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## *Systematic Position of the Milliped *Japanosoma scabrum* Verhoeff (Chordeumatida, Conotylidae)*

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### ABSTRACT

*Japanosoma scabrum* Verhoeff, a poorly known chordeumatid milliped, is confirmed as a member of the subfamily Conotylinae, family Conotylidae, of which the family name Japanosomatidae becomes a synonym. *Japanosoma* is closely related to *Plumatyla* Shear (California and Oregon), but not to *Crassotyla* Golovatch (Amur Region, Siberia).

In his 1914 description of the Hokkaido milliped species *Japanosoma scabrum*, Verhoeff established the subfamily Japanosominae (*recte*: Japanosomatinae), under Conotylidae, to receive the new genus and species. Although the available material escaped re-examination until the present study, this placement was regarded as well-supported by the original description (Shear, 1971, 1972; Hoffman 1980). I suggested in 1976 that *Japanosoma* seemed close to the North American conotyline genera *Taiyutyla* and *Conotyla*. However, Mauriès (1978) placed Japanosomatidae as a family in the Superfamily Acrochordoidea. Later (1982), he speculated that *Crassotyla amurica* Golovatch (Soviet Far East Province; Golovatch, 1980) was intermediate between the predominantly North American Conotylidae and *Japanosoma*, rendering a family name based on the latter superfluous, and removing *Japanosoma* from the Acrochordoidea.

As a part of a long-term study of the circum-Pacific and Asian chordeumatid fauna (Shear, 1979, 1986, 1987), I have examined Verhoeff's material of *Japanosoma scabrum*, and Dr. Sergei Golovatch very kindly loaned me specimens of *Crassotyla amurica*. My examination of the former has shown that the original placement of *Japanosoma* in Conotylidae was correct. The figures and brief descriptive paragraphs presented here demonstrate this proposition, and confirm the suspected close relationship of this genus to *Taiyutyla*, *Conotyla*, and

especially to the northern California cave-dwelling genus *Plumatyla*. Indeed, going further than Mauries (1982) suggested, it seems that there is no longer any justification even for a subfamilial designation, and the subfamily Japanosomatinae is herein synonymized with the subfamily Conotyliinae. *Japanosoma* will key out at couplet 7 (*Plumatyla*) in my 1976 key. It differs from *Plumatyla* in that males lack prefemoral lobes on any of the first seven pairs of legs.

*Crassotyla amurica* was correctly placed by Golovatch (1980) in Conotylidae, but is difficult to place in a subfamily. The genus is distinguished by the autapomorphy of the strongly modified male third legs (prefemur with a long mesial process, femur grossly inflated and subglobular), and has large and complex anterior gonopod telopodites. There are similarities in this gonopod plan to the conotylids of the genus *Lophomus* (Lophominae), known from two species in northwestern North America (Shear, 1976). Definite placement awaits discovery and description of more conotylids from the Asian mainland.

Thus it seems that while *Crassotyla* and *Japanosoma* are confamilial, they are not closely related to one another, as an examination of the figures presented here, and by Golovatch (1980), will show.

#### Family Conotylidae Cook

Conotylidae Cook 1896, p. 8 (type genus *Conotyla* Cook) — Verhoeff, 1914, p. 344, 1932, p. 500 — Shear, 1971, p. 58, 1972, p. 268, 1976, p. 5 — Mauriès, 1978, p. 64 — Hoffman, 1980, p. 128. Golovatch, 1980, p. 202.

Macromastidae Loomis and Schmitt, 1971, p. 126 (type genus *Macromastus* Loomis and Schmitt).

Japanosominae Verhoeff 1914, p. 346 (type genus *Japanosoma* Verhoeff) — Hoffman, 1980, p. 129.

Japanosomidae, Mauriès, 1978, p. 63, 1982, p. 180.

#### Subfamily Conotyliinae Cook

Conotyliinae, Loomis and Schmitt, 1971, p. 121. — Shear, 1976, p. 5.

Japanosominae Verhoeff 1914, p. 346. **New subjective synonymy!**

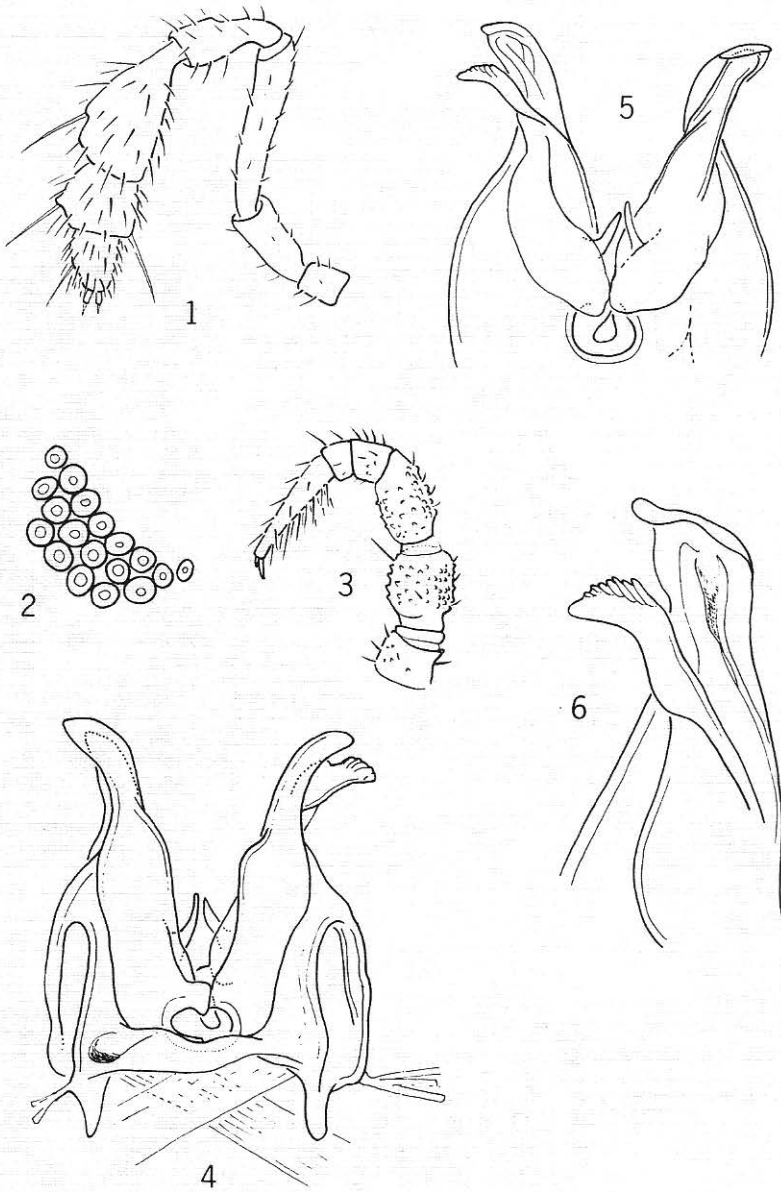
Japanosomatinae, Hoffman, 1980, p. 129.

**Included genera.** *Conotyla* Cook and Collins, *Taiyutyla* Chamberlin, *Bollmannella* Chamberlin, *Plumatyla* Shear (all North American), and *Japanosoma* Verhoeff (Hokkaido, Japan).

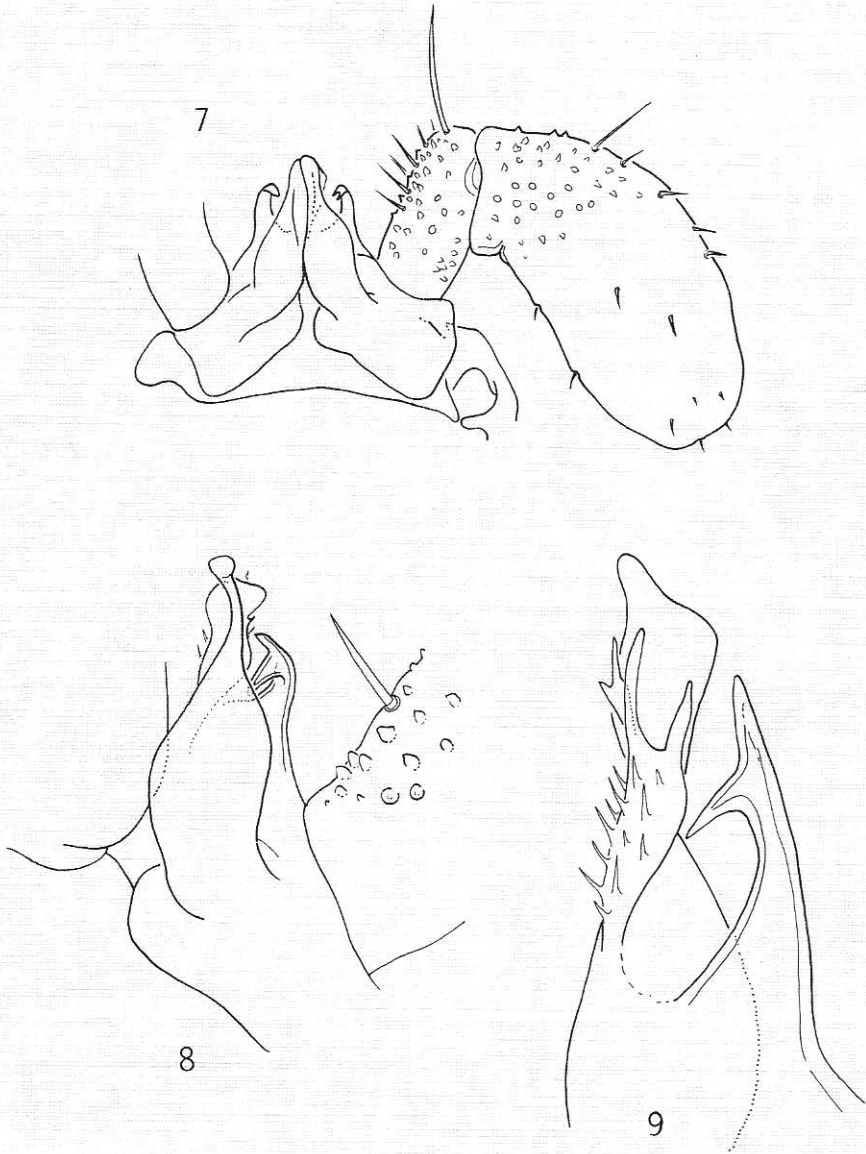
#### *Japanosoma scabrum* Verhoeff

Figs. 1-9

*Japanosoma scabrum* Verhoeff 1914, p. 347, figs. 1-4. — Miyosi, 1959, p. 124, figs. 172, 172'.



Figs. 1-6. *Japanosoma scabrum*. 1. Left antenna of female "syntype," probably posterior view, specimen flattened on side. 2. Left eyepatch of female "syntype" dorsal to the right. 3. Right leg 5 (?) of male, posterior view. 4. Anterior gonopods, anterior view. 5. Anterior gonopods, posterior view. 6. Apex of left gonopod, posterior view. Figs. 1-3, 200 X; Figs. 4-5, 400 X, Fig. 6, 650 X.



Figs 7-9. *Japanosoma scabrum*. 7. Posterior gonopods, anterior view, 200 X. 8. Left colpocoxite, posterior view, 400 X. 9. Apex of left colpocoxite, posterior view, 600 X.

**Types.** Female "syntype" in collections of the Zoologisches Museum of the Humboldt-Universität, Berlin (ZMB 12852, Verhoeff's 3351). Additional material, not labelled as types, of two males, is in the Zoologische Staatssammlung, Munich. The specimens were collected in Hokkaido, Japan, by Sauter, but no further collection data are available. Miyosi's illustrations (1959) are stylized copies of Verhoeff's, and his text is a translation into Japanese of salient points of the original — thus it can be assumed he did not have additional specimens and no further information on distribution and habitat. All material consists of microscope slide preparations. The slide carrying the Berlin female has four pairs of legs (probably pairs 1 and 3-5), the crushed head and gnathochilarium, collum, fragments of several segments, and the female genitalia. The two slides in the Munich collection are not numbered, but bear material coming from two different male specimens. One slide has six pairs of legs (probably pairs 1-6 or 2-7), both pairs of gonopods, and six pieces of segmental tergites; the other has five pairs of legs (the label says these are 1-5), a crushed head with antennae, and the collum. The presence of two sets of anterior legs indicates that these are parts of two different individuals.

Because he lacked access to a dissecting microscope during the early decades of his work, Verhoeff usually mounted his material on slides after pulling it apart as best he could. As a result, his interpretations of the ways in which structures fit together in the whole animal are sometimes mistaken, but his illustrations of gonopods are often highly detailed and usually accurate.

**Description.** Because the entire specimens are no longer available, we must rely on Verhoeff's 1914 description for some of the details. Crucial points: females 7-7.5 mm long, males 6.5 mm long, segments with pronounced metazonal shoulders bearing the outer two segmental setae of each side. Antennae of both sexes with a strong macroseta on segment six (fig. 1). 18-20 ocelli (fig. 2). Promentum absent. Seminal openings behind legpair 2 of male. Legpairs 3-7 of males crassate, with long, straight tarsi set with long setae (fig. 3), but otherwise unmodified. Legpair 10 of males with coxal glands; legpair 11 without glands but with a short inner spur.

Details of the gonopods are shown in figs. 4-9. The anterior gonopods consist of a strongly sclerotized coxosternum, the lateral parts of which extend up the lateral surfaces of the telopodites, as in *Plumatyla*. The telopodites are basally in contact both above and below a peculiar, nearly circular fossa between them, but do not appear to be fused (in *Conotyla*, *Taiyutyla*, and *Bollmanella* the telopodites are usually well-separated and the coxosternite does not extend up the lateral surface). In posterior view, the telopodite is seen to be divided nearly to its base into two branches, the posterior of which bears a small, mesially-extending basal spur. It appears that in the intact gonopod the posterior branch may have been partially sheathed in a groove of the anterior branch. The posterior gonopod is typically conotyline. The sternite is short and bandlike; the coxae bear two prominent coxite branches each, the anterior flattened and with posterior fimbriae (again as in *Plumatyla*) and the posterior smooth and strongly curved anteriorly. The short prefemur and the inflated terminal segment bear few setae but are set

with small, acute warts, found as well on the crassate anterior legs of the males, and also seen in at least one species of *Plumatyla*.

**Relationships.** *Japanosoma scabrum* is so similar to *Plumatyla humerosa* that they might be considered congeneric. However, the anterior leg prefemoral modifications in the males of the latter are an apomorphy that should not be ignored, since the presence of these modifications and their eventual stabilization (in *Bollmanella* species) are important in the other genera of the subfamily. Because of the extreme simplification and reduction of the anterior gonopods in *Conotylo*, that genus may be the sister group of the other four. When I have examined all available relevant material, I will attempt a cladistic analysis of the genera of the milliped superfamilies Heterochordeumatoidea, Diplomaragnoidea, and Conotyloidea, which seem at this time to be closely related to one another, united by the synapomorphy of the posterior gonopod telopodites reduced to one enlarged, globose, or pyriform segment filled with glandular tissue.

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