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(Travunoidea, Opiliones, Arachnida)

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The Harvestmen of Family Travuniidae from Japan
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ABSTRACT

Of Japanese and Korean members of the Travuniidae hitherto published only one species, Yuria pulcra, is a valid travuniid; all the others which were fallen in the genus Peltonychia are not travuniids but correctly members of the Triaenonychidae. This paper is concerned with the two authentic travuniid members, of which one is described as a new subspecies, Yuria pulcra briggsi. As taxonomic characters a free ninth tergite and small lateral sclerites on the abdomen and the hind claws in juveniles and adults are particularly emphasized. All of these were overlooked previously but are of much phylogenetic importance. The members that should be transferred to the Triaenonychidae are treated in the following paper (Suzuki, 1975).

The harvestmen of the Travuniidae have been regarded as relics on the basis of their isolation, usually in caves and of their rarity of individuals. Also, they are characterized by some very primitive structures. Since their extreme smallness prevents their precise observation, certain remarkable characters are liable to be overlooked. Recent studies, particularly those of Briggs (1969, 1971a, b, 1974) on the North American travunoids revealed new characters such as a free ninth tergite and small sclerites on the abdomen in some species. Also, taxonomic importance of the hind claws in juveniles on family or subfamily level was suggested by him. Under these situations Japanese and Korean specimens described as to be the Travuniidae have been thoroughly re-examined. As a result, it has become clear that of these specimens only one species, Yuria pulcra Suzuki, is a valid travuniid member, while the remaining four species and subspecies: Peltonychia japonica Miyosi, P. akamai Suzuki from Japan; P. c. coreana Suzuki, P. c. longipes Suzuki from Korea, are not travuniids but correctly members of the Triaenonychidae. Main reasons which would lead to such conclusion are presence or absence of the peltonychium on the third and fourth legs and of a free ninth tergite and the lateral sclerites on the abdomen. This paper is chiefly concerned with the discussion of such characters. And a new subspecies, Yuria pulcra briggsi, is described from Japan.

SYSTEMATIC POSITION AND DISTRIBUTION
OF THE TRAVUNIIDAE

Systematic position: The order Opiliones is divided into three suborders,
Cyphophthalmi, Laniatores and Palpatores. Of these, the Laniatores, to which the Travuniidae belong, are a very large group. Within this suborder the Travuniidae together with four other families, Synthetonychidae, Pentanychidae, Erebomastridae, and Triaenonychidae are grouped into the superfamily Travunoidea. Formerly, the familial relationships in the Travunoidea were rather confused, but recently they have been clarified in considerable degree by Forster (1954) and Briggs (l.c.). In this respect, a nice illustration presented by Briggs (Fig. 1 in Briggs, 1971a) is particularly useful for understanding the evolutionary relationships in the superfamily Travunoidea.

**Distribution:** The travunoids, differing from the other laniatorids that are predominantly tropical, dwell in the south- and north-temperate regions. In particular, the travuniids are known at present from only very limited areas of the north-temperate zone. Namely, most species (about eighteen species of eight genera) are centered in Europe, especially in caves of south Europe. Outside Europe only one species with one subspecies is recorded from Japan and one further species from lava tubes located in Washington of the United States.

In Japan a single species, *Yuria pulcra pulcra* has been known from only type-locality, Mt. Hikosan, Kyushu. Further occurrence of it in Akiyoshi-dō Cave was ascertained in this paper. One further undescribed form, *Yuria pulcra briggsi* was newly found from Kyushu, Shikoku and Kyoto prefecture. It is of interest that the Japanese travuniids, except for in Akiyoshi-dō Cave, were entirely taken in litter of dense forests, whereas in alien travuniids most specimens are cave-dwellers.

**PRIMITIVE STRUCTURES IN TRAVUNIIDAe**

The Travuniidae are distinguished by two remarkable structures. These are (1) peltonychium on the third and fourth tarsi, and (2) additional sclerites: the free ninth tergite and small lateral sclerites on the abdomen.

**Peltonychium:** The travunoids possess basically a single tarsal claw with lateral branching in the third and fourth legs. The structure of this claw is so highly differentiated that mainly basing on it as many as five families are separated in the Travunoidea. Of these, the Travuniidae together with the Synthetonychidae show the most complicated hind claw called peltonychium. The peltonychium of the former is a flattened and enlarged plate with a short stem (Fig. 1 E–I). The central prong (plate) bears lateral branches. The number of branches differs by species, ranging from about four to nine; however, due to the extreme smallness it is frequently not easy to determine their exact number. *Speleonychia sengeri* of the United States shows only four or fewer small branches, while European travuniids have six to eight branches. The central prong of our *Yuria pulcra* possesses the most numerous branches, ranging from eight to nine (Fig. 1 E–H). Here, the lateral branching is not always fixed but frequently variable within the same one individual with limited range. Moreover, there is occasionally asymmetry in branching. For instance, in this species branching formu-
Travuniids from Japan

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Resembled asymmetry has also been recorded for some European travuniids (Absolon and Kratochvil, 1932; Hadži, 1933).

*Juvenile hind claws:* The hind claws of juvenile travuniids differ in structure from those of adults. In the European travuniids striking difference has been shown between them by Roewer (1935). (For detail see Figs. 3 and 7 in Roewer, 1935). The juvenile of American *Speleonychia sengeri*, differing from the European travuniids, has a characteristic peltonychium, in which the central prong bears six branches and an arolium is not present or has been modified into an adhesive pad (Briggs, 1974). Such a claw resembles the adult peltonychium, differing only in having two more branches and a modified arolium. The juvenile hind claw of our *Yuria pulcra* is more or less similar to that of the American species, differing chiefly by having more numerous (five pairs) distolateral branches and lacking an arolium-like structure (Fig. 1 A–D). At any rate, the juvenile hind claws of the European travuniids considerably differ from those of the American and Japanese ones. According to Briggs (1974), the juvenile hind claw illustrated by Roewer (Fig. 3 in Roewer, 1935) rather resembles that of a late juvenile erebomastrid, a family together with travuniid belongs to Travunoidea. If Roewer’s illustration is completely reliable, both *Yuria pulcra* and *Speleonychia sengeri* may be classified as a separate group from the European travuniids.

*Additional sclerites:* In the Travunoidea the ninth tergite is usually fused to the anal plate or absent. However, Briggs (1971a) recently found the presence of the free ninth tergite in the Pentanychidae, an American family of the Travunoidea. Furthermore, he detected three vestigial lateral sclerites located on the abdomen in the same pentanychids. Subsequently two kinds of such additional sclerites have been ascertained in the United States travuniid, *Speleonychia sengeri* (Briggs, 1974). The same has been confirmed also in our *Yuria pulcra* in this paper (Fig. 1 J–K and Fig. 3 H–I). In these respects *Yuria* differs from *Speleonychia* only by having three instead of two pairs of lateral sclerites. These additional sclerites have not yet been examined in the European travuniids. As Briggs (1971a) and others point out, since reduction of sclerites has long been regarded as an important measure of specialization in arthropods, the travuniid and pentanychid harvestmen with additional sclerites should be considered as to be in early evolutionary stage. This view is supported further by the isolation, usually in caves and the rarity of individuals of these animals. Concerning their oldness Kratochvil and others (1958) stated that the European travuniids are relics of the pre-Tertiary fauna that is extinct at present and alives only in caves in which environmental conditions have remained almost unchanged.
**Description:** Tergal region of scute with indistinct boundaries of areas. Eye tubercle rounded and separated from anterior margin of carapacal region, unarmed. Ninth tergite separated, articulated with anal plate. Lateral sclerites present. Spiracles exposed. Legs unarmed, calcaneus extremely short. First tarsi with four segments, second with five or six, third four, rarely three, and fourth with four segments. Distitarsi of first legs with two segments, of second legs with three segments. Tarsi III and IV with eight or nine branches on peltonychium. Penis with complex distal segment bearing spoon-shaped ventral plate and sclerotized dorsal plate. Ovipositor with four lobes; lateral lobes with an apical spine and three strong spines on both dorsal and ventral surfaces. Juveniles with ten-branched peltonychium on hind claws, arolium not present.

**Relationships:** As stated before, known distribution areas of the travuniids are Europe, Japan, and the United States of America. The genus *Yuria* of Japan shows some affinity to the European travuniid genera in the adult peltonychium. However, in the juvenile hind claws, as far as we follow Roewer’s report (Roewer, 1935), any close relationship can not be found between them. Yet, in order to attain more reliable relationships, close re-examination of the juvenile hind claws and the study of the additional sclerites as well as the genitalia in the European travuniids are needed. On the other hand, *Yuria* exhibits rather close affinity to *Speleonychia* of the United States, particularly in the additional sclerites and in the peltonychium of both adults and juveniles. Main differences between the both genera are: (1) number of lateral branching on the central plate of peltonychium (*Yuria*: eight to nine branches in adults, five pairs of branches in juveniles; *Speleonychia*: four or fewer branches in adults, six branches in juveniles), (2) number of lateral sclerites (*Yuria*: three pairs; *Speleonychia*: two pairs), and (3) tarsal formula (*Yuria*: 3-5 or 6-3 or 4-4; *Speleonychia*: 4 to 5-11 to 20-4-4). The comparison indicates that all characters presented are more primitive in *Yuria* than in *Speleonychia*. From this it may be said that *Speleonychia* has derived from *Yuria* or the like.

The present genus includes only a single species from Japan, which is divided into two forms in this paper.

**Key to the subspecies of *Yuria pulcra* Suzuki, 1964**

1. Tarsal formula: 4-5-4-4; tarsal segment of palpus ♂, extraordinarily produced laterally ............................................. *Y. pulcra pulcra* Suzuki
   - Tarsal formula: 4-6-4-4; tarsal segment of palpus ♂, not so extraordinarily produced laterally ............................................. *Y. pulcra briggsii* n. subsp.

*Yuria pulcra pulcra* Suzuki, 1964


*Newly collected material:* 1 ♀, Mt. Hikosan, Kyushu, 27-VIII-1964, S. Suzuki
Fig. 1. *Yurina pulcra pulcra*. A–D. Hind claws of juveniles: A–B, dorsal, C, dorsolateral, and D, lateral view. E–H. Dorsal views of hind claws of adults: E, right third leg, male, with eight branches; F, right fourth leg, female, with nine branches; G, left fourth leg, female, with nine branches; H, right fourth leg, male, with nine branches and one accessory tooth. I. Lateral view of hind claw of adult, left fourth leg, female. J. Lateral view of female: note the free ninth tergite and three small lateral sclerites. K. Posterior portion of abdomen, spread on a slide: showing eighth and free ninth tergites (Tg 8, Tg 9) and anal plate (AP). L–M. Ventral views of genital operculum: L, male and M, female. N. Ovipositor. O. Lateral, P. dorsal and Q. ventral view of distal portion of penis.

leg.; 1♀, Akiyoshi-dō Cave, Yamaguchi pref., 2–5–1965, Tadashi Kuramoto leg.

Distribution and habitat: Mt. Hikosan and Akiyoshi-dō Cave. Found outside and inside caves. In Mt. Hikosan most specimens were collected by means of sifting leaf debris in dense forests, between 700 and 1,000 m in altitude.

Notes: In the original description no attention was paid to the additional sclerites and juvenile hind claws. Examination of the type-specimens and newly collected material revealed the presence of a free ninth tergite (Fig. 1K) and three pairs of small lateral sclerites on the abdomen (Fig. 1J). The lateral sclerites are very small pieces situated in folds of loose integument, adjacent to fourth, sixth and seventh sternites. The adult peltonychium was shown previously to have four pairs of lateral branches on the central plate, but it bears correctly eight to nine lateral branches. The lateral branching is not always constant but frequently differs within the same one individual with restricted range. Also, there is not a few asymmetries in branching. Thus branching formula is indicated as follows: 4+1+4, 5+1+4 or 4+1+5. Of these, 5+1+4 appears to be most frequent. In branching no appreciable difference was found between both sexes or between the third and fourth legs. The peltonychium of the juveniles is first illustrated in Fig. 1 A–D; the central prong is not so widened or enlarged as in adults, bearing five pairs of distolateral branches without exception; no arolium or adhesive pad was found. Genital operculum of the male as in Fig. 1L, sub-triangular, longer than wide. That of the female, differing from the male, nearly as long as wide, with two small lateral lobes.

Penis as in Fig. 1 O–Q.

Ovipositor first illustrated; with four distal lobes; lateral pairs largest, with a sharp-pointed apical spine, and three pairs of fairly elongated and strong spines in addition to a pair of accessory setae. Dispositions of these spines or setae are as shown in Fig. 1N.

Detailed description is in Suzuki, 1964.

Yuria pulca briggi n. subsp.
(Jap. name: Awa-tatezume-ratōmushi)
(Figs. 2-3; Fig. 4A-C)


Diagnosis: Distinguished by having the tarsal formula: 4–6–4 (rarely 3)–4 and the male tarsal segment of palpus only moderately produced laterally;
genital operculum of male nearly triangular, that of female lacking two small lobes.

**Description:**

**Measurements:** ♂ (Ex. from type-locality) — scute 0.90 mm long, 0.81 mm wide at widest portion; total body length 1.04 mm. Length of leg II: tr 0.19, fe 0.78, pa 0.31, ti 0.69, mt 0.60, ta 0.65 mm; total length 3.22 mm. Palpus: tr 0.17 mm wide, 0.20 mm long; fe 0.23 W, 0.42 L; pa 0.18 W, 0.26 L; ti 0.22 W, 0.30 L; ta 0.20 W, 0.26 L; total length 1.44 mm.

♀ (Ex. from Miyama-chô, Kyoto pref.) — scute 0.83 mm long, 0.84 mm wide at widest portion; total body length 1.13 mm. Length of leg II: tr 0.18, fe 0.73, pa 0.26, ti 0.60, mt 0.62, ta 0.53 mm; total length 2.92 mm.

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**Fig. 2. Yuria pulera briggi.** A. Dorsal view of male (type-locality: Shishikui-chô, Shikoku). B. Same view of female (Miyama-chô ex.). (A × 20, B × 17).

**Male:** —

Scute nearly quadrate in outline, posterior margin wider than anterior margin, sides lightly constricted at the level of tergal groove, and the abdomen widely rounded behind. Surface of scute finely granular, areas indistinct, not marked by setae or tubercles. Free tergites narrowed, unarmed, a free ninth tergite present (Fig. 3H). Eye tubercle rounded, unarmed, separated from anterior margin of carapace. Venter almost similar to the nominate species. Sternal area as in Fig. 3G; sternum widened, somewhat wedge-shaped, widening at juncture of second and third coxae and third and fourth coxae, apex bluntly pointed, crescent posteriorly; small setose area between posterior of sternum and opercular opening. Second maxillary processes with coarse setae. Three lateral sclerites small, isolated, adjacent to fourth, sixth, and seventh sternites (Fig. 3I). Spiracles exposed. Genital operculum nearly triangular.

Chelicera as shown in Fig. 4C.
Fig. 3. *Yuria pulcra briggii*. A. Dorsal view of male. B-C. Dorsal views of hind claws of adult males: B, left fourth leg with nine branches; C, right fourth leg with eight branches. D. Lateral view of tarsus and distal portion of tibia of right third leg, male. E-F. Ventral views of male and female genital operculums. G. Ventral view of sternal area of male, genital operculum removed. C2...C4 indicate second to fourth coxae. H. Posterior portion of abdomen, spread on a slide: showing eighth and free ninth tergites and anal plate. I. Lateral side of abdomen, spread on a slide: showing three small lateral sclerites: St4...St8 indicate fourth to eighth sternites, and Tg6...Tg8 sixth to eighth tergites. J. Ovipositor (Aso
Palpus. All segments considerably widened and strongly spined as shown in Fig. 4 A–B. Trochanter with a distinct ventral spine and a very small dorsal spine; femur compressed laterally, arched above, widest at the middle of length, with two strong and one short ventral spine, one distomedial spine and a row of four very short dorsal spines; patella with two medial spines and two small dorsal spines; tibia strikingly widened, flattened ventrally, with three strong ectal spines, of which the third longest, plus one very short apical spine, and three long medial spines; tarsus flattened beneath, proximal portion enlarged, but not so extremely produced as in the nominate form (compare Fig. 4A with 4D), with a row of five spines along both ridges.

Fig. 4 A–C. Yuria pulcra briggsi. A–B. Ectal and mesal views of right palpus of male. C. Ectal view of right chelicera of male.

Fig. 4 D. Yuria pulcra pulcra. Ectal view of right palpus of male.

Magnifications. A–D ×60.

Legs. Relatively short, femora III and IV slightly curved. Tarsal formula: 4–6–4–4. Distitarsus of first legs with two segments, of second legs with three segments. Calcaneus very short (Fig. 3 D). Peltonychium of third and fourth legs with eight or nine distolateral branches (Fig. 3 B–C).


Magnifications. A ×34; D–F, H–I, K–L ×70; G ×100; J ×120; M–O ×170; B ×300; C ×350.
Penis. As in Fig. 3 K–O. Distal segment complex. Ventral process spoon-shaped, bearing two pairs of setae. Dorsal process elongated, apex bluntly pointed, distal portion curves below; aedeagus not extending to the tip of dorsal process.

Coloration. Uniformly pale orange yellow, in some specimens sides of scute more or less clouded; eye rings black.

Female: — Similar to male except that abdomen not broadly rounded but pointed behind (Fig. 2B). Genital operculum more rounded anteriorly than in the male, without lateral lobes (Fig. 3F).

Ovipositor. As in Fig. 35, almost similar to the foregoing form.

Variation: One female from Mt. Kitamuke-yama, Aso was abnormal in the number of segments of tarsus III. That is, it had only three segments in the left tarsus but four in the right.

Etymology: This subspecies is named for Mr. T. S. Briggs, University of California, Berkeley, who gave me helpful advice at various times during the study of this series.

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LITERATURE


