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DYTISCIDAE: I. *Copelatus* (*Papuadytes*) *shizong* sp.n. from Yünnan (China), the first member of *Papuadytes* BALKE found west of the Wallace Line

(Coleoptera)

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Abstract

Copelatus (*Papuadytes*) *shizong* sp.n. (Coleoptera: Dytiscidae) from Yünnan, China, is described. This is a remarkable discovery, as species of the subgenus *Papuadytes* BALKE hitherto were thought to be endemic to the Australian region. Currently about 90 species of *Papuadytes* are known. Possible biogeographical explanations are provided.

Key words: Coleoptera, Dytiscidae, *Copelatus*, *Papuadytes*, new species, China, biogeography.

Introduction

The subgenus *Papuadytes* of the genus *Copelatus* ERICHSON was erected by BALKE (1998) for a speciose group of New Guinea running water species. A total of 56 New Guinea species are known so far (BALKE 1998, 1999, 2001), 55 of which are rheobiontic and one being a pond dweller. Moreover, BALKE (2001) suggested that some 13 Australian, one New Zealand, seven New Caledonian and one Hawaiian species also belong to *Papuadytes*. Finally, the total number of New Guinea species was estimated to be more than 100. It is likely that *Papuadytes* will have to be ranked as a genus with a basal position on the Copelatinae tree; however, this can be proved only by comprehensive cladistic analyses.

Here we report the remarkable discovery of a *Papuadytes* species from Yünnan, China. This is the first record of *Papuadytes* species from the Palearctic region, far west of Wallace's line.

Material and methods

The methods applied here are similar to those described by BALKE (1998). The specimens were collected using a handnet during September 2000.

The paratype and the two additional females are stored in 96% ethanol for later DNA extraction.

Acronyms & CWBS locality:

CWBS China Water Beetle Survey
NMW Naturhistorisches Museum Wien

CWBS loc. 266: **Guizhou Province**; Liupanshui City Region; 10 km W Liupanshui City, close to Yao Shang reservoir dam; deep pool, ca. 2 m², with aquatic vegetation, slightly polluted, ca. 1800 m a.s.l.; 27.VII.1997; leg. M. Wang.

Copelatus (*Papuadytes*) *shizong* sp.n.

TYPE LOCALITY: Near Shizong, Shizong County, Qüjing Prefecture, Yünnan Province, China.

TYPE MATERIAL: **Holotype** ♂ (NMW): "China: Yunnan, 2 km S. of Shizong: shadowed streampond, 12:IX:2000:Leg. J. Bergsten" / "Copelatus (Papuadytes) sp det AN - 00" [AN= Anders Nilsson]. **Paratype** (NMW): 1 ♂ in 96% Ethanol: "Copelatus (Papuadytes) n.sp.? Nr 114, Ch:Yu:2 km S. of Shizong, below the south tip of lake, shadowy streampond, 12:IX:2000:Leg. J. Bergsten".

ADDITIONAL MATERIAL EXAMINED: 1 ♀, CWBS loc. 266 (NMW); 1 ♀, "Copelatus (Papuadytes) n.sp.? Nr 110, Ch:Yu:2 km S. of Shizong, bay & edge of big lake, 16:IX:2000:Leg. J. Bergsten" (in 96% Ethanol, NMW); 1 ♀, "China: Yunnan:2 km S. of, Shizong: veg. rich bay of big lake, 16:IX:2000:Leg. J. Bergsten" (in 96% Ethanol, NMW). These three specimens are very similar to the holotype and we are assuming that they belong to the same species. In the absence of males from these localities, we prefer not to view them as paratypes.

DIAGNOSIS: Total length of beetle 4.5 mm. Body elongate, subparallel-sided (Fig. 1). Elytron ferruginous to dark brown, basally paler, rufo-testaceous. Punctation of pronotum very sparse and fine, faint on elytron, beetle shiny, male antenna and male protarsomere 5 simple (Fig. 5).

DESCRIPTION (Holotype male): Size: Body length 4.5 mm, length minus head 4.1 mm, greatest width 2.0 mm, width at base of pronotum 1.8 mm.

Colour. Head orange, posterior of eyes darker, blackish. Pronotum rufous to brown, laterally paler, dark orange. Elytron ferruginous to brown, base with rectangular patch paler, dark orange. Scutellum orange. Venter ferruginous, appendages orange.

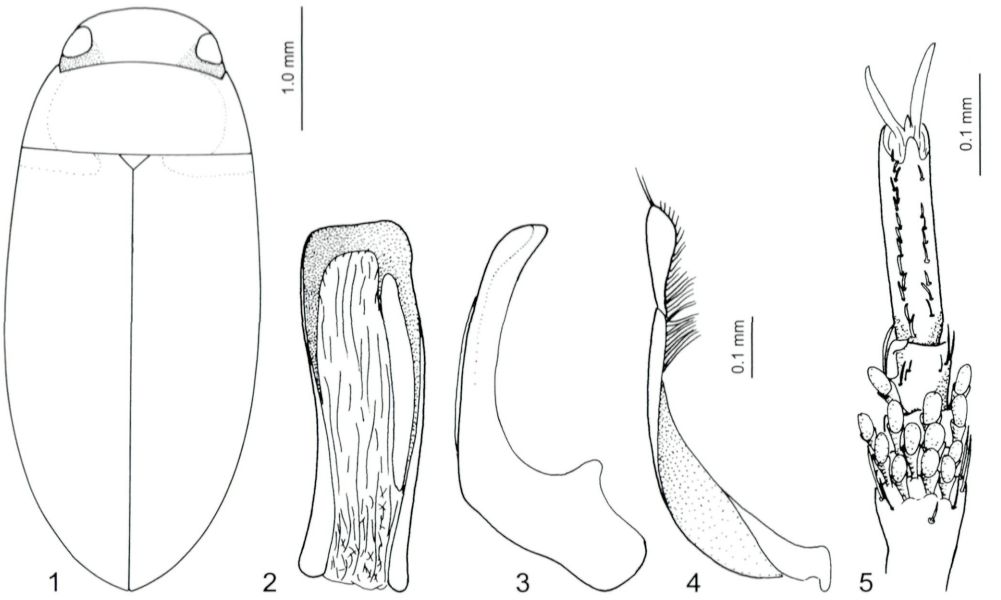
Surface sculpture. Entire dorsal surface of beetle covered with distinct microreticulation of small, regular polygonal meshes. Head and pronotum with few punctures, diameter equals diameter of the meshes. Elytron with two distinct rows of large serial punctures, and two rather sparse, more indistinct such rows. Elytron with rather dense and distinct punctation between suture and first serial row of punctures; punctation less dense toward lateral margin of elytron. Metaventrite with rather regular, small polygonal meshes, i.e. microreticulate; in small area below middle coxa devoid of meshes but with few punctures. Metacoxal plates with meshes of diagonal to horizontal (close to hind coxa) orientation and few diagonal cuts or strioles. Ventrites I - V shagreened and with strioles of diagonal (I, II) orientation to increasingly horizontal (III - V) orientation. Last ventrite (VI) laterally on each side with > 10 diagonal cuts or strioles; posterior of striolated area with row of setiferous punctures; area between rows microreticulate.

Structures. Pronotum with lateral bead. Prosternal process lanceolate, beaded, slightly convex and with a few setae. Last ventrite gently rounded apically.

Protarsomeres I - III ventrally with altogether four rows of stalked adhesive pads (number of tarsomere to which stalks are attached in parentheses): 2 or 3 (I) - 4 (I) - 4 (II) - 4 (III). Mesotarsomeres I – III same. Protarsomere IV ventrally on anterior margin with large hook-like seta that inserts halfway from base to distal margin of tarsomere (Fig. 5, two adhesive pads omitted from segment III). Protarsomere V simple, on venter anteriorly rather dense row of setae, which are lanceolate and slightly bent distally, posteriorly 7 - 8 shorter setae. Antenna simple, flagellum long and thin.

Median lobe of aedeagus almost symmetrical dorsally, with only slight S-like bend (Fig. 2); with two sclerites, one large and one small; lateral view Fig. 3. Paramere rather simple, with large distal stylus; tip in front of stylus twisted (Fig. 4); distal portion with inner margin slightly setose.

Female unknown. If the three females we have listed under additional material belong to *C. shizong*, then females are very similar to males, except that they do not possess enlarged tarsomeres which are ventrally equipped with adhesive pads.



Figs. 1 - 5: *Copelatus shizong*, 1) male, habitus (dotted lines indicate small areas of orange coloration); median lobe of aedeagus, dorsal view (2); median lobe of aedeagus, lateral view (3); paramere, internal view (4); protarsus, ventral view, two adhesive pads omitted from tarsomere III to show setae on tarsomere IV (5).

DIFFERENTIAL DIAGNOSIS: This species is characterised by the following combination of characters: **1)** Length 4.5 mm. **2)** Body rather elongate, subparallel. **3)** Head mainly orange, pronotum and elytron ferruginous to brown with paler areas laterally and basally, respectively (Fig. 1). **4)** Form of median lobe of aedeagus: More or less symmetrical in dorsal view; with one well-defined, smooth dorsal sclerite and second, also well-defined but much broader sclerite appearing wrinkled (Fig. 2). **5)** Elytron with rather dense and distinct punctation between suture and first serial row of punctures; less densely punctate towards lateral margin. **6)** Pronotum and elytron without lines (striae) or cuts (strioles). **7)** Distribution: Yünnan.

This set of characters readily will identify the species. However, when larger samples become available from China, one should always examine males as the existence of more than a single Chinese species may be expected.

HABITAT: The habitat of the type locality was a small pond of a brook measuring 3 x 1 m. It was completely shadowed by overgrown bushes that formed a small "cave" above the pond. There was no vegetation in the water and the bottom consisted of stones and coarse sand upon which some debris was collected from the surrounding "bush-cave walls". Additional species in the pond: Dytiscidae: *Rhantus sikkimensis* RÉGIMBART, 1899, *Agabus hummeli* (FALKENSTRÖM, 1936), *Copelatus rimosus* GUIGNOT, 1952, *Laccophilus kempi holmeni* BRANCUCCI, 1983, Gyrinidae: *Gyrinus orientalis* RÉGIMBART, 1883, *Gyrinus smaragdinus*, RÉGIMBART, 1891 a waterstrider, Gerridae: *Gerris gracilicornis* (HORVÁTH, 1879), and Veliidae: *Perittopus* sp. The surrounding landscape is open bushland with smaller trees, somewhat hilly and agricultural fields and rice-terraces nearby. Altitude ca 2000 m.

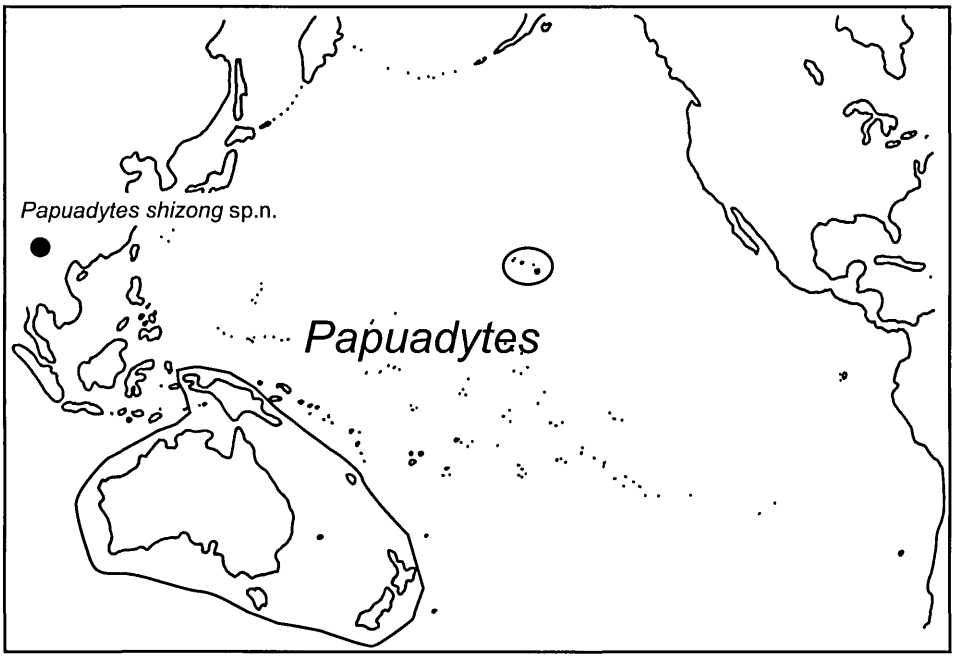


Fig. 6: Known distribution of *Copelatus shizong*; Only known from the type area near Shizong, Yünnan. Possibly, the single female from Guizhou Province (CWBS locality 266) represents the same species. The lines enclose the known range of *Papuadytes* otherwise: New Guinea, Australia, New Zealand and New Caledonia, as well as Hawaii.

The two females collected near Shizong were found in a vegetation rich bay of a larger lake about 1 km from the type locality. The habitat of the additional female collected by the CWBS is a deep pool, ca. 2 m², with aquatic vegetation.

DISTRIBUTION: Known from the type locality and possibly CWBS loc. 266 (Fig. 6).

ETYMOLOGY: The epithet is a noun in apposition. Named after the closest larger city to the type locality, Shizong, situated approximately 130 km east of the provincial capital Kunming. "See Tsong", one of three type localities of the dytiscid *Acilius guerryi* d'OLSOUFIEFF (d'OLSOUFIEFF 1925), probably refers to this city.

Discussion

This finding is remarkable, as the subgenus *Papuadytes* previously was considered to be restricted to New Guinea, Australia and some Pacific islands (BALKE 2001) (Fig. 6). Morphological data suggest a sister-group relation of *Papuadytes* and Madagascan *Aglymbus* species. The senior author has studied numerous Copelatinae from the entire area between New Guinea and China, as well as from India, without detecting specimens of *Papuadytes* among them.

Assuming a Gondwanan origin of *Papuadytes* + Madagascan *Aglymbus*, the presence of a Chinese species appears enigmatic. Possibilities that hold some explanation either involve long distance dispersal e.g. all over Wallacea and SE Asia with massive subsequent extinction in these regions; or drift of the Chinese stock on Gondwanan microcontinents. Such or similar

scenarios as the latter were recently postulated for different groups of insects (see NÄSSIG & OBERPRIELER 1993: Saturniid Moths; PARSONS 1996: Birdwing Butterflies; BAEHR 1998: Carabidae; MEY 1998: Caddisflies; BALKE et al. 2002: Dytiscidae).

The biologically and geologically complex Malesia (= SE Asia plus Melanesia) appears to be a melting pot, where faunas of different origins collide. Biogeographical lines have for example been suggested to delimit areas with mainly Oriental and Australian biota, respectively (WHITMORE 1981, OOSTERZEE 1997). The main task for the future is to work out deep level phylogenies, based on molecular markers, which will help to discriminate between faunas of different origins, long-distance dispersers that crossed biogeographic lines (e.g. Wallace's line), and Gondwanian clades that have long been isolated on different continental fragments to finally re-unite in Malesia (see PARSONS 1996).

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