THE DIPTEROUS FAMILY TANYDERIDÆ IN JAPAN (INSECTA)

CHARLES P. ALEXANDER

Professor of Entomology, Massachusetts State College, Amherst, Mass., U.S.A.

TWO FIGURES

(Received Nov. 18, 1931)

Among some Tipulidæ collected on Sobosan, Kyûshû, Japan, and kindly sent to me for determination by my friend, Professor Teiso Esaki, there were included three specimens of a beautiful new species of two-winged fly of the family Tanyderidæ. Since no member of this archaic family of Diptera had ever been taken in the Japanese Empire, and, in fact, only a single other species, *Protanyderus beckeri* (Riedel), on the entire Eurasian continent, it seems advisable to prepare a somewhat detailed account of the family for the benefit of Japanese entomologists. All dates in parenthesis refer to the Bibliography that concludes the paper.

I. GENERAL ACCOUNT OF THE FAMILY TANYDERIDÆ

The Tanyderidæ includes the most primitive of all living Diptera. For many years the members of this group were placed in the family Tipulidæ (Osten Sacken, 1859, 1869, 1880, 1886; Philippi, 1865). Still later, various students of the lower Diptera (Alexander, 1913; Enderlein, 1912; Handlirsch, 1909, 1910; Riedel, 1921) placed these flies in the family Ptychopteridæ, generally as a subfamily, the Tanyderina or Tanyderinæ. Alexander (1919) elevated the group to full family rank. The members of the Tanyderidæ have little in common with the Ptychopteridæ and certainly require a distinct family for their reception. From the general appearance of the adult flies, the mem-

bers of this group have been held to belong to the superfamily Tipuloidea but recent studies by Crampton (1925) have shown that the adult flies are very similar in structure to the Psychodidæ and are better placed in the superfamily Psychodoidea. The recent discovery of the immature stages (Alexander, 1930 a; Crampton, 1930 a, 1930 b) has shown that the group is highly isolated from either the Psychodidæ on the one hand or the Ptychopteridæ on the other. The Bruchomyiinæ, formerly placed with the Tanyderidæ, are now placed as a subfamily of Psychodidæ (Alexander, 1920 c, 1927 b, 1928; Crampton, 1925; Tonnoir, 1922).

Phylogeny: The first insect that can definitely be referred to the Tanyderidæ is the Baltic amber *Macrochile spectrum* Loew (Alexander, 1927 b, 1931; Crampton, 1926; Loew, 1851). The lower Tertiary *Etoptychoptera* (Handlirch, 1910) shows certain points of resemblance in the nature of the medial and radial fields of the wing but has two anal veins. Likewise the Mesozoic Eoptychopteridæ show no very close relationship to the Tanyderidæ. The discovery of the family Permotipulidæ (Tillyard, 1929) has carried the order Diptera back to the Palæozoic. The insect in question, *Permotipula* Tillyard, shows a highly modified radial field of the wing.

Morphology: The general morphology of members of this group of flies has been discussed in detail by Crampton (1926) and in a manuscript that is ready for the press by a student of Dr. Crampton, Miss Inez Williams. The wing-venation has been described and figured many times (Alexander, 1913, 1919, 1920 b, 1921, 1927 a, 1927 b, 1928 b, 1929 a, 1929 b, 1930 a, 1930 b, 1931; Comstock, 1924; Crampton, 1926; Edwards, 1923 a; Handlirsch, 1909; Loew, 1851; MacGillivray, 1923; de Meijere, 1915 a, 1915 b; Osten Sacken, 1869; Philippi, 1865; Riedel, 1920).

Immature Stages: The very curious early stages of a member of this family, *Protoplasa fitchii*, have recently been discovered and have been discussed in detail by Alexander (1930 a) and Crampton (1930 a, 1930 b). The larva earlier referred to this same genus with some question (Alexander, 1920 a) has thus proved to belong to some other group of flies, still unknown.

The early stages of *Protoplasa*, and presumably of all other mem-

bers of the family, occur in wet sandy soil at margins of major streams, indicating an aquatic or nearly aquatic habit. The whitish larva has the body eucephalous and terete, with lateral spiracles on the prothorax and eighth abdominal segment. No creeping welts on body. Caudal end of body with six long filaments, of which one pair are borne near the caudal ends of two elongate anal pseudopods, the latter terminating in a circlet of short outer crotchets and a central group of long slender crotchets. Four simple anal gills. Length, total, 17 — 18 mm.; filaments alone, 4.5 — 5 mm.; greatest diameter of body, 1.5 mm.

The pupa has an appearance very much resembling a Hexatomine Tipulid. Head surmounted by a high bispinous crest. Pronotal breathing-horns small, smooth, equal in size. Leg-sheaths lying side-by-side, the fore pair shortest, hind pair longest. Venation showing clearly on wing-pads. Abdominal segments with a tuberculate armature, chiefly near posterior margins of segments. Length, 8.5 — 9 mm.; width, dextro-sinistral, 1.5 — 1.6 mm.; depth, dorso-ventral, 1.6 — 1.8 mm.

Distribution: Eleven genera with twenty-four species are now known. These genera have the following general distribution, the figure in parenthesis following the generic name indicating the present number of species.

Araucoderus Alexander (1).—Neotropical (Chile) (Alexander, 1929 b).
Eutanyderus Alexander (1).—Australasian (Australia) (Alexander, 1928 b).
Macrochile Loew (1).—Lower Oligocene (Baltic Amber) (Loew, 1851).
Mischoderus Handlirsch (5).—Australasian (New Zealand) (Handlirsch, 1909).
Neoderus Alexander (1).—Neotropical (Patagonia) (Alexander, 1913).
Nothoderus Alexander (1).—Australasian (Australia) (Alexander, 1922).
Péringueyomyina Alexander (1).—Ethiopian (Cape Colony) (Alexander, 1921).
Protanyderus Handlirsch (4).—Holarctic (Handlirsch, 1909).
Protoplasa Osten Sacken (1).—Eastern Nearctic (Osten Sacken, 1859).
Radinoderus Handlirsch (7).—Australasian (Papua, Australia) (Handlirsch, 1909).
Tanyderus Philippi (1).—Neotropical (Chile) (Philippi, 1865).

From the above digest, it will be seen that the Australasian Region is richest in members of this palæogenic group, with four genera and

fourteen species (Alexander, 1928 b, 1930 a; Edwards, 1923 a; de Meijere, 1915 a, 1915 b; Riedel, 1921). The Neotropical Region (Alexander, 1929 b) has three genera and three species, all in the Chilean subregion. The Ethiopian Region has only the very distinct *Peringueyomyina barnardi* Alexander (1921). In the eastern Nearctic is found only the much discussed *Protoplasa fitchii* Osten Sacken (Osten Sacken, 1859, 1869; Alexander, 1919, 1920 a, 1927 b, 1930 a; Crampton, 1929, 1930 a, 1930 b). The sole remaining recent genus is *Protanyderus*, whose four known species are as follows:

Protanyderus beckeri (Riedel).—Turkestan (Riedel, 1920).

P. esakii sp. n. —Japan (Kyûshû).

P. vanduzeei (Alexander) —United States (California) (Alexander, 1918).

P. vipio (Osten Sacken). —United States (British Columbia, south to California, east to Colorado (Osten Sacken, 1877).

From the above data it will be seen that the occurrence of a member of this family in Japan was entirely to be expected. The various genera occurring in the Northern Hemisphere (*Macrochile*, *Protanyderus*, *Protoplasa*) are all more specialized than are the Antipodal groups in the lobing or bifurcation of the dististyle of the male hypopygium. It might be expected that the group has attained its present distribution in the southern hemisphere by migrations across the former Antarctic continent, thence northward along the Andean chain of South America to western North America, sending one branch into the eastern Nearctic (*Protoplasa*) and another (*Protanyderus*) northward and westward across the Bering land-connection to Eurasia.

II. DESCRIPTION OF PROTANYDERUS ESAKII SP. N.

Protanyderus esakii sp. n.

General coloration of thorax light brown, the præscutum with a darker stripe on either side of median line; legs yellow, the tips of femora narrowly but conspicuously dark brown; wings whitish subhyaline, with a heavy brown pattern, arranged chiefly as three slightly oblique crossbands, interconnected at certain points.

Male.—Length, about 7 mm.; wing, 7 mm.

Female.—Length, about 7 — 7.2 mm.; wing, 7.5 — 8 mm.

Rostrum chestnut brown, the elongate mouthparts black. Antennæ 16-segmented, the scape and pedicel dark brown, the flagellum pale brown; flagellar segments oval to long-oval, with verticils that only slightly exceed the segments in length; terminal segment reduced, approximately one-third the length of the penultimate. Head gray, the posterior vertex indistinctly marked with brownish, appearing as longitudinal areas on either side of the median line. Anterior vertex with a small tubercle immediately caudad of each antennal base.

Cervical sclerites dark brown, the pronotum paler brown. Mesonotum pale brown, the præscutal region with a darker stripe on either side of the median line. Pleura light brown. Halteres yellow, the knobs dark brown. Legs with the coxæ light brown; trochanters testaceous; femora light yellow, the tips narrowly but conspicuously dark brown; tibiæ yellow, the bases very narrowly dark brown, the tips narrowly and weakly infuscated; tarsi yellow, the outer segments more infumed. Wings (textfig. 1) whitish subhyaline, with a heavy brown pattern that varies in its details in different individuals but is arranged chiefly as three slightly oblique crossbands at level of origin of *Rs*, along cord, and at level of outer end of cell *1st* M_2, the first two connected along vein *Cu*, the second and third narrowly connected in cell Sc_1; wing-apex further variegated by a more or less cruciform area, the vertical arm crossing the wing from end of vein R_2 to M_1, the crossbar extending along cell R_4 to wing-margin, connecting basally

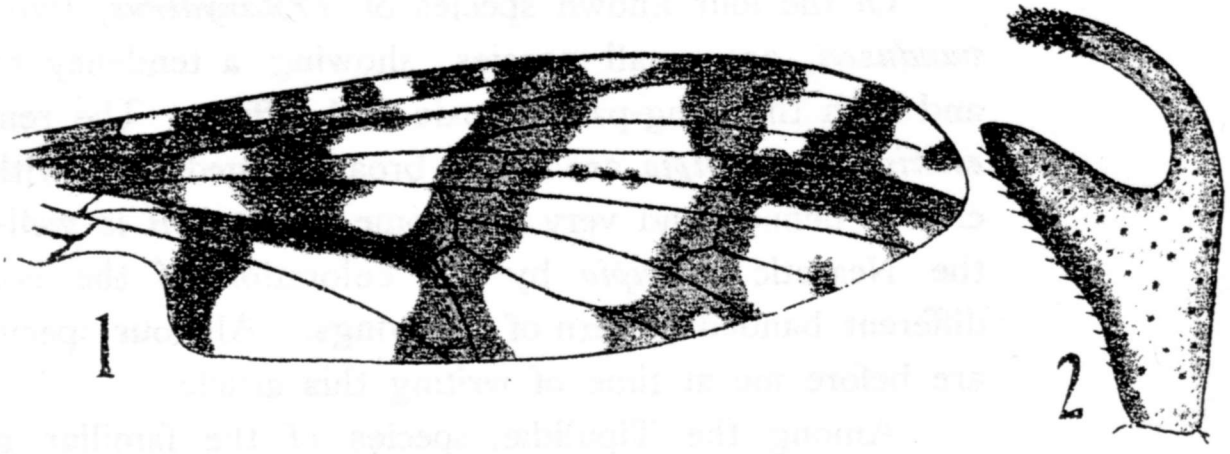

Fig. 1—Wing of *Protanyderus esakii* sp. *n.*

Fig. 2—Dististyle of male hypopygium of *Protanyderus esakii* sp. n.

with the outer band; additional dark areas in cell *C*, at wing-margin at ends of veins R_3 and M_4, small dots and spots in interspaces, on *Rs* *M*, and along R_5; anterior prearcular region darkened; the two outer crossbands are paler in centers than on the margins; veins brown, light yellow where traversing the ground-color. Anal angle of wing very conspicuous, forming an approximate right angle (slightly more prominent than shown in figure). Venation: R_{2+3} longer than the sinuous R_2; a spur from vein R_5 jutting basad into cell *R*; *m* angulate (as shown) to straight.

Abdomen brown, the sternites somewhat darker brown, the caudal margins of segments narrowly pale. Male hypopygium with the dististyle (textfig. 2) profoundly bifid, the more basal arm stouter, the apex narrowly blackened and acute; outer arm slender, blackened on distal third and here set with short stout setæ.

Hab. Japan (Kyûshû).

Holotype, ♂, Sobosan, Bungo, about 400 meters in altitude, July 16, 1931 (Esaki and Fujino).

Allotopotype, ♀, July 18, 1931.

Paratopotype, ♀, July 19, 1931.

The type male and female are preserved in the Entomological Laboratory of the Kyûshû Imperial University, Fukuoka; the paratype female in the writer's collection.

I take very great pleasure in dedicating this striking crane-fly to my friend and colleague, Professor Teiso Esaki, to whom I am very greatly indebted for many favors in the past.

Of the four known species of *Protanyderus*, two *P. beckeri* and *P. vanduzeei*, are small species, showing a tendency to wing reduction, and with the wing-pattern pale and diffuse. The remaining species, *P. esakii* and *P. vipio*, are larger, broad-winged flies, with the wing-pattern clearly defined and very handsome. *P. esakii* is well-distinguished from the Nearctic *P. vipio* by the coloration of the body and the very different banded pattern of the wings. All four species of *Protanyderus* are before me at time of writing this article.

Among the Tipulidæ, species of the familiar genus *Epiphragma* and, in the Japanese fauna, of the Pediciine genus *Heterangæus*, have a somewhat similar banded wing-pattern and may be temporarily con-

fused in collections with members of the Tanyderidæ. Thus, the American *Protoplasa fitchii* has almost invariably been found in museum collections to be placed in series of crane-flies of the familiar species, *Epiphragma fascipennis* (Say). A glance at the venation, as the possession of five branches of radius and the possession of a single anal vein, suffices to tell the present family from all other known Diptera excepting the smaller, plain-winged Psychodidæ.

III. BIBLIOGRAPHY OF THE TANYDERIDÆ.

Alexander, C. P. 1913 A revision of the South American Dipterous insects of the family Ptychopteridæ. Proc. U. S. Nat. Mus., 44: 331-335, 3 figs.

1918 New species of crane-flies from California (Dip.). Ent. News, 29: 285-286.

1919 The crane-flies of New York. Part I. Distribution and taxonomy of the adult flies. Cornell Univ. Agr. Expt. Sta., Mem. 25: 883, 1 fig.

1920a The crane flies of New York. Part II. Biology and Phylogeny. Cornell Univ. Agr. Expt. Sta., Mem. 38: 769-772, pl. 13.

1920b A new genus and species of net-winged midge (Blepharoceridæ) and an undescribed species of Tanyderidæ (Diptera). Arkiv för Zoologi, 13, No. 7: 5-7, fig.

1920c A new subfamily of Tanyderid flies (Diptera). Ann. Ent. Soc. America, 13: 402-407, pl. 32.

1921 A new genus and species of Tanyderidæ (*Peringueyomina barnardi*) in the South African Museum (Diptera). Ann. South African Mus., 18: 231-234, fig.

1922 Undescribed crane-flies (Tanyderidæ and Tipulidæ) in the South Australian Museum. Rec. South Australian Mus., 2: 226-227.

1924 Two undescribed species of *Tanyderus* from the Australasian Region. Insec. Inscit. Menst., 12: 141-143.

1925 An undescribed species of *Tanyderus* from Western Australia (Diptera, Tanyderidæ). Insec. Inscit. Menst., 13: 32-34.

1927a The interpretation of the radial field of the wing in the Nematocerous Diptera, with special reference to the Tipulidæ. Proc. Linn. Soc. New South Wales, 52: 44-45, 1 fig.

1927b Tanyderidæ. Genera Insectorum, Fasc. 189, 9 figs.

1928a The Australasian species of the genus *Nemopalpus* (Psychodidæ, Diptera). Proc. Linn. Soc. New South Wales, 53: 291-294, 2 figs.

1928b The Tanyderidæ of Australia (Diptera). Proc. Linn. Soc. New South Wales, 53: 367-374, figs. 4.

1929a A comparison of the systems of nomenclature that have been applied to the radial field of the wing in the Diptera. IV. Internat. Congress Entomol., 2: 700-707, 3 pls.

1929b Diptera of Patagonia and South Chile. Part I. Crane-flies. British Museum (Nat. Hist.), pp. 227-229.

1930a Observations on the Dipterous family Tanyderidæ. Proc. Linn. Soc. New South Wales, 55: 221-230, 2 pls., 1 fig.

1930b Tanyderus pictus Philippi (Fam. Tanyderidæ, Ord. Diptera). Revista Chinela de Hist. Nat., 34: 110-113, 1 fig.

1931 Crane-flies of the Baltic Amber (Diptera). Bernstein-Forschungen, Heft 2: 1-135, figs. 1-3.

Comstock, J. H. 1924 An introduction to entomology, p. 796, fig.

Crampton, G. C. 1925 A phylogenetic study of the thoracic sclerites of the non-Tipuloid Nematocerous Diptera. Ann. Ent. Soc. America, 18: 49-74, 5 pls.

1926 The external anatomy of the primitive Tanyderid Dipteran *Macrochile spectrum* Loew, preserved in Baltic Amber. Bull. Brooklyn Ent. Soc., 21: 1-14, 2 pls.

1929 A swarm of males of the rare and primitive cranefly *Protoplasa fitchii* observed near Chandler in the Gaspé Peninsula (Diptera). Canadian Ent., 61: 70-72.

1930a Some anatomical details of the pupa of archaic Tanyderid Dipteron *Protoplasa fitchii*, O. S. Proc. Ent. Soc. Washington, 32: 83-98, 3 pls.

1930b A comparison of the more important structural details of the larva of the archaic Tanyderid Dipteron *Protoplasa fitchii*, with other Holometabola, from the standpoint of phylogeny. Bull. Brooklyn Ent. Soc., 25: 239-258, 4 pls.

Edwards, F. W. 1923a A preliminary revision of the crane-flies of New Zealand (Anisopodidæ, Tanyderidæ, Tipulidæ). Trans. New Zealand Inst., 54: 270-272, pl. 27, figs. 4-9, pl. 32, fig. 123.

1923b New species of crane-flies collected by Mr. G. V. Hudson in New Zealand. Ann. Mag. Nat. Hist., (9) 11: 625-626.

Enderlein, G. 1912 Studien über die Tipuliden, Limoniiden, Cylindrotomiden und Ptychopteriden. Zool. Jahrb., Syst., 32: 84-85.

Handlirsch, A. 1909 Zur Phylogenie und Flügelmorphologie der Ptychopteriden (Dipteren). Ann. k.-k. Naturhist. Hofmus. Wien, 23: 263-272, pl. 11, figs. 1-13.

1910 Canadian Fossil Insects. Contributions to Canadian Palaeontology, 2: 122-123, 1 fig.

Hutton, F. W. 1900 The Tipulidæ, or crane-flies, of New Zealand. Trans. New Zealand Inst., 32: 48-49, pl. 4, figs. 21-22.

Loew, H. 1851 Beschreibung einiger neuen Tipularia terricola. Linnaea entomologica, 5: 402-403, figs. 24-25.

MacGillivray, A. D. 1923 External Insect-Anatomy, pp. 322-323, figs. 45-47.

Meijere, de, J. C. 1915a Diptera gesammelt durch die 3te Sud-Neu-Guinea Expedition. Nova Guinea, 13: 51-52, fig. 1.

1915b Diptera aus Nord-Neu-Guinea. Tijd. voor Entomol., 58: 104-106, fig. 1.

Osten Sacken, C. R. 1859 New genera and species of North American Tipulidæ, with short palpi, with an attempt at a new classification of the tribe. Proc. Acad. Nat. Sci. Philadelphia, 1859: 197-256.

1869 Monographs of the Diptera of North America. Part IV. Smithsonian Misc. Coll., 219: 316-319, fig. 7.

1877 Western Diptera. Bull. U. S. Geol. Survey. 3: 208.

1880 Die Tanyderina, eine merkwürdige Gruppe der Tipuliden. Verh. zool.-bot. Ges. Wien, 29: 517-522, figs. 1-2.

1886 Studies on Tipulidæ. Part 2. Review of the published genera of the Tipulidæ brevipalpi. Berliner Ent. Zeitschr., 31: 228-230.

Philippi, R. A. 1865 Aufzählung der chilenischen Dipteren. Verh. zool.-bot. Ges. Wien, 15: 780-782, pl. 29, fig. 57.

Riedel, M. P. 1920 *Tanyderus beckeri* n. sp. aus Turkestan (Dipt.). Die erste rezente, paläarctishce Art der Familie Tanyderidæ. Zool. Jahrb., Syst., 43: 365-370, 4 figs.

1921 Nematocera Polyneura aus Neu-Guinea usw. des Ungarischen National-Museums in Budapest. Ann. Mus. Nat. Hungarici, 18: 143-144.

Tillyard, R. J. 1926 The insects of Australia and New Zealand, pp. 346-347, fig. W 21.

1929 Permian Diptera from Warner's Bay, N. S. W. Nature, May 18, 1929, pp. 1-4 (separate pagination).

Tonnoir, A. 1922 Notes sur le genre *Nemopalpus* (Dipt. Psychodidæ) et description d'une espèce nouvelle. Ann. Soc. Ent. Belgique, 62: 125-136, pl.