, the lateral and ventral pairs. Lateral lobes rather short and blunt, the ventral edge with an irregular linear brown mark, the outer edge with a dense fringe of long hairs; ventral lobes longer with a long, arcuate, brown line down the inner face; outer edge with a dense fringe of long hairs, those at the tip being very elongate. Anal gills four, short, blunt, oval.

TIPULINI.

A considerable number of Tipuline forms were included in the present collection. Only one of these, *Tipula arctica* Curtis, was reared and the generic reference of the remainder must be considered as being somewhat doubtful. I have studied each of these species, however, in the light of our knowledge of other life-histories, and have placed them as closely as the data will warrant.

Tipula arctica Curtis.

Locality: Larvæ in the ground at Bernard harbour, Northwest Territories, May 27, 1916 (F. Johansen).

A male collected as a larva on May 27 pupated about June 20. (Rearing No. 106.)

Larvæ. Length, 23–25 mm.; diameter, about 4 mm.

Form cylindrical. Mouth-parts with the mentum (see Pl. V, fig. 53) long and slender with a large, blunt, median tooth and two smaller teeth on either side; directly beneath these lateral teeth similar subequal teeth are (hypopharynx) visible. Labrum as in Pl. V, fig. 52.

Chætotaxy: Dorsal surface, a transverse row of delicate hair-like setæ across the dorsum of the last thoracic segment and the abdominal segments, there being usually four of these punctures on the first three segments occurring at about mid-length of the segments; on the abdomen they lie on the posterior ring of each segment (see Pl. V, fig. 56); the lateral puncture bears two bristles, the inner punctures a single seta; they correspond exactly to the condition of the ventral segments except that here the solitary anterior bristle has moved caudad into alignment with the posterior paired bristles. In some there are a few weak supplementary bristles in the same line. Ventral surface (Pl. V, fig. 57) similar; two prominent widely separated setigerous punctures, each with two long bristle-like hairs nearer the caudal margin and two other smaller and more delicate bristles slightly cephalad and closer to the median line; these anterior ventral bristles are separated from one another by a distance that is a little less than the distance between them and the larger posterior bristles; on the lateral margin of the segment there is usually a more delicate hair.

Colouration dull yellow, the thoracic segments with abundant, tiny, appressed dark hairs that give a darker appearance to the anterior end of the body.

Spiracular disk (Pl. IV, fig. 45) surrounded by six short lobes, a dorsal pair, rather closely approximated medially, a dorso-lateral pair and a ventral pair. The dorsal pair are shorter than the lateral pair and the inner face in most specimens has a straight or slightly curved, dark brown, line. The lateral lobes are longer and more slender. The ventral lobes are short and broad.

The spiracles are very large and conspicuous, black. In some specimens there are two black dots just above each spiracle and two somewhat similar dots below the spiracles and on the ventral lobes; of these markings the ventral dots are the most constant. Anal gills, four in number, blunt, fleshy.

PUPÆ. Male: Length, 18–23 mm.; dorso-ventral depth, 3·8–4 mm.; dextro-sinistral width, 3·2 mm. Female: Length: 23 mm.; depth and width 4 mm.

MALE. (Pl. V, fig. 50): Colouration brown, the abdomen more yellowish brown; the pleural membrane paler; the breathing-horns, appendages, and sheaths dark brown; spines on the abdomen black.

Antennal bases situated on a high crest, elevated above the level of the breathing-horns. Pronotal breathing horns not conspicuous, short, directed slightly forwards and slightly divergent. On the pronotum a small knob just before the breathing horns; on the præscutum two widely separated tubercles and just behind these but nearer the median line, two smaller tubercles, the space between these tubercles connected by a row of crenulations. Leg-sheaths reaching to the middle of the third abdominal segment; wing-sheaths reaching the base of the second abdominal segment.

Abdominal tergites: segments 1 and 2 with a small tubercle on the caudal ring on either side of the median line; segment 3 with two tubercles on either side, the inner one largest; segments 4 to 6 with three or four tubercles on either side, the inner one largest; segment 7 narrowed, with two lateral spines and two separated blunt tubercles; segment 8 narrowed, the lateral angles ending in powerful tubercles with sharp points. Pleural integument coarsely punctured, on the edge nearest the sternites with a single sharp spine on the caudal ring of segment 1 and on segment 7 and two, one on each ring of segments 2 to 6. Sternites armed with circlets of powerful spines on the caudal ring, on segment 3 there being two, small and widely separated; on segments 4 to 7 there are four such spines, larger and rather approximated. Segment 9 rounded, indistinctly bifid, each side with a small, acute spine at the tip.

FEMALE. (Pl. V, fig. 51) similar to the male above described, the sexual differences being as follows: Sheaths of the tergal valves of the ovipositor elongate, powerful, lying parallel to one another, transversely wrinkled; sheaths of the sternal valves of the ovipositor tiny, located at the apex of the eighth segment.

Mr. Johansen has recently called my attention to the description and figures of the immature stages of this species by Dr. T. C. Nielsen.[1] As there are some discrepancies between the descriptions and figures of the material from northeast Greenland and that from the Canadian Northwest, it is possible that more than one species is involved under the name of *Tipula arctica*.

Stygeropis, possibly **parrii** (Kirby).

Locality: Melted ponds in the tundra at Demarcation point, Alaska, May 1914 (F. Johansen).

Two smaller specimens measure as follows: length, 20 to 24 mm.; diameter, 2·2 to 2·5 mm.

A larger larva (No. 5a), length, 38 mm.; diameter, 3·7 mm.

Form cylindrical, moderately elongated. Head-capsule with the antennæ long and slender, from three to four times as long as thick, cylindrical, yellowish.

Chætotaxy: Setæ very weak and delicate, on the thoracic segments being tiny lateral hairs. Abdominal tergites (Pl. V, fig. 58) with no setæ on the anterior ring; on the posterior ring with the following bristles: a small lateral bristle nearest the false suture; just before the caudal margin of the segment a more or less impressed line, at its outer end with two or three bristles arising from individual punctures; on either side of the reddish dorso-median vitta a prominent

[1] The Insects of the "Danmark" Expedition: Meddelelser om Grönland, vol. xliii, Copenhagen, 1910 pp. 57–9, Pl, vii, figs. 1–7.

seta directed proximad; on the penultimate and antepenultimate segments of the abdomen the bristles are very long and delicate. The sternites (Pl. V, fig. 59) similar, but the median bristles lie further cephalad and there is a smaller tiny bristle in its individual puncture just proximad of it; these median bristles are almost in alignment with the lateral bristles. The caudal bristles, three in number, are in alignment and rather widely separated.

Colouration above dark brown, the thoracic region more reddish; a broad, conspicuous dorso-median stripe reddish brown; lower surface greyish with a reddish caste. Skin very smooth without tubercles or roughenings of any sort. The sutures between the individual segments are very well-marked but not conspicuously constricted, at about two-thirds the length of each abdominal segment with a pseudosuture dividing the segment into two rings or annuli.

Spiracular disk (Pl. IV, fig. 46) surrounded by six very long, finger-like lobes, of which the ventral pair are slightly the longer. All the lobes are margined with dark brown and here develop long fringes of delicate pale hairs which are longest at the tips of the lobes, much shortened toward the base of the lobes; down the middle of the inner face of each lobe there is a long, narrow, black stripe extending from the tip back toward the centre of the disk, this mark longest on the ventral lobes; the lateral marks on the lobes are all expanded at their inner ends nearest the spiracles, the outer margins of the ventral lobes united with one another across the disk, between the spiracles, by a narrow, arcuated line. Spiracles large. Anal gills short but slender, inconspicuous, the inner pair very short.

From its great resemblance to the larva of *Stygeropis fuscipennis* Loew of northeastern America I would refer this larva to *Stygeropis* without question. Which species it represents is somewhat doubtful, but very probably either *parrii* or *parrioides*. The *Tipula* No. 1 of Malloch's preliminary classification[1] is *Stygeropis fuscipennis*.

Tipuline No. 1 (**Stygeropis,** supposition).

Locality: Two larvæ from a lake near Bernard harbour, Northwest Territories, June 25, 1915 (F. Johansen).

Two additional specimens from Demarcation point, Alaska (melted ponds in tundra, May, 1914. No. 7).

Length, 20·5–23 mm.; diameter, 1·8–2 mm.

Form cylindrical, moderately elongated, the anterior end abruptly tapering, the posterior end gradually tapering to the cauda; caudal lobes capable of close application to one another along their inner faces, protecting the spiracles.

Chætotaxy: Dorsal segments (Pl. V, fig. 60) with the setæ all on the posterior ring, an anterior lateral pair located in the lateral yellow line, consisting of two punctures, the more lateral one of which has a tripartite bristle, the proximal one simple. Nearer the caudal margin of the segments three long lateral bristles in alignment and rather widely separated, the distal one located near the inner margin of the yellow stripe, the inner two closer together located in the black lateral stripes, the innermost on its margin. In alignment with these three and located nearer the mid-dorsal region of the segment, one on either side of the apex of the shield-shaped dorsal mark, are two long bristles. All of these caudal bristles are in alignment with the caudal setæ of the ventral segments.

Lateral setæ: On the dark pleural stripe a group of three small, stout bristles on the posterior ring, arranged in a triangle; a single, longer hair on the anterior ring of the segment, much closer to the ventral edge than to the dorsal edge of the stripe.

Sternal segments with the setæ on the apical ring of the segment arranged as in Pl. V, fig. 61; there are two anterior setæ on each side, and closer to the

[1] Malloch, J. R. "A preliminary classification of Diptera based upon larval and pupal characters," Bull. Illinois State Laboratory of Natural History, vol. 12, pp. 199, 200, figs.; 1917.

median line; of these the distal one is the longest, the proximal one usually very short; there are three posterior setæ on either side, the two proximal being longest and in their own punctures, the third one distal in position, lying close to the black pleural stripe and located in a very small puncture on the margin of the adjoining larger puncture.

Colouration: Dorsum (Pl. V, fig. 60) dull yellow. Just inside the broad lateral stripe and separated from it by a narrow bright yellow line is a narrow dark brown line, almost continuous but slightly interrupted in places; this dark line begins on the mesothorax and continues to the last segment. The dorsum of the abdomen between these dark stripes is handsomely marked with dorsal shields of brown which are narrowly margined with darker brown, the narrow apex of the shield directed caudad; there are about seven of these dorsal shields, the integument on either side of them with three bright yellow dots in straight diverging lines, all of these dots lying on the cephalic ring of the segment. Pleural region dark brown, very broad but paler on the thoracic segments, gradually narrowed and becoming darker toward the end of the body, terminating near the anal gills. This dark pleural stripe is dotted with numerous yellowish spots. Ventral surface abruptly and conspicuously light yellow.

Spiracular disk surrounded by six long, finger-like lobes, the dorsal lobes rather the shortest although still long and finger-like, lying parallel, the ventral lobes longest; all the lobes narrowly margined with black and with a slender black vitta bisecting the inner face of the lobe from the tip inward toward the disk, at the distal end expanded into a blackish apex; the apex and lateral margins bear long fringes of hairs as in *Stygeropis*, these hairs being longest toward the tips of the lobes. Anal gills six, short but rather slender, inconspicuous, the two lateral pairs longest, the inner pair much shorter.

I would refer this to a position not far removed from *Stygeropis* although it is very differently coloured from the species last described under that name. However, the structure of the larvæ seems to indicate that it is more probably a *Stygeropis* than a *Tipula* or a *Nephrotoma*. If the generic reference is correct the larvæ probably belong to either *S. parrii* or *S. parrioides*.

In the specimens from Demarcation point, Alaska, the anterior end of the body is pale and the median dorsal shields are continuous as a practically uninterrupted dorso-median line, only slightly constricted toward the posterior end of each segment; the lateral dorsal stripes are very dark. However, the structure of the spiracular disk and the chætotaxy are entirely the same and I feel sure that all the material pertains to the same species.

In the vial containing the two larvæ from Bernard harbour, described above, there was an additional Tipuline larva that is closest to the Tipuline No. 3 described later, but probably represents a still different species. Because this is the only specimen included in the material it is not further discussed in this report.

Tipuline No. 2.

Locality: Three larvæ, taken at Demarcation point, Alaska, May, 1914. No. 4 (F. Johansen); melted ponds in the tundra.

Length, 20–23 mm.; dextro-sinistral width, 3·3–3·6 mm.; dorso-ventral depth, 2–2·2 mm.

Body moderately elongated, form strongly depressed; thoracic and first abdominal segments with the margins regular; abdominal segments 3 to 8 with a prominent false constriction or pseudo-suture at about two-thirds the length of the segment, the edges of the segments produced laterad to give a serrate appearance to the margins of the abdomen; the anterior ring of each segment has the serration larger than that of the posterior ring so that these alternate; penultimate segment of the abdomen with the caudal angles produced strongly caudad into long, slender lobes.

Chætotaxy: Tergites (Pl. V, fig. 62) with setæ on the posterior ring only, these bristles short and weak, the marginal group lying in or close to the dark lateral stripe, the outer one far removed from the inner pair. Bristles of the disk single, one on either side of the median dorsal stripe. Lateral bristles with two on the posterior ring, one on the anterior ring. Sternites (Pl. V, fig. 63) with no bristles on the anterior ring; posterior ring with two bristles on either side of the median line and at about mid-length of the ring, the distal bristle longest. Nearer the posterior margin and lying farther distad, three setæ almost in a line, rather closely approximated but each one in its own distinct puncture, the proximal two longest, the distal one small and weak.

Colouration: A beautiful larva (Pl. IV, fig. 47), light yellow in colour, the thorax and lateral margins of the abdomen dusky. Three interrupted dark-brown stripes on the dorsum, on the individual segments shaped as follows: on the anterior ring the median mark is rectangular, in front not attaining the segment preceding, connected at its caudal end with the lateral stripes which are dotted with yellow, on the proximal edge clear-cut, laterally passing into the dusky of the margins of the abdomen; posterior ring of each segment with three marks more irregular and diffuse. Sternites dull yellowish with an indistinct irregular dusky square on the anterior ring, this dusky area with an arcuated line of four oval spots across the anterior third and two larger yellow blotches on the posterior two-thirds, one on either side of the median line; on the posterior ring of each segment the dusky marks are irregular, shaped somewhat like an hour-glass.

Spiracular disk (Pl. IV, fig. 48) small, surrounded by six small lobes; dorsal lobes very small but slender, slightly divergent; lateral and ventral lobes long and slender, in some the lateral lobes notably shorter than the ventral pair; inner faces of the lobes unmarked with darker. Ventral lobes with a few long, sensory bristles at the apex; a single long bristle on the ventral face at about mid-length; lateral lobes with a similar group of bristles near the tip and a longer one on the outer face near the apex. Spiracles small, widely separated. Gills six in number, small, slender, inconspicuous, the caudal pair longest, the cephalic pair with a short lobule on the basal inner side so it appears there are six gills of which four are long, two short.

I have no idea to which species this handsome larva belongs. This species and the last are amongst the most beautifully patterned larvæ that I have ever seen. The present species exhibits an unusual degree of depression for this tribe of Tipulidæ and in some respects gives strong indications of how the even more accentuated conditions in the Cylindrotominæ may have been brought about. It seems probable that this larva belongs to the genus *Tipula* rather than to any of the related genera.

Tipuline No. 3.

Locality: Tundra at Nome, Alaska, August, 1916 (F. Johansen). Three larvæ, two large and one smaller specimen.

Two additional badly shrunken larvæ bearing the following label: "*Tipula* larvæ C, about one-fourth inch below the plant-covering of the tundra behind the winter house, Collinson point, Alaska, September 20, 1913."

Length, 27·5–30 mm.; diameter, 4–5 mm.

Form plump and robust; colouration brown, the body clothed with an abundant appressed dark pubescence, the dorsal ring of each segment that bears the setæ darkest in colour; each segment is divided by 4 or 5 pale transverse false sutures so the abdomen appears multisegmented. The true limits of each segment are readily determined by the caudal row of setæ.

Chætotaxy: Tergites (Pl. V, fig. 64) with four long, powerful bristles in alignment, the median pair closer to one another than either is to the lateral seta; extending proximad from each seta is a narrow, semi-impressed line

destitute of pubesence; each of the outer setigerous areas bears two closely approximated setæ. Lateral setæ two, one on each primary ring at about mid-length, the anterior one lying closer to the ventral margin, the posterior one closer to the dorsal margin. Sternites (Pl. V, fig. 65) with four setigerous areas, the median pair a little anterior to the posterior pair, one on either side of the median line, each area with two stout bristles. The above pertains to the abdominal segments. On the dorsum and lateral portions of the anterior ring of the prothorax at about mid-length there are about ten setigerous areas, the median pair close together and bearing a single seta, the next pair more widely separated, each with two short setæ; the third pair closer to the second pair than they are to one another, likewise with two setæ, one long slender bristle and a shorter slender one; lateral setæ solitary, long and stout, two on each side of the prothorax. The meso- and meta-thoraces at about midlength and almost in alignment have about ten setigerous punctures, the inner six close together and shortest (the innermost simple, the outer two pairs double); lateral bristles longer and more widely separated.

Spiracular disk (Pl. IV, fig. 49) surrounded by six short lobes, not conspicuous. Dorsal lobes short, conical, situated close together on the dorso-median line, divergent apically, broad at the base, tapering rapidly to the acute tip. Lateral lobes longest, elongate-conical, tapering to the rather acute apex. Ventral lobes short, broad, and blunt with a broad blackish blotch on the inner face, in the smaller specimen occurring as two parallel transverse lines beneath each spiracle. Gills short, blunt, dark in colour.

This is probably a species of *Tipula* rather than the related genus, *Nephrotoma*, but the immature stages of the two genera are very similar to one another.

EXPLANATION OF PLATE I.

Fig. 1. Wing of *Dicranomyia alascaensis*, n. sp.
" 2. " *Erioptera (Erioptera) angustipennis*, n. sp.
" 3. " *Limnophila (Dactylolabis) rhicnoptiloides*, n. sp.
" 4. " *Tricyphona brevifurcata*, n. sp.
" 5. " *T. frigida*, n. sp.
" 6. " *Nephrotoma arcticola*, n. sp.
" 7. " *Stygeropis parrii* (Kirby).
" 8. " *S. parrioides*, n. sp.
" 9. " *Tipula diflava*, n. sp. (pattern omitted).
" 10. " *T. arctica* Curtis.
" 11. " *T. johanseni*, n. sp.

EXPLANATION OF PLATE II.

Fig. 12. Antenna of *Stygeropis parrii;* basal and apical segments.
" 13. " *S. parrioides;* the same.
" 14. " *Nephrotoma arcticola;* basal segments.
" 15. " *Tipula johanseni;* the same.
" 16. " *T. diflava;* the same.
" 17. " *T. arctica;* the same.
" 18. " *T. subpolaris;* the same.
" 19. " *T. besselsoides;* the same.
" 20. Hypopygium of *Tricyphona frigida;* pleurite and appendages, dorsal aspect.
" 21. " *T. diaphana* (Doane); the same.
" 22. " *Stygeropis parrioides;* outer pleural appendage.
" 23. " *S. parrii;* the same.
" 24. " *S. parrii;* inner pleural appendage.
" 25. " *S. parrioides;* the same.
" 26. " *S. parrii;* ninth tergite, dorsal aspect.
" 27. " *S. parrioides;* the same.

EXPLANATION OF PLATE III.

Fig. 28. Hypopygium of *Nephrotoma arcticola;* ninth tergite, dorsal aspect.
" 29. " *N. arcticola;* outer pleural appendage.
" 30. " *Tipula hewitti;* the same.
" 31. " *T. besselsoides;* the same.
" 32. " *T. johanseni;* ninth tergite, dorsal aspect.
" 33. " *T. diflava;* the same.
" 34. " *T. diflava;* lateral aspect; *9 t.* ninth tergite; *9 pl.* ninth pleurite; *9 s.* ninth sternite.
" 35. " *Tipula arctica;* ninth tergite, dorsal aspect.
" 36. " *T. hewitti;* the same.
Fig. 37. Hypopygium of *T. arctica;* inner pleural appendage.
" 38. " *T. subpolaris;* ninth tergite, dorsal aspect.
" 39. " *T. besselsoides;* the same.
" 40. Ovipositor of *T. arctica;* female sternal valves.
" 41. Hypopygium of *T. subarctica;* ninth tergite, dorsal apsect.
" 42. " *T. besselsoides;* inner pleural appendage.
" 43. Ovipositor of *T. arctica;* dorsal aspect.

EXPLANATION OF PLATE IV.

Fig. 44. Larva of *Pœcilostola,* supposition; spiracular disk.
" 45. " *Tipula arctica;* the same.
" 46. " *Stygeropis,* supposition; the same.
" 47. " *Tipuline* No. 2; dorsal aspect of entire larva.
" 48. " *Tipuline* No. 2; spiracular disk.
" 49. " *Tipuline* No. 3; the same.

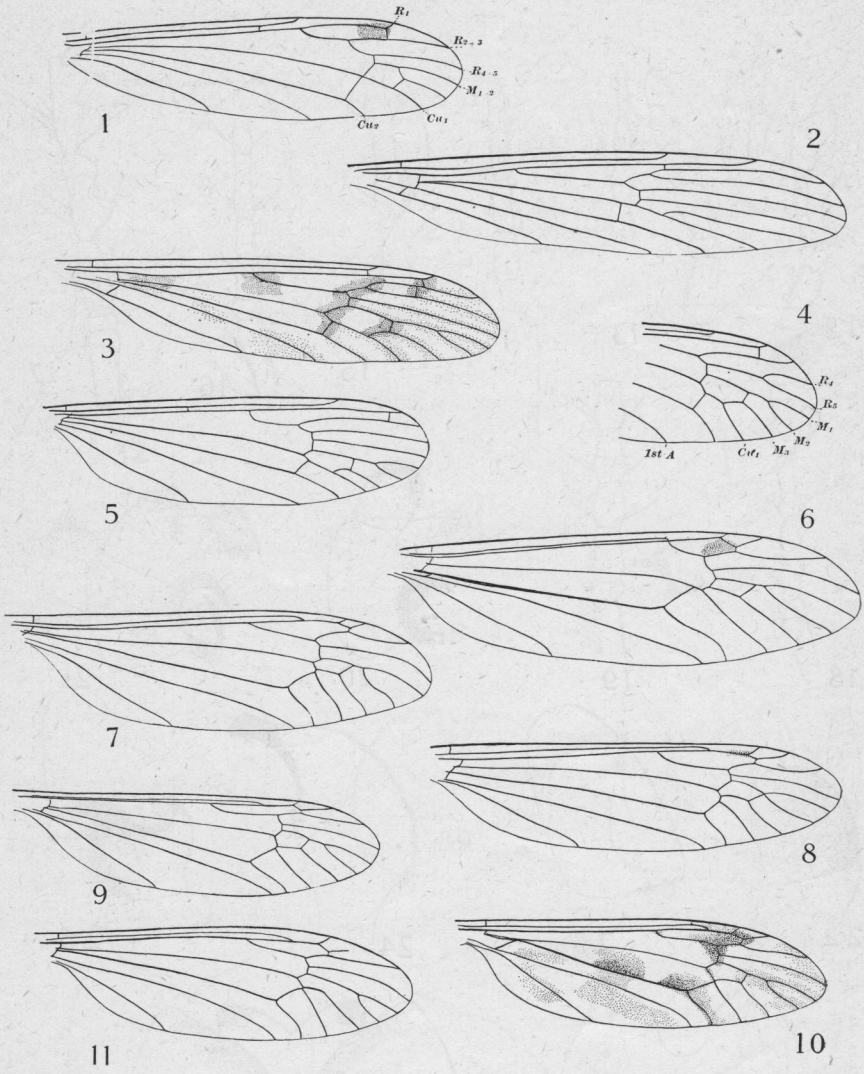
EXPLANATION OF PLATE V.

Fig. 50. Pupa of *Tipula arctica;* male, lateral aspect.
" 51. " *T. arctica;* female, dorsal aspect.
" 52. Larva of *Tipula arctica;* labrum, dorsal aspect.
" 53. " *T arctica;* mentum, ventral aspect.
" 54. " *Poecilostola,* supp.; outer lobe of maxilla.
" 55. " *Poecilostola,* supp.; mandible.
" 56. " *Tipula arctica;* chætotaxy of third abdominal tergite; dorsal aspect.
" 57. " *T. arctica;* the same, third abdominal sternite; ventral.
" 58. " *Stygeropis,* supp.; the same, third abdominal tergite; dorsal.
" 59. " *Stygeropis,* supp.; the same, third abdominal sternite; ventral.
" 60. " *Tipuline* No. 1; the same, third tergite; dorsal.
" 61. " *Tipuline* No. 1; the same, third sternite; ventral.
" 62. " *Tipuline* No. 2; the same, third tergite; dorsal.
" 63. " *Tipuline* No. 2; the same, third sternite; ventral.
" 64. " *Tipuline* No. 3; the same, third tergite; dorsal.
" 65. " *Tipuline* No. 3; the same, third sternite; ventral.

EXPLANATION OF PLATE VI.

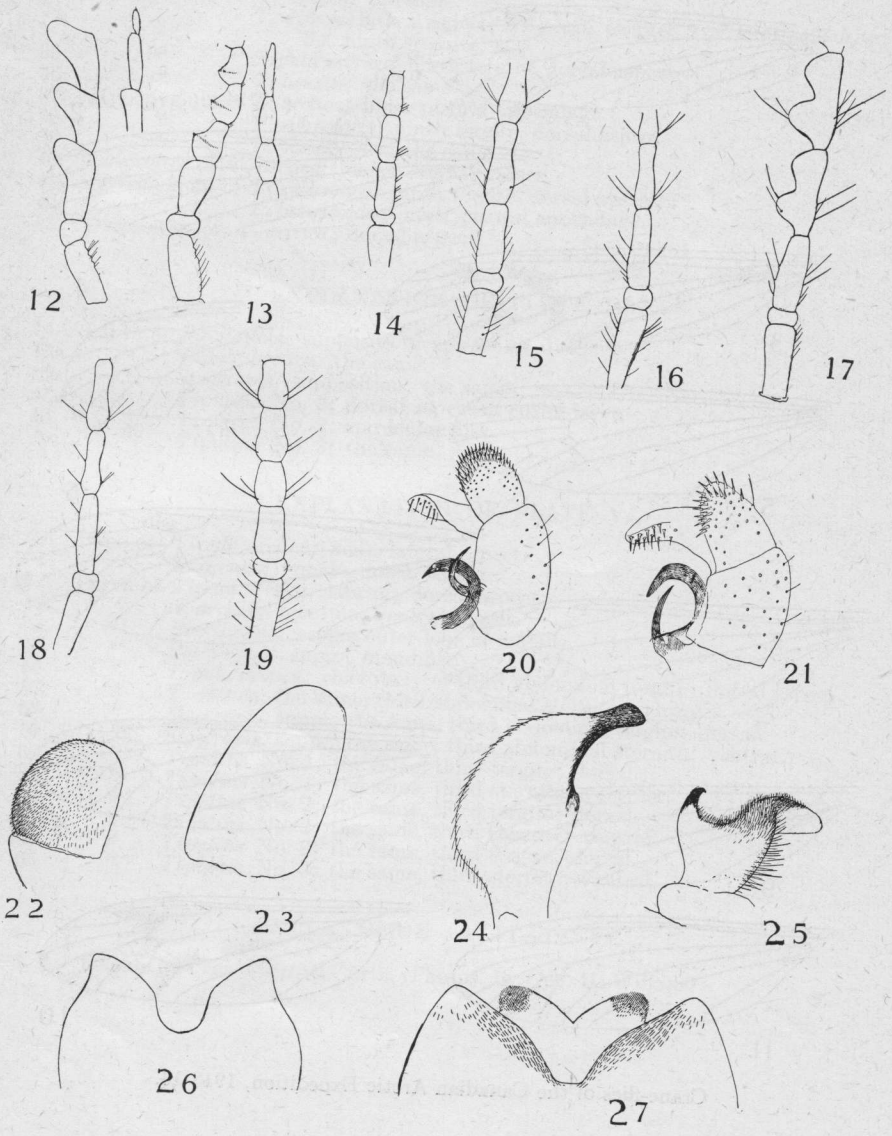
Figs. 1, 2. Female of *Tipula arctica* Curtis (Photos. by Geo. H. Wilkins)

PLATE I.



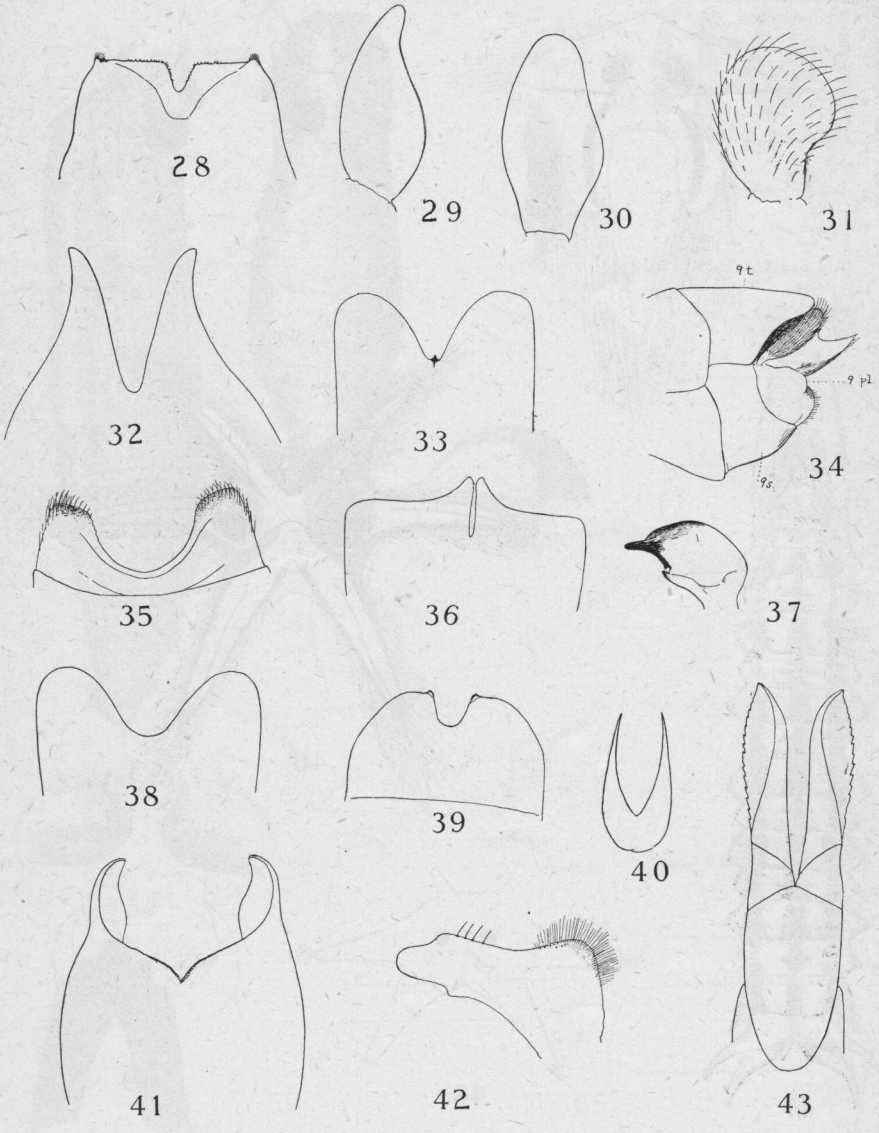
Crane-flies of the Canadian Arctic Expedition, 1913-16.

PLATE II.



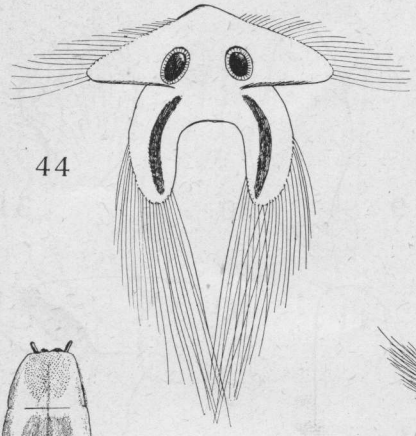
Crane-flies of the Canadian Arctic Expedition, 1913-16.

PLATE III.



Crane-flies of the Canadian Arctic Expedition, 1913-16.

PLATE IV.



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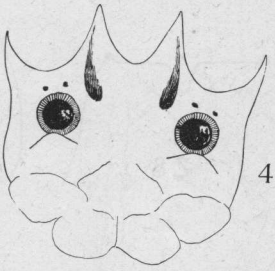

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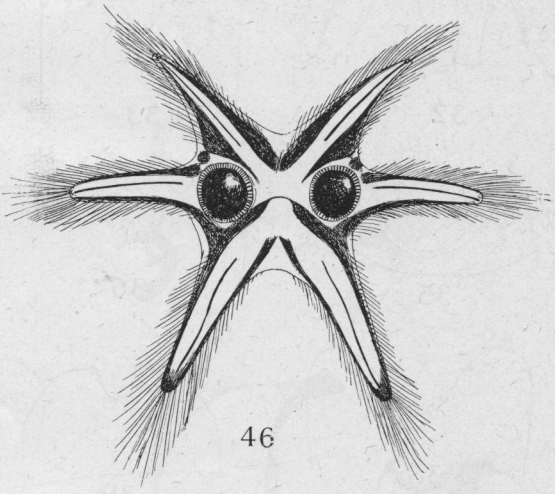

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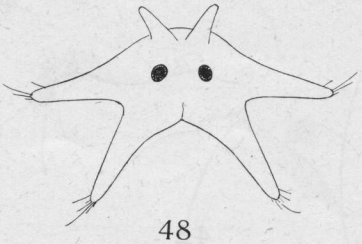

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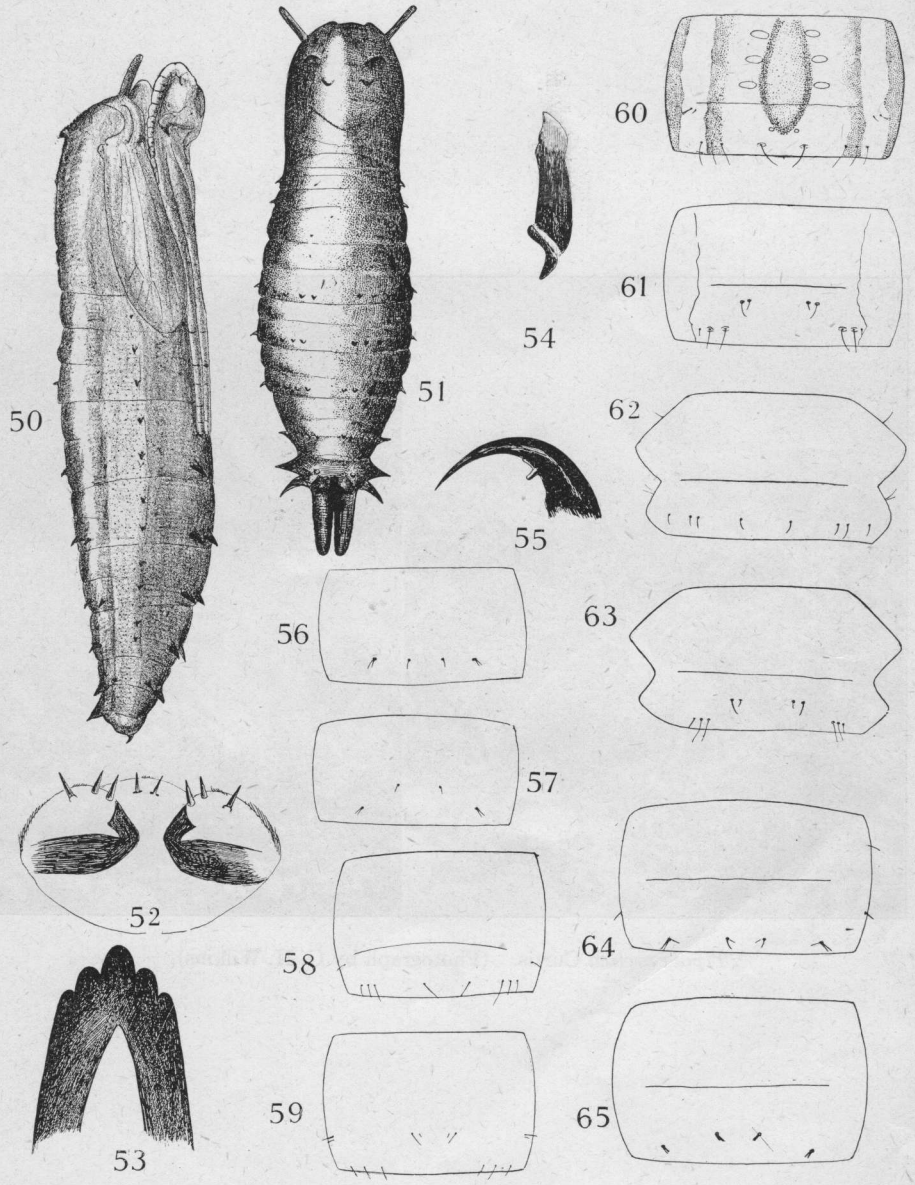
Crane-flies of the Canadian Arctic Expedition, 1913–16.

PLATE V.



Crane-flies of the Canadian Arctic Expedition, 1913-16.