# GENERA INSECTORUM

DIRIGÉS PAR

P. WYTSMAN

## DIPTERA

### FAM. PTYCHOPTERIDÆ

By CHARLES P. ALEXANDER

WITH I PLAIN PLATE

1927

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As now restricted, the family Ptychopteridæ includes only the three genera, *Ptychoptera*, *Bittacomorphella* and *Bittacomorpha*. Until 1919, the Flies that are now recognized as constituting the distinct and primitive family Tanyderidæ were included in the Ptychopteridæ, a group to which they are not very closely allied. The Ptychopteridæ, as thus restricted, form a compact group of flies that are widely distributed throughout the temperate and tropical regions of the World. The recent studies by Crampton (Entomological News, Vol. 37, p. 33-39, 65-70 [1926]) indicate that the true affinities of the Ptychopteridæ lie with the Psychodoid Diptera.

Through the studies of Réaumur on the remarkable larva and pupa of the group, the typical genus *Ptychoptera* was known even before the time of Linnæus and long before its diagnosis as a genus by Meigen in 1803. In 1835, Westwood erected the genus *Bittacomorpha*, based upon the so-called « phantom crane-fly », *Tipula clavipes* of Fabricius, and correctly indicated its affinities with *Ptychoptera*. Although the general appearance of the Flies of the Ptychopterinæ is very different from that of the Bittacomorphinæ, there is no question concerning their close relationship.

In the present paper, the Comstock-Needham-Tillyard system of wing-venation is used. The terminology of the male hypopygium is that of Crampton (1923).

The writer is greatly indebted to Professor and Mrs. J. Speed Rogers for co-operation in making the figures of wings used in this paper.

**Geographical distribution.** — Species of the typical genus *Ptychoptera* occur throughout the Holarctic Region, being especially characteristic of the European fauna, where no fewer than nine distinct species are found. Rather numerous species have been discovered in the Eastern Palæarctic Region (Japan) and at higher altitudes in the Oriental Region. The species in the Nearctic Region are more restricted in number. Other species of *Ptychoptera* occur throughout tropical Africa and one form has been recorded, but not described, from temperate South America. The genus thus appears to be lacking only from the Australasian Region.

The « Phantom Crane-Flies », *Bittacomorphella* and *Bittacomorpha*, were long known only from the Nearctic Region where a single species of each genus occurs on each side of the continent. Very recently a species of *Bittacomorphella* has been discovered in the mountains of Central Japan.

**Geological distribution.** — The only described fossil Ptychopteridæ are the *Ptychoptera deleta* Novak (Upper Oligocene), whose strict generic position is doubtful, and *Bittacomorphella miocenica* (Cockerell) from the Florissant Miocene, described as a *Bittacomorpha* but, from its comparison with *Bittacomorphella sackenii* (Röder), almost certainly a member of this latter genus.

**Biology.** — The adults of the species of *Ptychoptera* are especially characteristic of wet swales and open wet meadows. *Bittacomorphella* is a shade lover, the Flies being found in cold, darkened woodlands, usually near running water or springs, in small darkened ravines or along densely shaded runs. *Bittacomorpha* frequents open pond margins and alder swamps. The larvæ and pupæ of the Ptychopteridæ are very characteristic. The larvæ have the body eucephalous and metapneustic, the caudal end being prolonged into a more or less retractile breathing-tube that is protruded through the surface-film while the insect feeds beneath the water. A similar adaptation is found in the pupa where one of the two prothoracic breathing horns is enormously prolonged into a breathing-tube, the other being greatly atrophied. The larvæ and pupæ dwell in the water and saturated earth in the same habitats in which the adults occur.

As typical of the family, the life-history of *Ptychoptera albimana* (Fabricius), as studied by Topsent, may be briefly summarized. The eggs range in number from 520-587, averaging 554. They are pale yellow, slightly arcuated, the surface curiously ornamented, the dimensions being 0.825 by 0.264 millimeters. The duration of the egg stage is seven days. The newly hatched larva measures 3.85 mm., the respiratory tube 0.99 mm. The adult larva measures 77 mm., of which the respiratory tube constitutes 20 mm. The growth of the larva is rapid. When fifteen days old, the extended larva measures 25 mm. When sixty-seven days old it measures 45 mm. The pupal stage is from ten to twelve days, averaging eleven days. There are normally two generations per year.

The life-histories of the American *Ptychoptera rufocincta* (Osten-Sacken) and *Bittacomorpha clavipes* (Fabricius) are less completely known, but the pupal duration is very much shorter. In the case of the former species it is slightly less than five days. The known biology of the Ptychopteridæ is summarized in a paper by the writer (Cornell Univ. Agr. Expt. Sta. Mem. Nr. 38, p. 772 [1920]).

The species of *Bittacomorpha* have the basitarsi of all the legs, in both sexes, curiously dilated. These swollen tarsi are almost completely filled by the tracheæ and serve to buoy the insects as they drift in the wind. The flies of *B. clavipes* present a very curious appearance as they drift about in the breezes with all the legs extended like the radii of a circle.

**Characters of the Adult Flies.** — The adult flies of the two included subfamilies are very different from one another in their general appearance but the relationship existing is very close, the flies having many characters in common.

Head transverse, very closely applied to the thorax; fronto-clypeus produced, roughly triangular; maxillary palpi elongate, the terminal segment especially elongate, approximately equal to the others taken together. Labial palpi conspicuous, labelliform, the theca at the base on the ventral or caudal face chitinized. Antennæ 16-segmented in the Ptychopterinæ, 20-segmented in the Bittacomorphinæ. Pronotum very reduced. Mesonotum usually highly gibbous, the transverse suture bent strongly caudad at the region of the scutum to form a deep « scutal loop »; mesonotal præscutum with parallel longitudinal furrows on either side of the median area, these in alignment with the furrows of the scutal loop. Prehaltere present. Metathoracic spiracle close to base of halter. Mesothoracic meron fused with the mesepimeron. Legs moderately elongate, longer and more conspicuously hairy in the Bittacomorphinæ, in *Bittacomorpha* with the basitarsi dilated; tibial spurs present; empodia short, transverse. Wings with macrotrichiæ in the outer ends of the radial and medial cells in *Ptychoptera*,

more reduced in number in *Bittacomorphella*, lacking in *Bittacomorpha*. Venation (see **Plate, Fig. A. B.**) with $Sc_2$ lacking; $Rs$ usually short; $R_{2+3}$ thickened and running close to $R_1$, connected with the latter by $r$; $R_{4+5}$ delicate, cell $R_4$ always present; cell $M_1$ present in the Ptychopterinæ, lacking in the Bittacomorphinæ; posterior section of vein $Cu_1$ strongly sinuous; a conspicuous longitudinal furrow in cell $Cu$, extending from vein $2^{nd}$ $A$ to near the bend in the distal section of $Cu_1$. Abdomen moderately elongate, more so in the Bittacomorphinæ. Male hypopygium with the lateral lobes of the ninth tergite and the dististyles produced into more or less elongate digitiform lobes. Ovipositor with the tergal valves strongly compressed, bent slightly dorsad, so the ventral margin is straight or even feebly concave.

**Characters of the Larvæ.** — Body eucephalous, metapneustic, long and slender, the caudal end prolonged into a more or less completely retractile breathing tube that bears the spiracles at the tip. Lobes surrounding the spiracular disk small or indistinct. Anal gills two, elongate-cylindrical, simple. Integument with tiny hairs (*Ptychoptera*, **Plate, Fig. 2**), or with slight, warty protuberances (*Bittacomorpha*), or with conspicuous elongate tubercles (*Bittacomorphella*, **Plate, Fig. 6**). Pseudopods on abdominal segments one to three each bearing a curved claw. Head complete, eye-spots distinct. Mandibles opposed. Mentum many-toothed (*Ptychopterinæ*) or merely bilobed (*Bittacomorphinæ*).

**Characters of the Pupæ.** — Usually with one of the two pronotal breathing horns greatly elongated (**Plate, Fig. 3**), much longer than the body (this may not be true in the still insufficiently known pupa of *Bittacomorphella*); in *Ptychoptera* and *Bittacomorpha* it is the right horn that is normally elongated, the left being degenerated. In *Bittacomorphella* the right horn is degenerated. Tarsal sheaths all parallel in the Ptychopterinæ, the fore pair overlying the middle pair in the Bittacomorphinæ. Abdomen covered with setiferous tubercles arranged in transverse rows on tergites and sternites, and more or less in longitudinal rows on the pleurites. Cauda with a powerful dorsal median lobe near the base of segment eight.

**Phylogeny.** — It has generally been assumed that our recent Ptychopteridæ have been derived more or less directly from the family Eoptychopteridæ (Proptychopteridæ) of the Mecklenburg Lias (lowest Jurassic), where they are represented by three monotypical genera (*Eoptychoptera simplex* Geinitz, *Proptychoptera liasina* Handlirsch and *Eolimnobia geinitzi* Handlirsch). The writer is not fully convinced of this relationship and, if it is correct, some intermediate types must have existed that have not yet been re-discovered. Unquestioned Ptychopteridæ were in existence in the upper Oligocene and undoubted members of the Bittacomorphinæ in the Miocene.

Among the recent genera, *Ptychoptera*, from its adult structures, is the most primitive, followed by *Bittacomorphella* and *Bittacomorpha*. Based upon the structure of the larva, however, *Bittacomorphella* is the most generallized and is very distinct from *Bittacomorpha* and *Ptychoptera*, which are generally similar to one another. It is probable that the two recent subfamilies, Ptychopterinæ and Bittacomorphinæ, were derived from some common ancestor in pre-Tertiary times, and the direct derivation of *Bittacomorphella* from *Ptychoptera* is improbable.

# FAM. PTYCHOPTERIDÆ

**Ptychopterinæ** Schiner, Fauna Austriaca, Dipt. Vol. 2, p. 495 (1864).

**Ptychopterina** Osten-Sacken, Mon. Dipt. N. Amer. Vol. 4, p. 309 (1869); Berl. Ent. Zeitschr. Vol. 31, p. 226 (1887).

**Ptychopteridæ** Handlirsch, Fossilen Insekt. p. 967 (1908).

**Liriopidæ** Grünberg, Süsswasserfauna Deutschlands, Dipt. Zweiflügler, p. 74 (1910).

**Ptychopteridæ** Alexander, The Crane-Flies of New York, Biology and Phylogeny, Cornell Univ. Agr. Expt. Sta. Mem. Nr. 38, p. 772 (1920).

**Ptychopteridæ** Crampton, Ent. News, Vol. 37, p. 33-39, 65-70 (1926).

## TABLE OF SUBFAMILIES

### Adults.

Antennæ 16-segmented; wings with cell $M_1$ present . . . . 1. Subfam. PTYCHOPTERINÆ.
Antennæ 20-segmented; wings with cell $M_1$ lacking . . . . 2. Subfam. BITTACOMORPHINÆ.

### Larvæ.

Mentum with outer margin finely serrated; mandibles with three large outer teeth; pseudopods small; coloration yellow or brown . . . . . 1. Subfam. PTYCHOPTERINÆ.
Mentum bilobed, untoothed; mandibles with a single large outer tooth; pseudopods prominent, each with a conspicuous curved claw; coloration rusty red or black . . . 2. Subfam. BITTACOMORPHINÆ.

### Pupæ.

All tarsi lying parallel; wing-pads with cell $M_1$ present . . . 1. Subfam. PTYCHOPTERINÆ.
Fore tarsi lying over middle tarsi; wing-pads with cell $M_1$ lacking . . . . . 2. Subfam. BITTACOMORPHINÆ.

# 1. Subfam. PTYCHOPTERINÆ

**Ptychopterinæ** Schiner, Fauna Austriaca, Dipt. Vol. 2, p. 495 (1864).

**Remarks.** — The adult flies of the Ptychopterinæ all present a generally similar appearance, being glabrous or nearly so, with shiny black or blue-black colors, usually contrasting strongly with fulvous or rufous spots and bands. The wings are often cross-banded with brown, in such cases there being a nearly complete fascia at the cord and an outer broken band occupying the forks of cells $R_4$ and $M_1$.

**Characters.** — The essential characters of the adult flies of this subfamily are the presence of sixteen antennal segments and the retention of cell $M_1$ of the wing. The larvæ and pupæ do not differ strikingly from those of *Bittacomorpha*, less so than the latter genus does from *Bittacomorphella*.

The only valid genus in the subfamily is *Ptychoptera* Meigen.

## 1. Genus PTYCHOPTERA Meigen

**Liriope** Meigen, Nouv. Class. Mouches, p. 14 [1800] (nomen nudem).

**Ptychoptera** Meigen, Illiger's Mag. Ins. Vol. 2, p. 262 (1803).

**Ctenoceria** Rondani, Dipt. Ital. Prodr. Vol. 1, p. 187 (1856).

**Paraptychoptera** Tonnoir, Ann. Soc. Ent. Belg. Vol. 59, p. 115 (1919).

**Remarks.** — The adult flies of *Ptychoptera* may be swept from rank vegetation in and near swales and in open swamps. The larvæ occur in decaying vegetable matter in rich organic mud at the margins of swamps and ponds.

**Characters of Adults.** — Body relatively smooth, shiny or subshiny, the general appearance of the Flies suggesting somewhat a large fungus-gnat (Mycetophilidæ), this resemblance being heightened by the usual black and rufous coloration and the banded wings.

Head transverse; vertex between eyes broad; fronto-clypeus large, roughly triangular, bearing the tiny labrum at its apex. Maxillary palpi long, the terminal segment very long and flexible, exceeding in length the preceding three segments taken together. Labial palpi large and conspicuous, labelliform. Antennæ (**Plate, Fig. 8**) inserted on the anterior portion of vertex, closely approximated at origin, 16-segmented; scapal segments moderately large; in the male, flagellar segments cylindrical, becoming more flattened when dried, terminal segment very small; segments with a few short verticils and with a dense covering of short, subappressed silvery pubescence. In the female, the antennæ are very noticeably shorter, the flagellar segments beyond the first short-cylindrical, the ends slightly narrowed. Eyes relatively large, with delicate ommatidia.

Pronotum narrow, the anterior and posterior divisions evident; head closely applied to the cephalic margin of the mesonotal præscutum. Mesonotum of moderate size; suture between the præscutum and scutum subtransverse at lateral margins but near the median area deflected very strongly caudad, near the scutellum forming a posterior scutal loop; more or less distinct longitudinal furrows extend from this suture onto the præscutum, occupying the region of the interspaces and being in alignment with the scutal loop of the suture. Legs of moderate length only; coxæ elongate, especially the fore coxæ; vestiture of legs relatively short and delicate, appressed or subappressed; tibial spurs large and conspicuous, hairy, except for the acute glabrous tips; ungues very small; empodia small, transverse. Wings moderately broad, the distal fifth or more with macrotrichiæ in all the cells. Venation (**Plate, Fig. A**) : *Sc* ending in Costa a moderate distance beyond the cord, $Sc_2$ lacking; *Rs* variable in length, longest in *P. contaminata* (Linnæus), short and oblique in most species of the genus, in a few cases arcuated or weakly angulated; $R_{2+3}$ arising at or just before *r-m*, running close to $R_1$, connecting with this latter vein by *r* which lies close to the tip of $R_1$: there is a very strong probability that this *apparent* radial crossvein is, in reality, the basal section of vein $R_2$, a condition that obtains in the Pediciine Tipulidæ; $R_{4+5}$ forked, the fork a little longer than or subequal to the petiole; *M* forking at the cord, the fork of $M_{1+2}$ shorter and smaller than that of $R_{4+5}$, usually one-half or less the length of its petiole; $M_{3+4}$ subequal to *m-cu*; $Cu_1$ very strongly sinuate on its distal section, the semi-atrophied $Cu_2$ relatively well-defined; a single persistent Anal vein. A strong longitudinal fold or furrow in cell *Cu*, extending from near midlength of vein *1st A* to near the bend in the sinuate distal section of vein $Cu_1$

Abdomen relatively short, the male hypopygium of moderate to large size. The structure of the male hypopygium differs in its details in the various species, but the fundamental plan remains generally the same. *P. japonica* Alex. (**Plate, Fig. 5**) may be taken as typical : 8th tergite short and narrow. Ninth tergite with a very deep median incision, the lateral lobes thus formed being produced caudad into digitiform, setiferous arms. Basistyle roughly triangular, with the apex rounded, bearing at its tip the slender, digitiform dististyle. Ninth sternite very high at base, the caudal ventral margin strongly chitinized, produced caudad and dorsad in a long, slender arm, immediately dorsad of which is a shorter, more strongly chitinized arm with five or six blunt denticles along its ventral face. Ædeagus double, the parts separate except at base, divergent, chitinized, the outer angle produced distad into a slender, chitinized arm. In many species of the genus, the lateral arms of the ninth tergite are shorter and stouter than in the case described. The ovipositor (**Plate, Fig. 4**) is strongly compressed,

nearly glabrous, bent gently dorsad, a condition approaching that found in the related family Trichoceridæ.

**Characters of Larvæ.** — Head oval to subpyriform, broadest behind, narrowed in front, not heavily patterned above; setæ of head branched or plumose. Submentum large, usually but a little narrowed posteriorly, the anterior lateral angles slightly produced; mentum broader than long, the outer margin with numerous (18-22) teeth. Prementum with palpi rather small, lying parallel, densely hairy on outer or ventral face. Mandible with three powerful outer teeth and about six smaller inner teeth. Maxilla with the cardines elongate-triangular, with three setiferous punctures; maxillary palpi antenniform, cylindrical. Labrum broad, transverse, with dense tufts of setæ beneath. Integument almost smooth, without prominent warty elevations. Pseudopods low, with small claws.

**Characters of Pupæ.** — Head small, with a reduced cephalic crest. Sheaths of maxillary palpi elongate, the tips projecting around knee joints of fore legs. Leg sheaths with all the tarsi parallel, not overlapping one another. Wing sheaths with Media branched. Pronotal breathing horns very unequal, one (usually the right) exceedingly elongate, longer than remainder of body, the other horn tiny, degenerate. Abdomen set with transverse and longitudinal rows of small setiferous tubercles on the segments.

On the ventral surface of the fourth abdominal sternite of the adult males of certain species of *Ptychoptera*, is found a setiferous glandular pouch. Tonnoir has proposed the generic term *Paraptychoptera* for the European species showing this character (*P. handlirschi* Czizek, *P. lacustris* Meigen, *P. longicauda* Tonnoir and *P. palustris* Meigen). The function of this pouch is not fully understood and the group, being based on a sexual character, is not recognized in this paper, though perhaps worthy of subgeneric rank under *Ptychoptera*. It should be noted that a very comparable condition is found in certain Eriopterine Tipulidæ (genera *Paratropesa* and *Teucholabis*) where an entirely similar sternal pouch occurs in the males of certain species while apparently lacking in others that are seemingly closely allied.

**Type species :** *Ptychoptera contaminata* Linnæus.

**Geographical distribution.**

| | |
|---|---|
| 1. *P. africana* Alexander, The Entom. Vol. 53, p. 101 (1920). | Nigeria. |
| 2. *P. albimana* Fabricius, Mant. Ins. Vol. 2, p. 323 [1787] (*Tipula*). | Europe. |
| 3. *P. annandalei* Brunetti, Rec. Indian Mus. Vol. 15, p. 296 (1918). | India. |
| 4. *P. camerounensis* Alexander, Insec. Inscit. Menst. Vol. 9, p. 146 (1921). | Cameroun. |
| 5. *P. capensis* Alexander, Ann. S. Afr. Mus. Vol. 17, p. 139, pl. 10, f. 1 (1917). | South Africa. |
| 6. *P. contaminata* Linnæus, Syst. Nat. (ed. 10), p. 586 [1758] (*Tipula*). *P. fuscipes* Gmelin, Syst. Nat. p. 2819 [1792] (*Tipula*). | Europe. |
| 7. *P. daimio* Alexander, Insec. Inscit. Menst. Vol. 9, p. 80 (1921). | Japan. |
| 8. *P. distincta* Brunetti Rec. Indian Mus. Vol. 6, p. 232 (1911); Fauna Brit. India, Dipt. Nematocera, p. 281, pl. 5, f. 1 (1912). | India. |
| 9. *P. formosensis* Alexander, Insec. Inscit. Menst. Vol. 12, p. 49 (1924). | Formosa. |
| 10. *P. handlirschi* Czizek, Zeitschr. des Mährischen Landesmus., Vol. 17, p. 14 [1924] (*Liriope*). | Central Europe. |
| 11. *P. japonica* Alexander, The Canad. Ent. Vol. 45, p. 198, pl. 3, f. 7, pl. 4, f. 11-16 (1913). | Japan. |
| 12. *P. lacustris* Meigen, Syst. Beschr. Zweifl. Ins. Vol. 6, p. 291 (1830). | Europe. |
| 13. *P. lenis* Osten-Sacken, Bull. U. S. Geol. Surv. Vol. 3, p. 206 (1877). | Western North America. |
| 14. *P. longicauda* Tonnoir, Ann. Soc. Ent. Belg. Vol. 59, p. 121 [1919] (*Paraptychoptera*). | Europe. |
| 15. *P. minor* Alexander, Ent. News, Philad. Vol. 31, p. 3 (1920). | Western North America. |
| 16. *P. minuta* Tonnoir, Ann. Soc. Ent. Belgique, Vol. 59, p. 120 (1919). | Europe. |

17. *P. paludosa* Meigen, Klass. Vol. 1, p. 82, pl. 3, f, 13 (1804). Europe.
17*a* *P. paludosa coerulea* Strobl, Glasnik Zem. Mus. Bosni i Hercegov. Sarajevo, Vol. 10, p. 602 (1898). Europe.
Europe.
18. *P. rufocincta* Osten-Sacken, Proc. Acad. Nat. Sc. Philad. p. 252 (1859). Eastern North America.
19. *P. scutellaris* Meigen, Syst. Beschr. Zweifl. Ins. Vol. 1, p. 206 (1818). Europe.
20. *P. subscutellaris* Alexander, Insec. Inscit. Menst. Vol. 9, p. 81 (1921). Japan.
*P. scutellaris* Matsumura (nec Meigen), Thousand Ins. Japan, Add. Vol. 2, p. 473 (1916).
21. *P. surcoufi* Séguy, Encycl. Ent. Dipt. Vol. 2, p. 22 [1925] (*Paraptychoptera*). Algeria.
22. *P. tibialis* Brunetti, Rec. Indian Mus. Vol. 6, p. 233 (1911); Fauna Brit. India, Dipt. Nematocera, p. 282, pl. 6, f. 1-4 (1912). India.
*P. atritarsis* Brunetti, Rec. Indian Mus. Vol. 6, p. 234 (1911); Fauna Brit. India, Dipt. Nematocera, p. 283, pl. 6, f. 5-6 (1912).

**Species of Uncertain Synonymy :**

1. *P. fasciata* Scopoli, Ent. Carniol. p. 321 [1763] (*Tipula*). Europe.
? *P. paludosa* Meigen.
2. *P. metallica* Walker, List Dipt. Brit. Mus. Pt. 1, p. 80 (1848). Western North America.
? *P. lenis* Osten-Sacken.
3. *P. nigra* Fabricius, Syst. Antl. p. 21 (1805). Europe.
? *P. scutellaris* Meigen.
4. *P. ocreata* Schrank, Enum. Ins. Austriaca, p. 427 [1781] (*Tipula*). Europe.
? *P. albimana* Fabricius.
5. *P. pectinata* Macquart, Hist. Nat. Dipt. Vol. 1, p. 77 (1834). Europe.
6. *P. quadrifasciata* Say, Long's Exped. to St. Peter's Rivers, Appendix, p. 359 (1824). Eastern North America.
? *P. rufocincta* Osten-Sacken.

## 2. Subfam. BITTACOMORPHINÆ

**Bittacomorphinæ** Alexander, Cornell Univ. Agr. Expt. Sta. Mem. Nr. 38, p. 779 (1920).

**Remarks.** — The remarkable appearance of the flies of the subfamily Bittacomorphinæ has given to them the rather appropriate name of « phantom crane-flies ». They are all of delicate, ethereal build, with semi-transparent, unmarked wings, and with long and conspicuous black and white banded legs that form the most evident part of the insect as it drifts easily in the wind with all the legs radiating outward like the spokes of a wheel.

**Characters.** — The essential characters of the subfamily are the presence in the adult flies of elongate, 20-segmented antennæ and the complete fusion of veins $M_1$ and $M_2$ of the wings. The larvæ of the two included genera are very distinct in their general appearance. *Bittacomorpha* possessing a long, rusty-red larva with the body-integument relatively smooth and the anal end tapering gradually into a long, partly retractile breathing-tube. *Bittacomorphella*, on the contrary, has a short, stocky larva, black in color, with the body-integument covered with long, horny projections and with the short, yellow breathing-tube entirely retractile.

### TABLE OF GENERA

**Adults.**

*Wings with macrotrichiæ in the distal ends of the radial and medial cells; basitarsi of legs not dilated* . . . . . 1. Genus Bittacomorphella, Alexander.

*Wings without macrotrichiæ in the cells; basitarsi of legs conspicuously dilated* . . . . . 2. Genus Bittacomorpha, Westwood.

**Larvæ.**

*Coloration black, the breathing-tube light yellow; breathing-tube entirely retractile; body covered with very long projections which are encased in a black, horny substance; mandibles with an inner comb of teeth* . . . . . 1. Genus BITTACOMORPHELLA, Alexander.

*Coloration rusty-red; body tapering gradually to the long, slender, partly retractile, breathing-tube; body covered with transverse rows of shorter, stellate tubercles; mandibles without an inner comb of teeth* . . . . . 2. Genus BITTACOMORPHA, Westwood.

**Pupæ.**

*Right breathing horn small, degenerate; abdominal tubercles weak, tipped with several strong setæ.* . . . . . 1. Genus BITTACOMORPHELLA, Alexander.

*Right breathing horn elongate, filiform, longer than the body; abdominal tubercles strong, elongate, crowned by a circlet of four or five spines and tipped with a setiferous papilla.* 2. Genus BITTACOMORPHA, Westwood.

## 1. GENUS BITTACOMORPHELLA ALEXANDER

**Bittacomorphella** Alexander, Proc. Acad. Nat. Sc. Philad., p. 545 (1916).

**Remarks.** — The adult flies of *B. jonesi* Johnson, the best known of the pygmy phantom crane-flies occur in cool, shaded woods, usually near small trout streams or near springs. In some cases the flies lurk beneath low, dark bridges and beneath culverts. The larvæ dwell in the rich organic mud in these shaded woods.

**Characters of Adults.** — Fundamental characters generally as in *Ptychoptera* but the general appearance (**Plate, Fig. 1**) very different, the coloration being black, more or less pruinose, with the relatively long and slender legs conspicuously banded with black and white.

Fronto-clypeus large, more or less arched dorsally, the labial palpi conspicuous; maxillary palpi long and slender. Antennæ (**Plate, Fig. 7**) 20-segmented, in the males long and slender, in the females shorter; scapal segments small, especially the second; in the males, the flagellar segments are elongate-cylindrical; basal segment very long but partly divided near midlength by a nearly complete suture to form two subequal pseudo-segments; flagellar segments beyond the second gradually elongated to the seventh, thence gradually shortening to the end of the organ; terminal segment very small; all flagellar segments clothed with a short but dense pale pubescence. Antennæ of female shorter than in the male.

Thoracic structure very similar to that of *Ptychoptera*. Pronotum much more reduced; laterocervical plates very small. Legs relatively long and slender; coxæ moderately elongate; femora at bases very narrow and breaking very easily from the trochanters; basitarsi not dilated but all the legs provided with long, conspicuous, suberect setæ that are especially conspicuous on the tibiæ and tarsi; these setæ are black on the darkened portions of the legs, snowy-white on the tibial and tarsal annuli; tibial spurs very slender and delicate; ungues and empodia about as in *Ptychoptera*. Wings approximately as in *Ptychoptera*, the chief distinctions being in the unforked condition of vein $M_{1+2}$; distal section of vein $Cu_1$ very strongly sinuous. Veins *Rs*, $R_{2+3}$, $M_3$ and *Cu* much thicker and more conspicuous than are veins $R_{4+5}$, $R_4$, $R_5$ or $M_{1+2}$. Conspicuous macrotrichiæ in the distal cells of the wing, more extensive

n *B. jonesi* (Johnson) and *B. sackenii* (Röder) where nearly the outer sixth of the wing is included, very reduced in *B. nipponensis* (Alexander), where they are restricted to a few trichiæ in cells $2_{nd}R_1$, $R_3$ and $R_5$.

Abdomen long and slender, the general structure of the male hypopygium and the ovipositor approximately as in *Ptychoptera*.

**Characters of Larvæ.** — Body short, covered with very prominent projections which are longest on lateral and caudal parts of body (**Plate, Fig. 6**). Pseudopods prominent, with very large, curved claws. Breathing-tube short, entirely retractile within body. Head subquadrate, the foramen ventral in position; setæ of head unbranched. Mandible with an inner comb of teeth. Mentum bilobed, cephalic margin untoothed. Coloration black; breathing-tube light yellow.

**Characters of Pupæ.** — Right breathing horn very short, degenerate. Fore tarsi overlying middle tarsi. Tubercles on abdomen moderately elongated, not crowned by a circlet of spines but tipped with a long seta.

**Type species :** *Bittacomorphella jonesi* Johnson.

**Geographical distribution.**

| | |
|---|---|
| 1. *B. jonesi* Johnson, Psyche, Vol. 12, p. 75 [1905] (*Bittacomorpha*). | Eastern North America. |
| 2. *B. nipponensis* Alexander, Insec. Inscit. Menst. Vol. 12, p. 51 (1924). | Japan. |
| 3. *B. sackenii* Röder, Wien. Ent. Zeit. Vol. 9, p. 230 [1890] (*Bittacomorpha*). | Western North America. |

**Fossil Species.**

| | |
|---|---|
| 4. *B. miocenica* Cockerell, Bull. Amer. Mus. Nat. Hist. Vol. 28, p. 280, f. 2 [1910] (*Bittacomorpha*). | Miocene, Colorado. |

## 2. GENUS BITTACOMORPHA WESTWOOD

**Bittacomorpha** Westwood, London and Edinburgh Philos. Mag. Vol. 6, p. 281 (1835).

**Remarks.** — The curious Flies of the genus *Bittacomorpha* are very characteristic of alder swamps and the wet margins of ponds. The larvæ are usually abundant in decaying vegetable matter in the rich organic mud about ponds and in swamps. In some cases the larvæ become scavengers and fill an important function in sewage elimination.

**Characters of Adults.** — The characters are generally similar to those of *Bittacomorphella*, differing in the following essential features: Basitarsi of all legs in both sexes conspicuously dilated into a hollow, fusiform structure (**Plate, Fig. 9**) that is covered with conspicuous setæ. Wing-membrane without macrotrichiæ in the cells.

**Characters of Larvæ.** — Form elongate, body gradually narrowed behind into a partly retractile breathing-tube. Integument with transverse rows of tubercles. Pseudopods on abdominal segments one to three prominent, with large curved claws. Head subpyriform, the dorsum with rows of conspicuous black spots that converge behind. Mandible stout with a single powerful outer tooth. Mentum bilobed, the anterior margin not toothed. Coloration of body rusty red.

**Characters of Pupæ.** — Right pronotal breathing horn very elongate, the left very small and short, subdegenerate. Fore tarsi overlying middle tarsi. Tubercles on abdomen very long, located on

broad transverse bands of chitin, each tubercle with a star of four or five spines surrounding the apex which bears along seta.

**Type species :** *Bittacomorpha clavipes* Fabricius.

**Geographical distribution.**

1. *B. clavipes* Fabricius, Spec. Ins. Vol. 2, p. 404 [1781] (*Tipula*). Eastern North America.
2. *B. occidentalis* Aldrich, Psyche, Vol. 7, p. 201 (1895). Western North America.

## FOSSIL PTYCHOPTERIDÆ

The only fossil Ptychopteridæ that have been recorded are the *Ptychoptera delata* Novak (Oligocene, Krottensee) and *Bittacomorphella miocenica* (Cockerell) which has been discussed under the genus *Bittacomorphella*. According to Scudder, Novak's species (Sitzber. Akad. Wiss. Wien, Vol. 76, p. 88, pl. 2, f. 1 (1877) is certainly referable to the Ptychopteridæ but is probably not a true *Ptychoptera*.

# INDEX

## EXPLANATION OF PLATE

Venation of the Ptychopteridæ. (Interpreted according to the Comstock-Needham-Tillyard System.)

Symbols. — *A* = Anal vein; *C* = Costa; *Cu* = Cubitus; *f* = fold; *h* = humeral crossvein; *M* = Media; *m-cu* = medial-cubital crossvein; *R* = Radius; *Rs* = Radial sector; *r-m* = radial-medial crossvein.

Fig. 1. *Bittacomorphella jonesi* Johnson, lateral aspect of adult male.
— 2. *Ptychoptera rufocincta* Osten-Sacken, dorsal aspect of larva.
— 3. *Ptychoptera rufocincta* Osten-Sacken, lateral aspect of pupa.
— 4. *Ptychoptera japonica* Alexander, lateral aspect of female ovipositor.
— 5. *Ptychoptera japonica* Alexander, lateral aspect of male hypopygium.
— 6. *Bittacomorphella jonesi* Johnson, dorsal aspect of larva.
— 7. *Bittacomorphella jonesi* Johnson, antenna of male.
— 8. *Ptychoptera rufocincta* Osten-Sacken, antenna of male.
— 9. *Bittacomorpha clavipes* Fabricius, posterior leg.
— 10. *Ptychoptera japonica* Alexander, wing.
— 11. *Ptychoptera formosensis* Alexander, wing.
— 12. *Bittacomorphella sackenii* Röder, wing.
— 13. *Bittacomorphella nipponensis* Alexander, wing.
— 14. *Bittacomorphella jonesi* Johnson, wing.
— 15. *Bittacomorphella clavipes* Fabricius, wing.
— A. *Ptychoptera albimana* Fabricius, venation.
— B. *Bittacomorpha occidentalis* Aldrich, venation.

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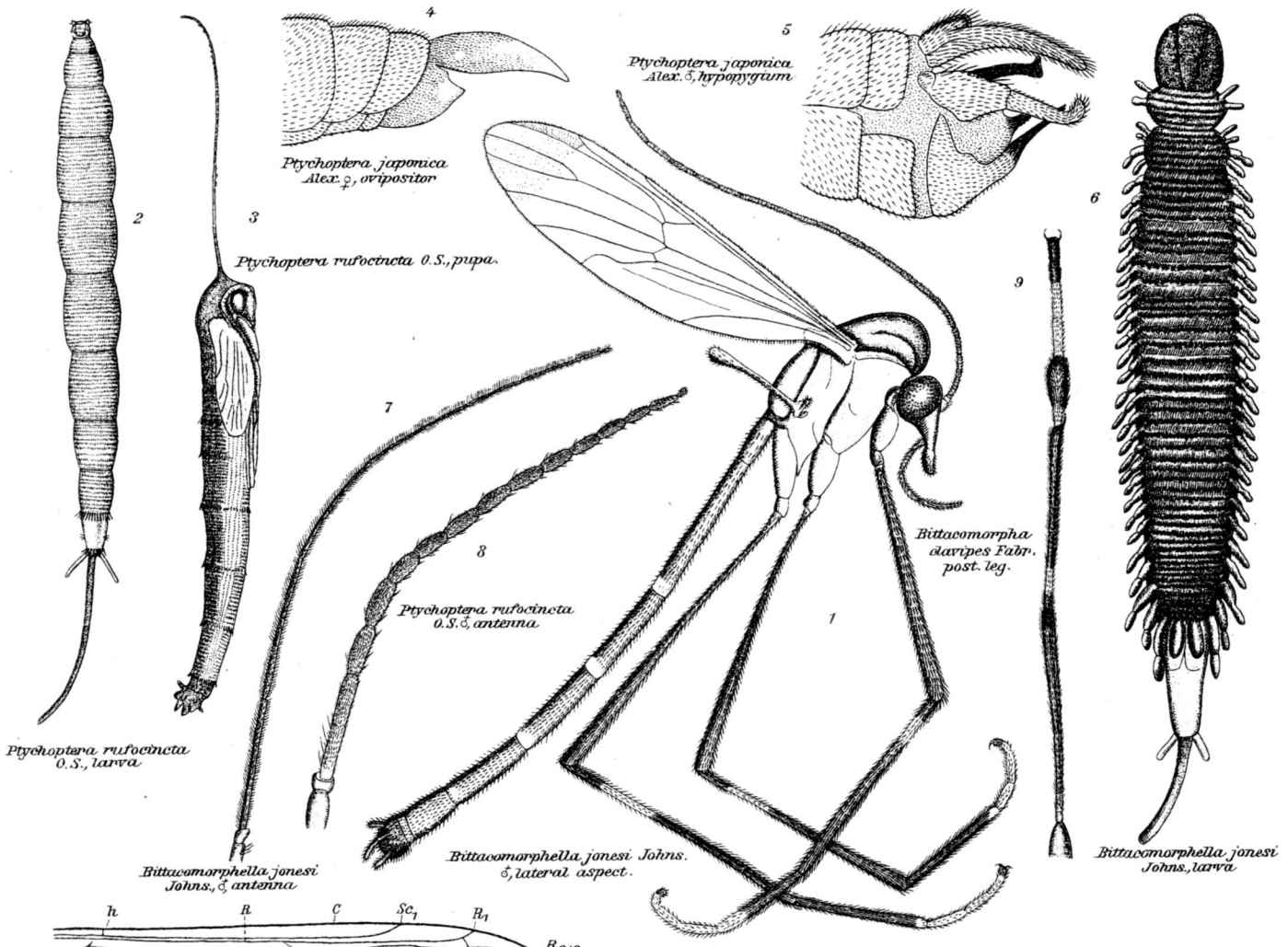
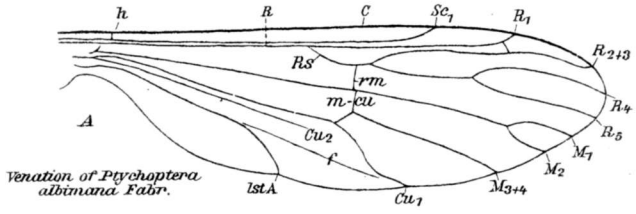
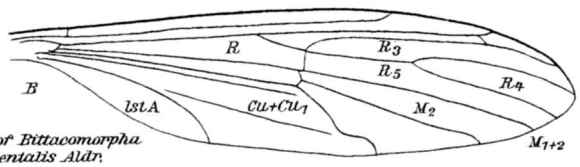
Amherst, Mass. (U. S. A.), June 1, 1926.

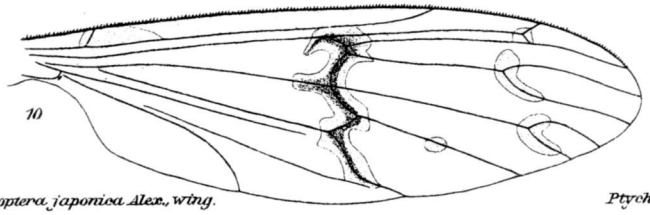


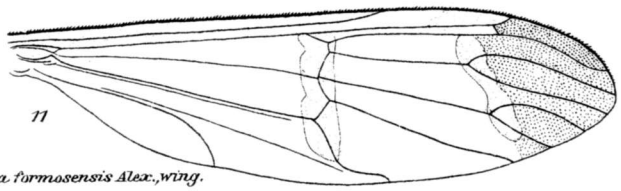

Venation of Ptychoptera albimana Fabr.



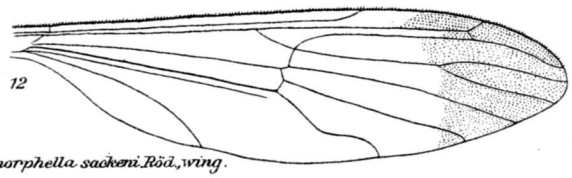

Venation of Bittacomorpha occidentalis Aldr.



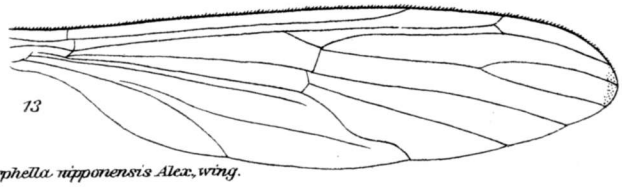

Ptychoptera japonica Alex., wing.



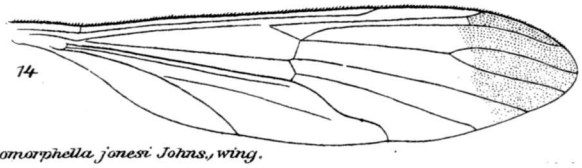

Ptychoptera formosensis Alex., wing.



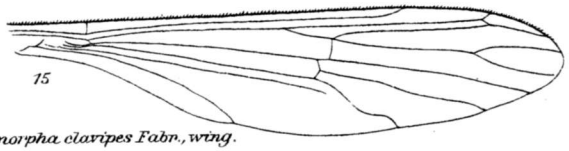

Bittacomorphella sackeni Röd., wing.




Bittacomorphella nipponensis Alex., wing.




Bittacomorphella jonesi Johns., wing.




Bittacomorpha clavipes Fabr., wing.