SCOPURIDAE, AN ABERRANT FAMILY OF THE ORDER *PLECOPTERA**

By

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(With 2 Figures)

Since the discovery in 1925 of the remarkable nymph, on the basis of which a new genus *Scopura* was established, more than thirty new localities of nymphs of the same characteristics have been recorded up to the present. Its imaginal stage, however, occurs very rarely, the first male having been obtained in 1930. A careful examination of this single male and many nymphs with reference to their habitats made it evident that the genus *Scopura* was found to group itself into a distinct family. The formation of *Scopuridae* was fully justified by KOHNO's recent discovery of the female imago of *Scopura* which, like the male, has no wings. The characteristics that distinguish this new family are given below, together with its present status of distribution in Japan.

The writer wishes to express his cordial thanks to friends who graciously supplied him with the material from various localities.

Scopuridae UÉNO

UÉNO: Animal Life in the Azusa River System. (In Japanese). Tokyo. 1935, p. 41.

An apterous insect with an elongated cylindrical body. General color brown, legs yellow. Antennae about half as long as body, composed of more than 40 joints. Pronotum quadrangular, hind angles somewhat produced. Of tarsal joints, second least, third slightly longer than first two together. Palpi rather short and thick, composed of joints nearly equal in length. Glossae of labium extend slightly beyond tips of paraglossae. Cerci a little shorter than half of body length, 18-jointed in male and 23-jointed in female. Around 10th abdominal segment a remnant of a rosette of gill-tufts. In male: subanal plate papilla-like blunt processes, not wholly chitinized; supra-anal plate chitinized, prolonged in two pointed projections which are curved downward and forward. In female: 8th abdominal sternite produced into a subgenital plate; 10th tergite covered

* Contribution from the Otsu Hydrobiological Station of the Kyoto Imperial University.

with 9th tergite, only its hind margin being visible from above; supra-anal process circular in outline, with a long fine process at the center. Length of body 20 mm. in male, 23 mm. in female.

Nymph. An elongated cylindrical nymph, without thoracic or abdominal gills but with a unique rosette of gill-tufts around its 10th abdominal segment. General color dark brown. Pronotum large and quadrangular. Cerci short, divergent, tapered rapidly toward tip. Subanal plate prolonged in conspicuous paired chitinous projections close to the underside of each cercus. Full-grown nymph 20 mm. in length.

Type genus. *Scopura* UÉNO, 1929, p. 124; genotype: *Scopura longa* UÉNO, l. c. p. 124–130, figs. 13 & 14 (cf. also UÉNO 1931).

Scopura longa UÉNO

An apterous stone-fly with an elongated body.

Color brown; marginal borders of thoracic nota and legs yellow; antennae and cerci light brown; thoracic and abdominal dorsum marked with dark irregular patterns. Antennae about half as long as body, composed of 40 joints in male and 46 joints in female. Pronotum wider than long, a little broader posteriorly, front angles a trifle produced, hind angles sharply produced. Mesonotum and metanotum wider than pronotum, lateral margins round, hind angles sharpened. Legs long and slender; of three tarsal joints, second shortest, third a little longer than first two combined. Maxillary palpi rather short, nearly equal in length. Glossae of labium a trifle extended beyond tips of paraglossae. Abdomen elongated cylindrical, not remarkably narrowed posteriorly; 9th segment longest and 10th entirely covered. Cerci a little shorter than half of body length, composed of 18 joints in male and 23 in female, attached wide apart to 10th abdominal segment, with a pair of chitinous processes at their bases. Around 10th abdominal segment a remnant of a rosette of gill-tufts, but no other type of gills. The genitalia in both sexes are as described under the family characters (cf. also KOHNO 1937 for the female genitalia). A detailed description and discussion of the nymph are given in UÉNO (1929)

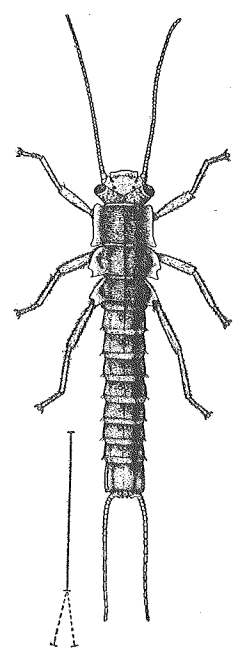

Fig. 1

Scopura longa UÉNO
♂. (UÉNO 1931)

Systematic Position of *Scopuridae* in the Order *Plecoptera*

The nymph of *Scopuridae* is remarkable in having a unique rosette of gill-tufts around the anus but lacking other types of gills. The stone-fly nymph having such a rosette of gills is found only in *Leptoperlidae* which is distributed in Australia and its adjacent regions (TILLYARD 1921, p. 37; 1926, p. 118). With regard to the characters of the mouth-parts, *Scopuridae* resembles closely the group comprising *Taeniopterigidae*, *Leuctridae*, *Capniidae* and *Nemouridae*. The mandibles are of the well-preserved type; both maxillary and labial palpi are composed of rather short and thick joints equal in length; the glossae and paraglossae extend forward about the same distance.

The imago closely resembles the nymph in most respects. The mouth-parts have the short-jointed palpi and the mandibles which do not reduce to lamina, as seen in *Perlidae*. The clypeus and labrum are visible from above. The anterior coxae are rather wide apart. Of the tarsal joints, the second is the shortest and the third is a little longer than the first two together, as seen in the nymph. The cerci are composed of many (more than 18) joints.

Recently FRISON (1935, p. 309) proposed that the form of the glossae and paraglossae of the labium is the fundamental character for dividing the order *Plecoptera* into "two main lines of descent". According to this view, it is obvious that *Scopuridae* is included in the *Hologнatha* of ENDERLEIN (or the *Filipalpia* of KLAPÁLEK), which is one of the two suborders of *Plecoptera*. *Scopuridae* possesses a labium with the glossae and paraglossae extending forward about the same distance. The features of mandibles and the terminal palpal joints are those defined for the *Hologнatha* or *Filipalpia*.

According to TILLYARD (1921), "the old line of evolution which began with the *Eustheniidae* and *Austroperlidae*[1], is carried on by the *Nemouridae* and *Capniidae*. Both these families retain the original form of mandibles, clypeus and frons, while they also keep the primitive widely separated front coxae". (l. c. p. 37). In regard to the imaginal stage, *Scopuridae* has not only a set of archaic characters as defined by TILLYARD but also some specialized ones. In this family, the coxae of the fore-legs remain rather widely separated, but the tarsal joints become specialized, the second being very short and the third a little longer than the first and second together. It retains also the original form of mandibles, clypeus and labrum visible from above, as well as the many-jointed cerci. Thus, with the exception of tarsal joints, *Scopuridae* is said to have many archaic

1) These two families are peculiar to the southern hemisphere, particularly to Australia and New Zealand (cf. TILLYARD 1926). HANDLIRSCH (1930) has placed these two families together with *Leptoperlidae* under the subfamily *Gripopteriginae*.

characters. In the nymph, however, it is characterized by the development of a secondary gill-rosette which is carried over into the imago at metamorphosis. Within such a character complex with the exception of a rosette of gills, *Scopuridae* shows a close relationship to both *Nemouridae* and *Capniidae*. In general appearance, the nymph of *Scopura* resembles very closely those of the North American *Pteronarcidae*, but the latter differs from the former in having not only an anal rosette of gills but also distinct secondary gill-tufts around the base of the legs and on the first two or three abdominal segments.

In the presence of such a unique anal rosette of gills, *Scopuridae* seems, as discussed already, to have a close relationship with *Leptoperlidae*, but the latter has wings and cerci conspicuously longer than body. The entire absence of wings in *Scopuridae* makes it impossible to ascertain clearly its relationship with other families. However, so far as the available characters in both imago and nymph are concerned, the possible position for this family may be given between the *Leptoperlidae* and the large group comprising the more specialized types, viz. *Taeniopterigidae*, *Leuctridae*, *Capniidae* and *Nemouridae*. Accordingly, the following nine families representing two main lines of evolution are known in Japan, viz. *Perlidae*, *Perlodidae* and *Chloroperlidae* in the *Hologuatha* or *Filipalpia*; *Peltoperlidae*, *Scopuridae*, *Taeniopterigidae*, *Leuctridae*, *Capniidae* and *Nemouridae* in the *Systellognatha* or *Subulipalpia*.

Distribution and Habitats of *Scopura longa*

So far as is known up to the present date, *Scopura longa* is distributed in the middle and northern parts of Honsyu (the main island), Hokkaido and Korea. These data are shown on the accompanying map (fig. 2).

The nymph is usually found in small streams, cold springs, spring-fed brooks and the adjacent hygropetric places, at altitudes higher than about 1,500 metres, where the temperatures of water are lower than 10°C, often as low as 3°C or less, in mid-summer. Sometimes it is found in very cold, small, snow-fed streams on the high mountains elevated more than 2,600 metres above the sea, but it does not occur in torrents with large volumes of water. When it is found at places lower than 1,000 metres or less above sea level in middle Honsyu, it usually inhabits cold water springs or very small brooks, the temperatures of which are about 10°C in mid-summer. This nymph is therefore without doubt a typical stenothermal cold-water inhabitant, capable of living either in a thin layer of water or in hygropetric places such as under mosses or fallen leaves. Its unique development of gill-rosette is probably an adaptation to such habitats as mentioned above. When the nymph is alive, this gill-rosette can be drawn into the ninth segment.

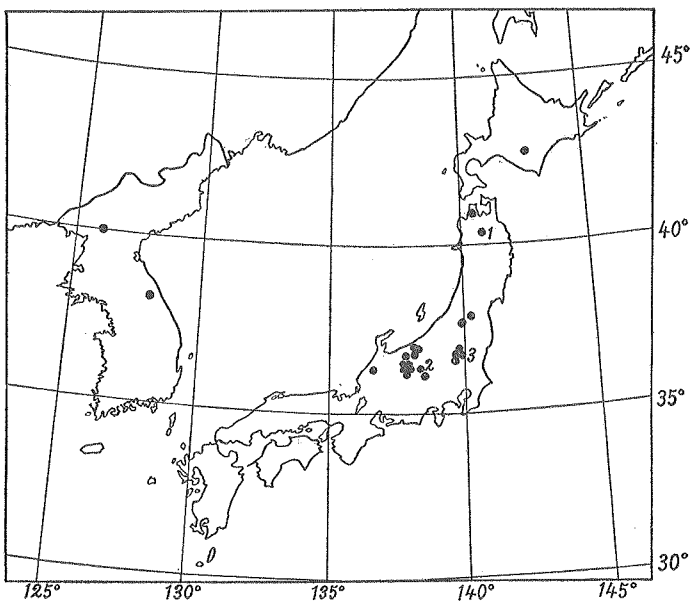

Fig. 2

The known distribution of *Scopura longa*. 1. Lake Towada, the locality of the type (nymph); 2. Takeisi-tôge at which the first male imago was taken; 3. Nikkô where the first female imago was obtained (v.de KOHNO 1937).

According to the known distribution and habitats of the nymph, *Scopura longa* is probably one of the so-called "boreo-alpine" species defined by HOLDHAUS (1912). He (l. c. p. 407) enumerated the following three stone-flies of the boreo-alpine species in the middle and southern Alps: *Dictyopteryx recta* KEMPNY, *D. septentrionis* KLAPÁLEK and *Arcynopteryx dovrensis* MORTON. In Japan, with the exception of *Scopura longa*, there are no elements that can be regarded undoubtedly as "boreo-alpine" (glacial relic), insofar as our explorations have revealed.

It is to be noted that a parallel phenomenon is seen between *Scopura longa* and a triclad turbellarian *Planaria vivida* IJIMA et KABURAKI. This cold-water inhabiting planarian which is closely related to the typical glacial relic *Planaria alpina* in Europe is in most cases found together with the nymph of *Scopura longa*.

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摘　　要

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大正14年十和田湖畔で得られた積翅目の一幼蟲は頗る特異なもので、*Scopura longa*（トワダカワゲラ）と命名せられた。その後雄の成蟲が發見せられるに及び、この1屬1種を含む1科を設けねばならぬことが明かとなつた。この科の記載は邦文でせられたので（上野 1935）、玆に改めてその簡單な記載と現在までに知られた分布狀態とを示した。同時にその分類上の位置に就ても若干の論議を試みた。既知の産地名は別誌に邦文を以て報ずる考へである。