SPIXIANA	9	1	1–23	München, 31. Oktober 1986	ISSN 0341-8391

Revision of the Australian Zuphiinae
5. The genus Zuphium Latreille

(Insecta, Coleoptera, Carabidae)

By **Martin Baehr**

Zoologische Staatssammlung München

Abstract

As a fifth part of a general revision of the Australian Zuphiinae the genus *Zuphium* Latreille is revised. The known species *Z. australe* Chaudoir, *Z. thouzeti* Castelnau, and *Z. castelnaui* Gestro are redescribed. For *Z. thouzeti* and *Z. castelnaui* a lectotype each and paralectotypes are designated. Following taxa are newly described: *Z. australe millstreameanum* subspec. nov., *Z. australe incertum* subspec. nov., *Z. thouzeti minor* subspec. nov., *Z. macleayanum* spec. nov. and *Z. moorei* spec. nov. *Z. fitzroyense* Macleay and *Z. pindan* Macleay are treated as doubtful species, especially as the type specimens are either badly damaged or lost, respectively, and as no additional specimens are known. *Z. fitzroyense*, however, is doubtfully synonymized with *Z. thouzeti minor* subspec. nov., but *Z. pindan* will perhaps be never recognizable.

With exception of *Z. macleayanum* all Australian species are very closely related, especially the species of the *Z. australe* – *Z. thouzeti* – *Z. moorei* complex. It is discussed, whether the species and their subspecies constitute rather a superspecies than own separate taxa. In view of the present knowledge, however, it was preferred to give them their own rank, as such a superspecies would be rather difficult to establish without good knowledge of distribution and possible interbreeding of the taxa involved.

The phylogenetic status of the genus *Zuphium* and its Australian members is briefly discussed. Compared with most other Australian genera *Zuphium* is highly apomorphic, but in various characters it is plesiomorphic when compared with the closely related genus *Parazuphium*. Three species groups are recognizable: 1. *Z. australe*, *Z. thouzeti*, and *Z. moorei*. 2. *Z. castelnaui*. 3. *Z. macleayanum*. *Z. castelnaui* seems most derivative, whereas *Z. macleayanum* could be primitive in some respects, if these features are not considered secundarily reduced.

The known distribution of the species is mapped. Very few is known on their life histories, and *Zuphium* species seem very rare in collections. Thus, in future new species will be likely discovered and the range of the known species will be better known.

The zoogeography of the genus in Australia is briefly discussed. *Zuphium* perhaps invaded into Australia in two ways, from New Guinea via Cape York Peninsula into eastern Australia, and directly across the Timor Sea to northwestern Australia. Within Australia, the main immigrating stock, perhaps similar to *Z. thouzeti*, spread southwards and westwards and split there into new species and subspecies, some of which are today isolated endemic taxa.

Introduction

The subfamily Zuphiinae is a quite distinctive, but not very numerous group of truncatipennian Carabidae. Especially in Australia, Zuphiinae are rather heterogenous. The Australian Zuphiinae are distributed in the genera *Zuphium* Latreille, *Parazuphium* Jeannel, *Acrogenys* Macleay, *Pseudaptinus* Castelnau, *Colasidia* Basilewsky, and *Planetes* Macleay. The taxonomic status of *Planetes*, however,

is rather controverse (Basilewsky 1963, Jedlička 1963, Habu 1967, Reichardt 1967, Darlington 1968). Until beginning of revisional work (Baehr 1984) 12 Zuphiine species were described from Australia. All these species have been described in last century and most are not recognizable. Therefore, a revision of the Australian Zuphiinae has been started (Baehr 1984, 1985a, b in press), which is here continued with the revision of the genus *Zuphium*.

Very few is known about the life histories of Zuphiinae, especially of the Australian species. Perhaps, most species are more or less hygrophilous and live near standing and running water in the tropical-subtropical part of Australia, but they are also found in rather dry areas of the interior, as for example, some *Pseudaptinus*-species (Baehr 1984, 1985a, b). All species seem to be very rare and they are chiefly collected at light. Generally, Zuphiinae are pantropical Carabids, which penetrate just into temperate zones. Thus, they lack from Tasmania (Sloane 1920) and are rather rare in temperate southern Australia.

The Australian Zuphiines are commonly considered quite recent invaders from tropical southeastern Asia. Perhaps, this is true only for some highly evolved genera as *Zuphium, Parazuphium, Planetes,* and *Colasidia*. Other genera are endemic *(Acrogenys)* or possess a very curious distribution in Australia and America, respectively, being absent from Asia *(Pseudaptinus)*. Therefore, Zuphiines are rather interesting with regard to zoogeographical questions.

Of the 7 described *Zuphium*-species, actually 5 belong to the genus in the modern sense (genus *Parazuphium* excluded). All species have been described in last century and, as then usually, the descriptions are for the most part very vague. Actually, it is virtually impossible to determinate Australian *Zuphium* species from descriptions. Of three species only identified specimens are in the material at hand, namely of *Z. australe* Chaudoir, *Z. thouzeti* Castelnau, and *Z. castelnaui* Gestro, the last, however, is very rare. Of the two species described by Macleay (1888) from King's Sound, northwestern Australia, no further specimens seem to exist. As the single type specimen of *Z. fitzroyense* is badly damaged and that of *Z. pindan* is apparently lost, the first species is hardly recognizable and *Z. pindan* not at all. With regard to the other species some determinators (esp. T. G. Sloane) thought it possible that – with exception of *Z. castelnaui* – only one further species is present in Australia, *Z. thouzeti* and *Z. pindan* being synonymes of *Z. australe*. Indeed, all Australian species, no matter, how many species are actually involved, are extremely similar.

As in other Australian Zuphiines, material of the genus *Zuphium* is rare in collections. Moreover, the majority of specimens are very old, inadequately dated or even completely undated. Most specimens are from southern or eastern states, very few from the far north or northwest, but these comprise some recently collected specimens, especially from the collecting trips of Darlington in northern Queensland, and from Britton, Upton, and others in the Northern Territory and in northwestern Australia. Additional rather rich material from the Northern Territory and from the northern parts of Western Australia was collected during a travel carried out by the author in November–December 1984. Altogether, the revision is based on 116 specimens.

Generally, specimens of *Zuphium* have been found especially at light, some also in flood refuse. Strikingly, females come in larger numbers to light than males. This is perhaps due to greater activity of females which is illustrated by the fact that females tend to possess larger eyes than males, as it is the case also in some *Parazuphium*-species (Baehr 1985b). Because of the collecting methods mentioned very little is known on habits and ecology of the species.

Acknowledgements

A large amount of the material considered was collected by the author during a travel through northern and northwestern Australia, carried out from November to December 1984. The travel was supported by a travel grant from the Deutsche Forschungsgemeinschaft (DFG). At this place, I want to thank once more the authorities of the DFG.

For loan of specimens and for material from the collections they care for, or from their own collections I heartily thank following persons:

Dr. R. P. Dechambre (Paris), Dr. F. Hieke (Berlin), Dr. D. S. Horning, Jr. (Sydney), Dr. E. G. Matthews (Adelaide), Dr. G. B. Monteith (Brisbane), Dr. B. P. Moore (Canberra), Dr. A. F. Newton, Jr. (Cambridge/Mass.), Dr. R. Poggi (Genova), Dr. G. A. Samuelson (Honululu), Dr. G. Scherer (München), Dr. N. E. Stork (London), Mr. K. Walker (Melbourne), Mr. T. A. Weir (Canberra).

Thanks are also due to my wife for her most valuable assistence in field work.

Abbreviations of collections used in text

ANIC – Australian National Insect Collection, Canberra
BMNH – Britsh Museum Natural History, London
BMH – Bernice P. Bishop Museum, Honululu
CBM – Collection M. Baehr, München
CMC – Collection B. P. Moore, Canberra
FMT – Museum G. Frey, Tutzing
MCSN – Museo Civico di Storia Naturale, Genova
MCZ – Museum of Comparative Zoology, Cambridge/Mass.
MMS – Macleay Museum, Sydney
MNB – Museum für Naturkunde, Berlin
MNHN – Muséum National d'Histoire Naturelle, Paris
NMV – National Museum of Victoria, Melbourne
QM – Queensland Museum, Brisbane
SAM – South Australian Museum, Adelaide
ZSM – Zoologische Staatssammlung, München

Methods

Characters

The most important character for distinguishing of species and subspecies is shape of aedeagus, especially of apex. So far the aedeagi are known, however, they are rather similar and in some species, f. e. in *Z. australe*, the shape varies in fairly wide limits. The aedeagus of at least the Australian species is characterized by the extensive equipment of the inner sac with conspicuous spines, which are easily recognizable from outside as dark areas (Fig. 5).

Although range of body size overlaps in most species to some extent, size (esp. large size) may be quite useful for immediate recognition of some species. Also body colour and density of puncture of upper surface, especially on pronotum and elytres, may be useful. Small eye size is helpful for immediate recognition of *Z. castelnaui*.

Species may be also rather easily differentiated by means of size and shape of pronotum which may be very robust or rather small, or may or may not possess acute hind angles. Also proportions, especially width of base as compared with widest part, are useful characters for distinguishing of most species, but there is some variation.

In most other respects, e. g. mouth parts, antennes, chaetotaxy, there are extremely little differences between the species, or on the other hand, there is remarkable variation within species.

Measurements

Some measurements are presented in the table. Overall length of species has been measured from tip of labrum to apex of elytres. All measurements were made under a stereolens by use of an ocular micrometer with 40× to 160× magnification.

Distribution maps

Distribution maps are based only on label data of examined specimens. In some older specimens it was not possible to localize the label data, those data, also pure state records, are not indicated in the maps.

Classification

Subfamily Zuphiinae

For synonymy, for further comments, and for diagnosis see Baehr (1985a, b). For determination of the genus *Zuphium* see key to Australian and New Guinean genera of Zuphiinae in Baehr (in press).

Tribus Zuphiini

Apart from the tribe Zuphiini two other tribes have been described, Leleupidiini (Basilewsky 1951) and Patriziini (Basilewsky 1953). Limitation and justification of the tribes have been already discussed in detail (Baehr 1985a). *Zuphium* belongs without doubt to tribe Zuphiini.

Genus Zuphium

In the modern sense, that is, after separation of *Parazuphium* (Jeannel 1942, 1949), *Zuphium* comprises only the larger species of darker colour and with only one tactile seta at 1st antennal segment.

Zuphium

Latreille, 1806, p. 198
Latreille & Dejean, 1822, p. 121
Dejean, 1825, p. 192
Lacordaire, 1854, p. 85
Chaudoir, 1862, p. 310
Csiki, 1932, p. 1562
Jeannel, 1942, p. 1094
Jeannel, 1949, p. 1048
Jedlicka, 1963, p. 477
Darlington, 1968, p. 219

Zophium Gistl, 1839, p. 112

Schmidt-Göbel, 1846, p. 27

Zoyphium Motschoulsky, 1850

Bedel, 1914, p. 295

For further information see Csiki (1932), p. 1562.

Type species: *Zuphium olens* (Rossi, 1790)

Diagnosis

Genus of subfamily Zuphiinae and tribus Zuphiini. Head conspicuously separated from neck, temples large, rounded. Mentum with a broad, bifid tooth. Glossa apically widened, square, polysetose. Paraglossae membraneous, very elongate, free. Palpes pilose, penultimate segment of labial palpus polysetose. Lacinia spinose. Outer rim of mandibular scrobe pilose. Labrum sexsetose. 1st antennal segment very elongate, scapiform, about as long as 2nd-4th segments together, with one long tactile seta. 3rd antennal segment longer than 4th, 2nd segment very short, $^1/_4$–$^1/_5\times$ as long as 3rd segment. Whole antennes densely pilose. Posterior temporal setae somewhat moved away from posterior border of eye, no additional temporal setae present. Pronotum with posterior lateral setae, base not excised. Elytres depressed, apex square. Striae rather distinct, whole surface densely pilose. Last abdominal segment in ♂ with 1, in ♀ with 2 setae. ♂ anterior tarsus symmetrically clothed. Aedeagus not deformed, orificium with two sclerites, inner sac with some spinose areas. Right paramere smaller than left. Genital segment circular. All Australian species are winged.

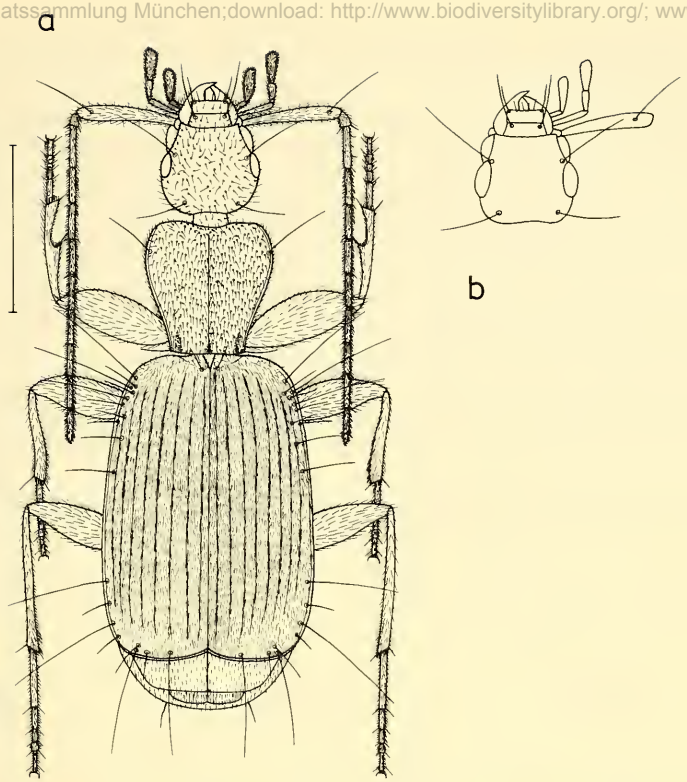


Fig. 1a. *Zuphium castelnaui* Gestro, lectotype, ♀ (MCSN), 1b. *Zuphium thouzeti* Castelnau, head. Scale: 2,5 mm.

Key to species of Zuphium from Australia and New Guinea

1. Eyes small, much shorter than temples. Colour always reddish. Pronotum rather heart-shaped, sides anteriorly strongly convex, at widest part about 1,5 × as wide as near base. 1st antennal segment elongate, normally longer than width of head. Puncture of elytres rather widespaced, about 7–8 each interval. Aedeagus very convex, apex short. Size rather large (7,65–8,75 mm). Victoria and New South Wales . . . . . *castelnaui* Gestro

– Eyes large, about as long or longer than temples. Colour of mature individuals dark piceous or black, frequently rather glossy. Pronotum less curved laterally, at widest part less than 1,5 × as wide than near base. 1st antennal segment normally shorter than width of head. Aedeagus variable. Size variable . . . . . 2.

2. Posterior angles of pronotum acute, laterally prominent, less than 90°. Puncture on pronotum widespaced, rather coarse, at widest part about 15 punctures between median line and border. Puncture and pilosity on elytres rather sparse, about 6 punctures each interval. Hairs rather elongate, hirsute. Surface glossy. Size large (8.7 mm). Northwestern Northern Territory . . . . . *macleayanum* spec. nov.

– Posterior angles of pronotum less acute, not prominent, at least 90° or more. Punctures of pronotum dense, fine, at widest part about 20 or more punctures between median line and border. Also punctures and pilosity of elytres dense and fine, about 10–12 punctures each interval, pilosity shorter, less hirsute. Size variable . . . . . 3.

3. Posterior angles of pronotum rather acute, about 90°–95°, angles not obtuse. Base laterally less sinuate. Base rather wide. Upper side glossy. Aedeagus fairly depressed, with very elongate, thin, wide apex. Size small (7.15–7.95 mm). Northwestern Australia . . . . . *moorei* spec. nov.

– Posterior angles of pronotum obtuse, more than 95°. Base laterally rather sinuate. Base normally narrower. Upper side less glossy. Aedeagus fairly depressed to very convex, but apex always shorter, less wide and thin. Size variable . . . . . 4.

4. Large, size normally over 8 mm (7.85–8.8 mm). Pronotum more robust, wider, base relatively wider. Aedeagus moderately convex, apex of sclerites rather straight. Apex of aedeagus fairly elongate . . . . . *thouzeti* Castelnau 5.

– Smaller, size normally under 8 mm (6.75–8.1 mm). Pronotum less robust, narrower, base relatively narrower. Aedeagus short and very convex, tip of sclerites convex, apex of aedeagus short, knoblike . . . . . *australe* Chaudoir 6.

5. Pronotum very robust, wide, posterior angles rather obtuse, frequently about 100°, apex of aedeagus rather elongate (Fig. 10). Eastern Australia . . . . . *thouzeti thouzeti* Castelnau

– Pronotum less robust, narrower, posterior angles less obtuse, 95°–100°. Apex of aedeagus shorter (Fig. 11). Northern parts of Northern Territory and Western Australia . . *thouzeti minor* subspec. nov.

6. Aedeagus very convex, apex very short and thick, knoblike (Fig. 7). Southern Australia . . . . . *australe australe* Chaudoir

– Aedeagus less convex, apex less short (Fig. 8, 9) . . . . . 7.

7. Aedeagus rather convex, apex rather short (Fig. 8). Hamersley Range, Western Australia . . . . . *australe millstreameanum* subspec. nov.

– Aedeagus less convex, apex much more elongate and less stout (Fig. 9). Northern half of Northern Territory . . . . . *australe incertum* subspec. nov.

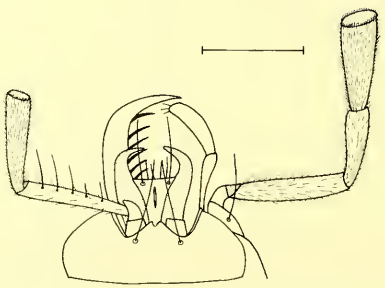


Fig. 2. *Zuphium castelnaui* Gestro, lower side of head and mouthparts. Scale: 0,5 mm.

Description of species

Zuphium australe Chaudoir, 1862

Chaudoir, 1862, p. 312
Gestro, 1875, p. 865
Csiki, 1932, p. 1563

Zuphium australe australe Chaudoir, 1862
(figs. 3a, 4a, 5, 7, 13)

Types: Holotype: ♂, ex Coll. Oberthur, Australie, Melbourne, S. Stoens (MNHN).

Locus typicus: Melbourne.

Diagnosis: Length: 6,75–8,05 mm, width: 2,5–2,9 mm. Colour: Dark piceous to black, rather glossy, mouthparts from clypeus and last segments of antennes light brown to reddish. A relatively small species with a narrow pronotum and relatively short antennes. Aedeagus very convex, apex short.

Description:

Head: Eyes large, longer or somewhat shorter than temples. Antennes relatively short, especially 1st segment normally distinctly shorter than width of head. Mouthparts of average size and form, but 3rd segment of labial palpus rather short, sparsely pilose. Surface of head fairly glossy, pilosity dense.

Pronotum (fig. 3a): Comparatively small, narrow, sides fairly rounded, prebasal sinuosity shallow, posterior angles distinct, but not acute, 90°–100°. Surface densely punctate and pilose, about 20–22 punctures between median line and side border. Punctures about as large as interspaces between them or still larger. Widest part of pronotum at or just a little behind anterior lateral seta.

Elytres (fig. 4a): Rather elongate, of average form. Striae rather distinct, intervals slightly convex. Puncture and pilosity very dense, about 10 hairs each interval. Pilosity regular, depressed.

Aedeagus (fig. 5, 7): Short and very convex. Sclerites at tip convex, apex very short, thick, knob like.

Variation: A rather variable species, especially with regard to shape of pronotum and of elytres which are somewhat more widened in ♀♀. Typical specimens from southern regions are rather small, narrow and very dark and glossy, nearly black.

Distribution (fig. 13): Southern half of Australia, Victoria, New South Wales, southern Queensland, South Australia, southwestern Australia north to Carnarvon.

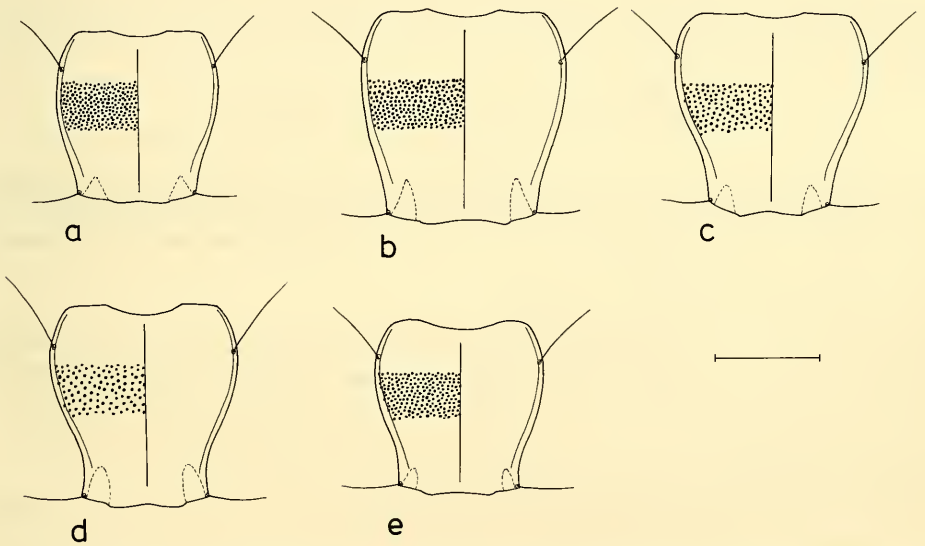


Fig. 3. Pronotum of Australian *Zuphium* species: a. *Z. australe* Chaudoir, b. *Z. thouzeti* Castelnau, c. *Z. castelnaui* Gestro, d. *Z. macleayanum* spec. nov., e. *Z. moorei* spec. nov. Scale: 1 mm.

Material examined (36 specimens):

South Australia: 1♂, Blackb's Coll. Australia, S. Australia (SAM), 1♂, S. Australia, Blackburn (SAM), 1♀, Farina, S. Aust. 27. Oct. 1970 (SAM), 2♀♀, Frome River Crossing of Birdsville Track nr. Marree, At light, 25. and 28. Oct. 1966, G. F. Gross (SAM), 1♀, Hyde Park, S. A. At light, 1. Mar. 1960, R. V. Southscott (SAM).

Victoria: 1♂, Melbourne, L. Stroens, Coll. R. Oberthur, Holotypus! (MNHM), 1♂, Kulkyne F. N. W. Vict., 17.2.1969, G. W. Anderson (CMC), 1♂, L. Hattah, N. W. Vict., 12.3.1969, G. W. Anderson (NMV), 1♂, 3♀♀, Kulkyne Lakes, flood margin, 30.9.1970, G. W. Anderson (CBM, CMC), 1♂, Kulkyne, Vic., 1.3.1969, G. A. (ANIC), 1♂, 34°44′S, 142°21′E, Lake Hattah, Vic, 28.2.1967, G. W. Anderson (ANIC), 1♀, NSW see Masters, ex Museo H. B. Bates, Ex Coll. R. Oberthur, Melbourne, Stroens (MNHN).

Fig. 4. Puncture of elytres in Australian *Zuphium* species: a) *Z. australe* Chaudoir, b) *Z. thouzeti* Castelnau, c) *Z. castelnaui* Gestro, d) *Z. macleayanum* spec. nov., e) *Z. moorei* spec. nov.

New South Wales: 2♀♀, 1 (sex not determinable), Rope' Creek, N S Wales (MMS), 2♀♀, Bourke and Wilcannia, NSW, Darling R. flood, Helms, V–VI. 90 (SAM), 1 (sex not determinable), N S Wales, Darling R. (MMS), 2♂♂, New Holl., NSW, Masters, Fry Coll. 1905, 100 (BMNH).

Queensland: 1♀, „Conandoo", Fletcher, SQ, 9 mi S. of Stanthorpe, 28°46′ S, 151°51′ E, 20.9.1968, Britton & Misko (ANIC), 1♂, 4♀♀, 20 km E of Thylungra, S. W. Qld, 22. Sept. 1983, G. B. Monteith (CBM, QM), 1♀. Roma, Queensland, F. H. Taylor (ANIC), 1♂, Brisbane, Moreton Bay (Written by Macleay) (MMS).

Western Australia: 1♀, SW Australien, Spargoville, 50 mil. S. Kalgoorlie, 5.1.1961, leg. H. Demarz (ZSM), 1♀, Carnarvon, W. A. Demarz, IV, 1967 (FMT).

Undated: 1♀, Rosewood, 17.12.33, J. G. Brooks Bequest 1976 (ANIC).

Habits: Virtually unknown. Some specimens at light, some from "flood margin" or flood refuse. Comparatively many specimens are from rather dry country, but there often from the vicinity of rivers.

Activity period: Records are from September to March, most records, however, from September to October.

Zuphium australe millstreameanum subspec. nov.
(figs. 8, 13)

Types: Holotype: ♂, 21°35′ S, 117°04′ E, Millstream, WA, 30.10.1970, eucalypt-spinifex, E. Britton (ANIC). Paratypes: 1♀, same locality and date, E. Britton (ANIC), 2♂♂, 21°35′ S, 117°04′ E, 1 km N of Millstream, W. A., 23.10.1970, M. S. Upton (CBM, ANIC), 2♂♂, 21°35′ S, 117°04′ E, Millstream, WA, 5.11.1970, eucalyptus-spinifex, at light, E. B. Britton (ANIC).

Locus typicus: Millstream, Western Australia.

Diagnosis: Length: 7,15–8,05 mm, width: 2,6–2,85 mm. Colour: Reddish to brown. Mouthparts from clypeus and whole antennes lighter. Small and rather light-coloured with slightly narrower pronotum than nominate subspecies. Aedeagus slightly less convex with more elongate apex.

Description of holotype:

Length: 7,5 mm, width: 2,65 mm. Colour as above.

Head: Eyes large, about as long as temples. 1st antennal segment shorter than width of head. Mouthparts of average size. Surface rather glossy, puncture fine.

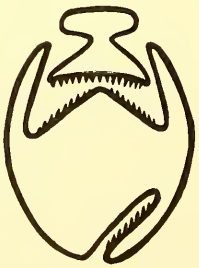


Fig. 5. *Zuphium australe* Chaudoir, cross-section from behind through aedeagus showing spinose areas.

Pronotum: Slightly more elongate and slightly narrower at base than nominate subspecies. Puncture and pilosity dense, about 20 punctures between median line and border. Prebasal sinuosity distinct, but tip of posterior angles obtuse, angle about 95°–100°.

Elytres: Of average size and form. Puncture and pilosity very dense, about 10 punctures each interval, pilosity depressed.

Aedeagus (fig. 8): Slightly less convex than in the nominate subspecies, apex slightly more elongate.

Variation: Judging from the material at hand very little.

Distribution (fig. 13): Only recorded from the vicinity of Millstream, Western Australia.

Material examined (6 specimens):
Western Australia: 5♂♂, 1♀, Millstream (ANIC, CBM).

Habits: Most specimens were collected at light in "spinifex-eucalypt" country. But as there are large pools of the Fortescue River in the Millstream area, it is not sure from where the specimens actually came, and they are likely hygrophilous.

Activity period: All known specimens are recorded from end of October to beginning of November.

Zuphium australe incertum subspec. nov.
(figs. 9, 13)

Types: Holotype: ♂, Anthony lagoon, NT. Demarz, 9.1965 (FMT). Paratypes: 1♂, same locality and date (CBM), 1♀, Darwin, Demarz, 10.1965 (FMT), 1♂, Daly R. N. T., A. Wesselman, Ditto N. Territory (SAM), 1♂, Bessie Spring, 16°40′S, 135°51′E, 8 km ESE of Cape Crawford, NT. 26. Oct. 1975, M. S. Upton (ANIC), 1♂, Lake Wood, 15 km sw Elliot, NT, at light, 5. Oct. 1977, G. F. Gross (SAM).

Locus typicus: Anthony Lagoon, Northern Territory.

Diagnosis: Length: 7,25–8,10 mm, width: 2,6–2,9 mm. Colour: Dark brown, mouthparts and last segments of antennes lighter brownish to reddish. Medium sized, apart from shape of aedeagus difficult to distinguish from nominate subspecies.

Description of holotype:

Length: 7,45 mm, width: 2,65 mm. Colour as above. Head, pronotum and elytres of average size and form, within variation range of nominate subspecies (see table).

Aedeagus (fig. 9): Rather low, less convex than in nominate subspecies, also apex of sclerites less convex, apex of aedeagus considerably more elongate.

Variation: Little. As mentioned before, size and shape well within variation range of nominate subspecies. Thus, the description of this subspecies is done with some hesitation, especially, because there is rather little material at hand. The procedure seems justified, however, because there is so far a large distribution gap between *Z. a. australe* and the new subspecies (see fig. 13).

Distribution (fig. 13): Northern parts of Northern Territory.

Material examined (6 specimens):
Northern Territory: 2♂♂, Anthony Lagoon, holotype! (CBM, FMT), 1♀, Darwin (FMT), 1♂, Daly River (SAM), 1♂, Bessie Spring near Cape Crawford (ANIC), 1♂, Lake Wood near Elliot (SAM).

Habits: Unknown.

Activity period: Recorded from September and October.

Zuphium thouzeti Castelnau, 1867

Castelnau, 1867, p. 17, 1868, p. 103
Gestro, 1875, p. 866
Csiki, 1932, p. 1567
Darlington, 1968, p. 219

Zuphium thouzeti thouzeti Castelnau, 1862

(figs. 1b, 3b, 4b, 10, 14)

Types: Lectotype: ♀, Rockhampton, Coll. Castelnau, esemplare tipica. Coll. Castelnau, *thouzeti* Cast., Syntypus *Zuphium thouzeti* Cast. (MCSN). Paralectotypes: 2♂♂, 1♀, Rockhampton, Coll. Castelnau, Syntypus *Zuphium thouzeti* Cast. (MCSN), 1♀, Pt. Denison, Coll. Castelnau, Syntypus *Zuphium thouzeti* Cast. (MCSN).
Locus typicus: Rockhampton, Queensland.

Diagnosis: Length: 7,9–8,8 mm, width: 2,8–3,15 mm. Colour: Brown to dark piceous, mouthparts, median and last segments of antennes, and tibiae and tarsi slightly lighter. A large species with a big pronotum and rather obtuse posterior angles, with overall dense pilosity, and with a rather depressed aedeagus with fairly elongate apex.

Description:

Head (fig. 1b): Eyes large, as long or slightly shorter than temples. Mouthparts of average size, but comparatively slender and elongate. 3rd segment of labial palpi elongate, rather sparsely setose. Antennes medium-sized. 1st segment sometimes not much darker than posterior ones.

Pronotum (fig. 3b): Large, rather wide, also wide at base. Widest part at position of anterior lateral seta. Prebasal sinuosity normally fairly shallow, posterior angles obtuse, not prominent, about 100° or more. Puncture and pilosity fine and dense, about 20–22 punctures between median line and border, punctures about as large or little smaller than interspaces. Pilosity short, depressed.

Elytres (fig. 4b): Of average size, not considerably widened towards apex. Intervals slightly convex. Puncture and pilosity very dense and fine, about 10 punctures each interval. Pilosity short, regular, depressed. Surface of elytres less glossy than in most other species.

Aedeagus (fig. 10): Rather depressed, apex of sclerites just slightly convex to straight. Apex of aedeagus rather elongate, fairly narrow and thin.

Variation: A rather variable species (see table). Especially ♀♀ possess a large pronotum and wide elytres. Without considering of aedeagus small specimens are sometimes difficult to distinguish from large specimens of *Z. australe*. The few specimens at hand from New Guinea are rather parallel and have fairly acute posterior angles on pronotum.

Distribution (fig. 14): Eastern and northern Queensland, western New South Wales, northwestern South Australia, New Guinea.

Material examined (32 specimens):

South Australia: 1♂, S. Aust. Frome River crossing of Birdsville Track nw. Marree. At light. 25. Oct. 1966, G. F. Gross (SAM).

New South Wales: 1♀, s. Hay, light, N. S. W., 24.11.70, B. P. Moore (CMC), 1♂, s. Hay, light, N. S. W., 13.12.72, B. P. Moore (CMC), 1♀, Armst. NSW, 1947, J. G. Brooks Bequest 1976 (ANIC), 1♀, Bogan River, NSW, S. of Nyngan, Oct. '57, Darlingtons (MCZ), 1♂, NSW, By Simson's number (SAM).

Queensland: 2♂♂, 2♀♀, Rockhampton, lectopype!, paralectotypes! (MCSN), 1♀, Pt. Denison, paralectotype! (MCSN), 1♂, N. of Mareeba, Feb. '58, N. Q., Darlingtons (MCZ), 1♂, 1♀, W. of Ravenshoe, Atherton Tab., Q., c. 3000', Feb. '58, Darlingtons (MCZ), 1♂, Qld. Australia (BMNH), 1♀, N. Holl., Q'land, Janson Acq. 1884, Coll. R. Oberthur, Australie, Cape York, Schmeltz (MNHN), 1♂, 2 miles ENE of Rollingstone, Q., 26. Apr. 1969, I. F. B. Common & M. S. Upton (ANIC), 1♂, Cape York, Schmeltz, Ex Museo Chaudoir, ex Coll. R. Oberthur (MNHN), 1♂, Rockhampton, Coll. Castelnau, ex Coll. R. Oberthur, Australie, Cape York, Schmeltz (MNHN), 1♀, Q.'land, (NMV), 1♀, at light, Normanton, Qld,. 4 May 1963, P. F. Aitken & N. B. Tindale (SAM), 1♀, N. Holl. Rockhampt. (MNB), 1♀, Yeppoon, Q., 14.–18.12.64, I. F. B. Common & M. S. Upton (ANIC), 1♀, Eungella, CQ., 13.1.67, T. A. B., m. 25, J. G. Brooks Bequest, 1976 (ANIC), 1♀, Townsville, Qld., 7.1.03, F. P. Dodd (BMNH), 1♀, Rockhampton (MNB), 1♂, Townsville, Qld., 8.2.02, F. B. Dodd (BMNH), 1♂, Nov. Holl., Queensld., Simson, Fry Collection (BMNH).

New Guinea: 1♂, 1♀, SE Mamai Pltn, E. of Port Glasgow, 150 m, 5. and 7.2.1965, R. Straatman, light trap (BMH).

Undated: 1♂, Nov. Holl. Bor., Fry Coll. 1905, 100 (BMNH), 1♀ (SAM).

Habits: Unknown, some specimens captured at light. In the northern part of its range the species seems to live rather near coast, in the southern parts most records are from inland.

Activity period: Specimens have been taken from October to May, most, however, from December to February.

Zuphium thouzeti minor subspec. nov.
(figs. 11, 14)

? *Zuphium fitzroyense* Macleay, 1888, p. 449. (doubtful synonymy, see doubtful species).

Types: Holotype: ♂, 17 km ne Willeroo, Northern Territory, 8.11.1984, at light, M. & B. Baehr (ANIC). Paratypes: 2♂♂, 2♀♀, same locality and date (CBM, ZSM), 1♂, Fitzroy Crossing, Western Australia, 18.–20.11.1984, at light, M. & B. Baehr (CBM), 1♂, Oenpili, N. A., 5.12.18, P. Cahill (NMV), 1♂, Tindal, N. T., 14°31′S, 132°22′E, 1.–20. Dec. 1967, light trap, W. J. M. Vestjens (CMC), 1♀, Nangulala, N. T., I.73, M. Reeve (CMC), 1♀, 12°23′S, 132°57′E, 5 km NNW of Cahill's Crossing (East Alligator River), NT., 5.11.72, E. B. Britton (ANIC).

Locus typicus: Willeroo, Northern Territory.

Diagnosis: Length: 7,85–8,45 mm, width: 2,8–3,1 mm. Colour: Piceous to blackish, mouthparts, antennes from 2nd segment and tarsi slightly lighter. In most specimens whole legs and 1st antennal segment also lighter. Rather large, with a slightly smaller pronotum than in nominate subspecies. Aedeagus more convex, with shorter apex.

Description of holotype:

Length: 7,95 mm, width: 2,85 mm. Colour: Somewhat lighter than in diagnosis.

Head: Of average size, eyes always considerably longer than temples. Antennes medium-sized, 1st segment always shorter than width of head. Generally, head very similar to nominate subspecies.

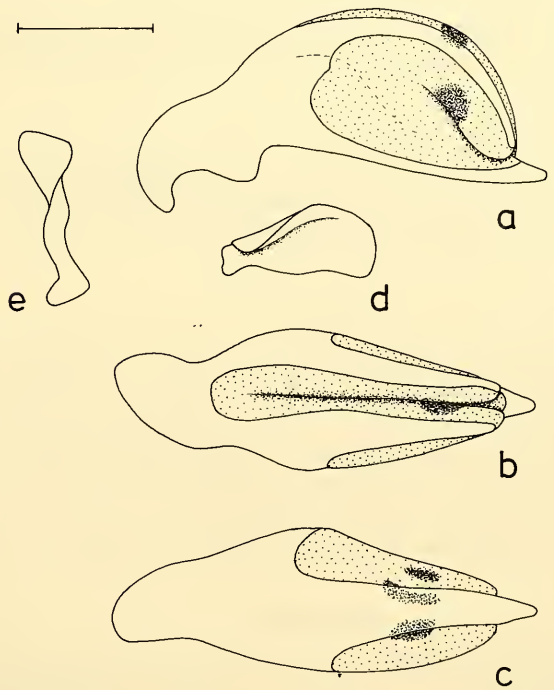


Fig. 6. *Zuphium castelnaui* Gestro, Aedeagus. a) left side, b) ventral side, c) dorsal side, d) left paramere, e) right paramere. Scale: 0,5 mm.

Pronotum: Smaller and narrower than in nominate subspecies, prebasal sinuosity slightly more accentuate, posterior angles more distinct, less obtuse, about 95°–100°. Puncture and pilosity similar.

Elytres: Of similar size and shape as in nominate subspecies, pilosity dense.

Aedeagus (fig. 11): As a whole, more convex than in nominate subspecies, sclerites at apex slightly convex, apex of aedeagus rather short.

Variation: Not much variation in shape of pronotum and of aedeagus, which are best characters for separating the subspecies.

Note: Perhaps *Z. fitzroyense* Macleay belongs to this subspecies. Due to the poor condition of the badly destroyed type specimen, however, it is impossible to settle this question exactly.

Distribution (fig. 14): Northern parts of Northern Territory and of Western Australia.

Material examined (10 specimens):

Northern Territory: 1♂, Oenpili (NMV), 1♀, Cahill's Crossing (ANIC), 1♂, Tindal (CMC), 1♀, Nangulala (CMC), 3♂♂, 2♀♀, Willeroo, Holotype! (ANIC, CBM, ZSM).

Western Australia: 1♂, Fitzroy Crossing (CBM).

Habits: As most specimens were caught at light, few is known about their habits. The specimens from Willeroo have been collected in open grassland, apparently far away from any standing or running water.

Activity period: Most specimens were captured in November, single specimens in December, January, and March.

Zuphium castelnaui Gestro, 1875
(figs. 1a, 2, 3c, 4c, 6, 14)

Gestro, 1875, p. 865

Csiki, 1932, p. 1564

Castelnau, 1867, p. 17, 1968, 9. 103 (cited as *Z. australe* Chaudoir).

Types: Lectotype: ♂, Sydney, Coll. Castelnau, Typus, *castelnaui* Gestro, *Zuphium australe* Chd. det. Castelnau (MCSN). Paralectotypes: 2♀♀, Sydney, Coll. Castelnau, Syntypus *castelnaui* Gestro, *Zuphium australe* Chd. det. Castelnau (MCSN).

Locus typicus: Sydney, New South Wales.

Diagnosis: Length: 7,85–8,75 mm, width: 2,85–3,2 mm. Colour: Reddish to light brown, mouthparts and legs slightly lighter, 1st antennal segment hardly darker than following segments. The species is at once distinguished from all other Australian species by uniform reddish colour, small eyes, wide, heart-shaped pronotum, and large, apically wide elytres.

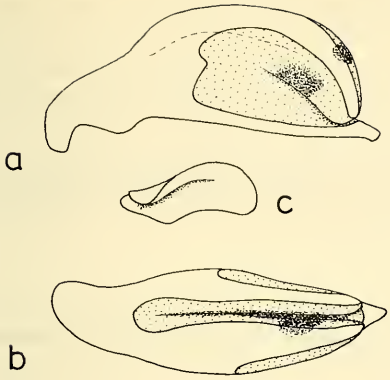
Description:

Head: Eyes small and not at all prominent. Temples about 1,5× as long as eyes. Thus, head rather circular. Mouthparts fairly elongate, especially 3rd segments of both palpi. Antennes elongate, 1st segment as long or longer than width of head. Surface fairly densely punctate.

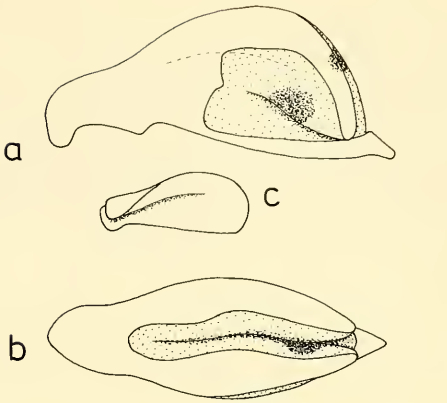
Pronotum (fig. 3c): Strongly heart-shaped, at widest part about 1,5× as wide as in front of base, sides especially at anterior angles strongly rounded. Prebasal sinuosity shallow, but elongate. Posterior angles rather obtuse, not prominent, about 100°–110°. Puncture of surface rather coarse, moderately dense, about 18 punctures between median line and border. Interspaces between punctures about 1,5× as wide as punctures. Pilosity short, depressed. Surface not very glossy.

Figs. 7–12. Aedeagus of Australian *Zuphium* species. a) left side, b) ventral side, c) left paramere. Scale: 0,5 mm. Fig. 7. *Z. australe australe* Chaudoir, Fig. 8. *Z. australe millstreameanum* subspec. nov., Fig. 9. *Z. australe incertum* subspec. nov., Fig. 10. *Z. thouzeti thouzeti* Castelnau, Fig. 11. *Z. thouzeti minor* subspec. nov., Fig. 12. *Z. moorei* spec. nov.

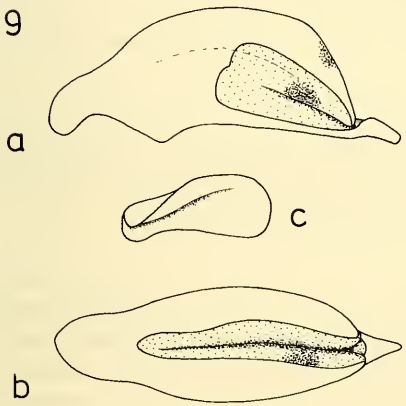
7



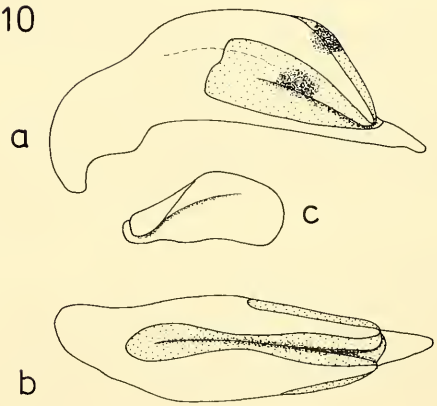
8



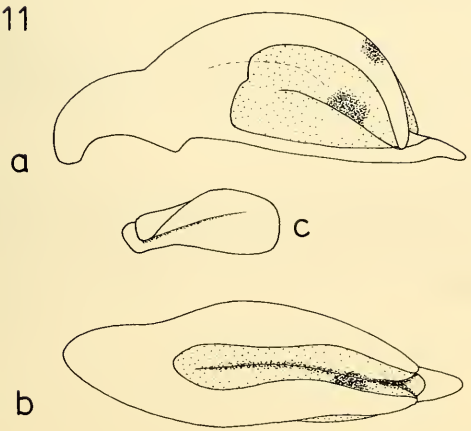
9



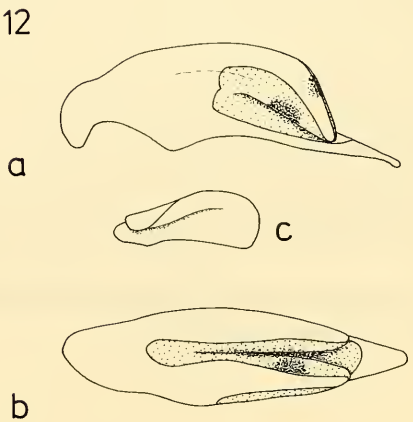
10



11



12



Elytres: Rather wide, especially towards apex. Shoulder slightly more oblique than in the other species. Intervals less distinctly convex. Puncture moderately dense, about 8 punctures each interval. Punctures rather coarse, but not well discernible, elytres with a leathery appearence, and rather dull. Pilosity depressed, hairs moderately elongate.

Aedeagus (fig. 6): Big and very convex, also apex of sclerites convex. Apex of aedeagus short, somewhat knoblike. Both parameres very compact.

Variation: Apart from some variation of size little variation. A defect specimen from Rope's Creek, NSW (only elytres and abdomen, sex not determinable) is tentatively classed among this species.

Distribution (fig. 14): New South Wales, eastern Victoria.

Material examined (9 specimens):

Victoria: 1♂, Benalla, E. Wilson coll. (NMV), 1♀ (BMNH).

New South Wales: Sydney, 1♂, 2♀♀, lectopype!, paralectotypes! (MCSN), 1♀, Sydney, Higgin, Mus. Chaudoir, Coll. Oberthur (MNHN), 1♂ (presumably) (MMS), 1 (sex not determinable), NSW, Rope's Creek (MMS).

Habits: Completely unknown, not recent material available.

Activity period: Unknown, no specimen dated.

Zuphium macleayanum spec. nov.
(fig. 3d, 4d, 15)

Types: Holotype: ♀, 17 km ne Willeroo, Northern Territory, 8.11.1984, at light, M. & B. Baehr (ANIC) (head partly destroyed).

Locus typicus: Willeroo, Northern Territory.

Diagnosis: Length: 8,7 mm, width: 3,35 mm. Colour: Light brown, legs and mouthparts feebly lighter. A large, glossy species with a narrow, conspicuously heart-shaped pronotum with prominent posterior angles, also characterized by its sparse puncture and pilosity.

Description of holotype:

Measurements and colour as above.

Head: Partly destroyed. Eyes large, mouthparts rather elongate, 3rd segment of labial palpus sparsely setose. Antennes rather elongate. Surface sparsely punctate and pilose, very glossy.

Pronotum (fig. 3d): Distinctly heart-shaped, rather narrow, convex, at widest part about 1,5× as wide as in front of base. Sides well rounded, prebasal sinuosity deep, posterior angles prominent, acute, slightly divergent, only the very tip obtuse, less than 90°. Lateral groove conspicuous, basal grooves deep, lateral border near base conspicuously raised. Puncture sparse, rather coarse, just about 15 punctures between median line and border. Surface higly polished.

Elytres (fig. 4d): Rather elongate. Striae distinct, intervals rather convex, slightly more than in other species. Puncture comparatively sparse, about 6 punctures each interval. Each point freely recognizable, intervals without any leathery appearence, rather glossy. Pilosity relatively sparse, hirsute, less depressed and more elongate than in other species.

Aedeagus: Unknown, holotype is a ♀.

Variation: Unknown, only 1 specimen known.

Distribution (fig. 15): Only known from the type locality in northwestern Northern Territory.

Habits: The unique specimen flew to light in a grassland area apparently far away from any open water.

Activity period: Only captured in November.

Note: See under doubtful species.

Zuphium moorei spec. nov.
(figs. 3e, 4e, 12, 15)

Types: Holotype: ♂, 108 km wsw Hall's Creek, Western Australia, 16.11.1984, at light, M. & B. Baehr (ANIC). Paratypes: 2♀♀, same locality, same date (CBM), 1♂, 2♀♀, Frog Hollow Creek, 135 km n Hall's Creek, Western Australia, 14.11.1984, at light, M. & B. Baehr (ANIC, CBM), 2♀♀, Ord River, 105 km n Hall's Creek, Western Australia, 15.11.1984, at light, M. & B. Baehr (CBM, ZSM), 1♂, 1♀, Mary River, 115 km wsw Hall's Creek, Western Australia, 17.11.1984, at light, M. & B. Baehr (CBM), 1♂, 2♀♀, Fitzroy Crossing, Western Australia, 18.–20.11.1984, at light, M. & B. Baehr (CBM, MCZ), 1♂, Hooley Creek, 68 km nw Wittenoom, Western Australia, 2.12.1984, at light, M. & B. Baehr (CBM), 1♀, Tunnel Creek, E. of Derby, WA, 1. Nov. 1978, M. S. & B. J. Moulds (CMC), 1♂, NT. 3-ways Roadhouse, 21.9.1979, at light, P. A. Meyer (ANIC).

Locus typicus: 108 km wsw Hall's Creek, Western Australia.

Diagnosis: Length: 7,15–7,95 mm, width: 2,6–2,85 mm. Colour: Dark piceous to blackish, mouthparts and tarsi slightly lighter, last antennal segments reddish. A small, very dark species with rather prominent posterior angles of pronotum, and an elongate, depressed aedeagus with elongate and depressed apex.

Description of holotype:

Length: 7,15 mm, width: 2,6 mm. Colour: somewhat lighter than in diagnosis, the specimen is perhaps not fully coloured.

Head: Of average size and shape. Eyes rather large, about as long as temples. Mouthparts medium-sized, 1st segment of antennes shorter than width of head. Surface of head moderately densely punctate and pilose, fairly glossy.

Pronotum (fig. 3e): Rather wide, especially at base. Prebasal sinuosity fairly distinct, basal angles distinct, but not prominent, tip of angles obtuse, angles about 95°. Surface densely punctured, about 20–22 punctures between median line and border. Punctures about same size as interspaces between them. Pilosity dense, depressed. Surface moderately glossy.

Elytres (fig. 4e): Of average form, intervals rather convex. Puncture very dense, about 10 punctures each interval. Punctures not well discernible, surface therefore of somewhat leathery appearence. Pilosity dense, depressed.

Aedeagus (fig. 12): Elongate, depressed, hardly convex. Apex of sclerites straight. Apex of aedeagus very elongate and flattened, wide, with a small knob at the very tip. Parameres small, depressed, elongate.

Variation: Not much variation in size or form. In some specimens apex of aedeagus is slightly shorter and less depressed.

Distribution (fig. 15): Northern Western Australia, south to Hamersley Range, adjacent Northern Territory.

Material examined (16 specimens):

Northern Territory: 1♂, 3-ways Roadhouse (ANIC).

Western Australia: 1♂, 2♀♀, 135 km n Hall's Creek (ANIC, CBM), 2♀♀, 105 km n Hall's Creek, (CBM, ZSM), 1♂, 2♀♀, 108 km wsw Hall's Creek, holotype! (ANIC, CBM), 1♂, 1♀, Mary River, 115 km wsw Hall's Creek (CBM), 1♂, 2♀♀, Fitzroy Crossing (CBM, MCZ), 1♀, Tunnel Creek (CMC), 1♂, 68 km nw Wittenoom (CBM).

Habits: Most specimens were collected at light, some near standing or running water of rivers, but some also in spinifex semidesert at least 7 km away from any open water.

Activity period: Most records are from November to beginning of December, 1 specimen is from September.

Doubtful species

There are two species, both described by Macleay (1888) from the vicinity of King's Sound in northwestern Australia, which remain rather doubtful, because the types are either badly damaged or lost and as there is no additional material which has been or could be associated with these species.

? *Zuphium fitzroyense* Macleay, 1888

Macleay, 1888, p. 449
Csiki, 1932, p. 1564

Types: I saw the type specimen from the Macleay Collection in the ANIC. It is labelled: *Zuphium fitzroyense* Macl. King's Sound (label written by Macleay).

Locus typicus: King's Sound. Western Australia.

The description of Macleay (1888) gives no information what Z. *fitzroyense* actually is. Macleay compares it only with the foregoing species Z. *pindan* and tells us, that it differs especially by its lighter colour, more cordiform thorax which has, however, less acute hind angles, and by its longer, entirely red, antennae and legs. As the description of Z. *pindan* is very vague, too, it is impossible to decide from the description alone, to which species Z. *fitzroyense* is to be appointed or whether it represents an own species. Unfortunately, inspection of the type specimen gives hardly a better picture, because it has lost most of its appendages and cannot be sexed, as the abdomen was eaten. From my view the type of Z. *fitzroyense* represents a specimen of Z. *thouzeti,* perhaps it belongs to the subspecies Z. *t. minor.* As this subspecies is especially founded on the shape of aedeagus, it is impossible to settle this question exactly. Therefore, I did refrain from formally synonymizing Z. *fitzroyense* and Z. *thouzeti minor.*

? *Zuphium pindan* Macleay, 1888

Macleay, 1888, p. 448
Csiki, 1932, 1.1566

Types: According to Mr. T. A. Weir the type specimen is not present in the ANIC, although there is a label for that species in the Macleay Collection. Most likely the type is lost.

Locus typicus: King's Sound, Western Australia.

In his description Macleay (1888) stated that the species is rather similar to Z. *australe,* and that the colour is a nitid black. The rest of the description is very vague and adds nothing of interest, with exception of what Macleay says about the posterior angles of prothorax which are "acute and recurved". The overall length of "4 lines" is rather small and should be equivalent to about 7,5 mm when compared with the measurements in this revision.

There is some very vague correspondence between the description of Z. *pindan* and the new species Z. *macleayanum* or Z. *moorei,* respectively, especially with regard to the acute posterior angles of pronotum or, in the second case, with regard to colour and size. But, from my view, this is far too less for synonymizing Z. *pindan* with one of these species and, as no additional material of Z. *pindan* is at hand, it will perhaps never be settled.

There is a specimen of Z. *thouzeti* before me from Northern Territory (NMV) bearing a label written by Sloane "Z. *australe* Chaud. = Z. *thouzeti* Cast. ? = Z. *pindan* Macl. Id. by T. G. Sloane". I do not know, whether Sloane did ever see the Macleay Collection. If he did and if he had the opportunity, to compare the species mentioned, Z. *pindan* perhaps belongs to either Z. *australe* or Z. *thouzeti.* But it could also belong to a still unknown species. This would be not impossible, because northwestern Australia is surprisingly rich in species, as can be seen from this and from other reviews of Zuphiines (Baehr 1984, 1985a, b).

Discussion

Phylogenetic status of the genus *Zuphium* and of its species

A detailed differential diagnosis of the species has been omitted, for that purpose the reader should consult the key and the diagnoses heading the description of each species. The systematic position of the genus *Zuphium* and its relation to other Zuphiine genera shall not be discussed in detail, as not even all authorities agree in the limitation of the subfamily Zuphiinae or its tribes, and as a general revision of the subfamily has been never attempted. In addition, too little is known on the Zuphiine faunas of New Guinea and of southeastern Asia, respectively. Therefore, it is only possible to name some characters which are likely apomorphic. These may illustrate the approximate phylogenetical status of *Zuphium* within Australian Zuphiinae. Possible apomorphic characters of *Zuphium*, with respect to a supposed basic plan of Zuphiinae are:

1. Depressed body
2. Strong contraction of neck
3. Enlarged temples with posterior supraorbital seta far removed from eye
4. Elongate, scapiform 1st antennal segment, as long as 2nd–4th segments together
5. Very slender, elongate antennes
6. Weak striation of elytres with just slightly convex intervals
7. Lack of tactile setae at odd intervals
8. Dense and depressed pilosity on elytres

Tab. 1. N: Number of specimens measured. 1. length (tip of labrum – apex of elytres) in mm. 2. Pronotum, ratio length/width, 3. Pronotum, ratio width at widest part/width near base, 4. Elytres, ratio length/width, 5. Ratio length of temples/length of eyes, 6. Ratio length of 1st antennal segment/width of head.

	N	1	2	3	4	5	6
Z. a. australe	35	6,75–8,05	1 –1,09	1,35–1,48	1,39–1,48	0,8 –1,22	0,86–1,01
Z. a. millstreameanum	6	7,15–8,05	1,05–1,08	1,40–1,48	1,49–1,53	0,89–1,10	0,88–0,96
Z. a. incertum	6	7,25–8,1	1,04–1,08	1,37–1,45	1,56–1,59	0,88–1,07	0,94–1
Z. t. thouzeti	32	7,9 –8,8	0,98–1,06	1,33–1,47	1,42–1,62	0,90–1,18	0,88–1,02
Z. t. minor	9	7,85–8,45	1 –1,07	1,36–1,41	1,47–1,58	0,84–0,92	0,93–0,98
Z. castelnaui	8	7,65–8,75	1,05–1,10	1,47–1,57	1,45–1,52	1,29–1,66	0,99–1,07
Z. macleayanum	1	8,7	1,06	1,52	1,55	–	–
Z. moorei	16	7,15–7,95	1,03–1,09	1,33–1,42	1,43–1,54	0,87–1,07	0,9 –0,98

There are hardly any clear plesiomorphic characters in *Zuphium* as compared with the Australian genera *Acrogenys* and *Pseudaptinus* which both seem to be rather primitive genera. The situation is completely different when compared with *Parazuphium*. To be sure, *Zuphium* and *Parazuphium* seem to be closely related one to another, but in most respects *Parazuphium* is by far more derivative. In following characters *Zuphium* seems to be plesiomorphic as compared with *Parazuphium:*

1. Large size
2. Rather dark colour
3. Less strongly enlarged and less rectangular temples
4. No additional (temporal) seta behind eye
5. Only one tactile seta on 1st antennal segment
6. Normal-shaped, not excised posterior angles of pronotum
7. Well developed posterior lateral seta on pronotum
8. Stronger striation of elytres with intervals more convex
9. Oblique, but not sinuate apex of elytres
10. Less deformed aedeagus and parameres

Only some minor characters are perhaps more derivative in *Zuphium* than in *Parazuphium,* especially the more elongate antennes and palpes.

Within the Australian species a well founded phylogenetical classification is difficult to establish, especially as most Australian *Zuphium* species seem very closely related. Few species are immediately recognizable and morphologically well limited. Nevertheless, three different groups are perhaps to distinguish, two of them, however, contain only one species each:

1. group: *Z. australe, Z. thouzeti,* and *Z. moorei,* and their subspecies
2. group: *Z. castelnaui*
3. group: *Z. macleayanum*

The members of 1st group are all extremely closely related and seem generally rather generalized. Within this group *Z. moorei* is the most advanced species on behalf of its very elongate apex of aedeagus. *Z. castelnaui* is in some respects more derivative than the other species, especially in its:

1. light colour
2. small eyes
3. elongate antennes
4. elongate palpes
5. more elongate tactile setae at elytral borders

All these characters are perhaps due to a more subterranean habit of *Z. castelnaui* as compared with the other species. However, as we do not possess any recent material or observations of this species, it is impossible to confirm this statement.

Z. macleayanum, on the other hand, exhibits some features which could be regarded as rather primitive within the genus, if they do not represent secundary reductions.

1. Coarse, but sparse puncture of surface
2. Sparse, fairly hirsute pilosity
3. Rather glossy surface
4. Heart-shaped pronotum with acute posterior angles
5. Somewhat more distinct striation of elytres and slightly more convex intervals

As the aedeagus of this species is so far unknown, the suggested primitive status of *Z. macleayanum* is still speculative.

As stated above, Sloane (1920) still supposed that the members of the *Z. australe – Z. thouzeti – Z. moorei*-group belong perhaps all to one species. He then did not know *Z. moorei,* but he included into his consideration also *Z. pindan* which he perhaps did not know. Surely, Sloane (l. c.) was right in that these species are extremely closely related. Indeed, it is not always possible to identify females correctly, especially of *Z. australe* and *Z. thouzeti. Z. australe* seems in particular to represent a rather heterogenous species whose large specimens are sometimes rather similar to small specimens of *Z. thouzeti.* With respect to the close relation of the species of this group, the variability of *Z. australe,* as well as the presence of geographically isolated populations of both, *Z. australe* and *Z. thouzeti,* it is by all means possible that the species of this group actually form altogether a large superspecies which covers nearly the whole of Australia with about six more or less distinct populations. Because the presence of such a superspecies cannot be established without very good knowledge of distribution and of what is happening in the zone where two populations overlap – if there interbreeding takes place or not and to what extent – I preferred for the present to treat the populations as species, where the differences are rather obvious, or as subspecies, respectively, where they are not so significant. I am aware that in future it will be perhaps more convenient to treat at least *Z. australe* and *Z. thouzeti* as parts of a superspecies which, however, do probably not interbreed in most overlap areas. With regard to *Z. moorei I* do not feel sure to the same extent, that it should belong to such a superspecies.

Distribution

Prior to discussing distribution the current knowledge of distribution and life histories of the Australian *Zuphium* species should be briefly mentioned. Australian *Zuphium* species are rather rare in collections which is illustrated by the fact that less than 100 specimens from the Australian and the larger European and American museums were at hand, among them only 9 specimens from Western Australia and 11 from Northern Territory. Nearly all northern and western specimens were collected within last 25 years. The older material consists almost completely of single specimens, whereas recent collecting revealed some small series. This is surely due to the use of light traps, but it does not settle the question, whether the Australian *Zuphium* species have such a secret way of life as to escape the notice of collectors while using "traditional" methods, or if their great majority lives in such remote areas where so far no collecting work was carried out.

For settling these questions and for securing sufficient well dated material for the current revision, especially from northern and northwestern Australia, a travel was carried out by the author during November and December 1984 trough the northern parts of Northern Territory and of Western Australia. By means of daily collecting at light more than 20 additional specimens of three species were captured at several localities. This successful collecting illustrates, that at least northern and northwestern Australia is rather rich in species and that individuals are also not very rare. It is the question, if careful searching with adequate methods in other remote areas, f. e. Cape York Peninsula, interior of Northern Territory, or inland Queensland should not produce similar results.

In spite of careful searching by hand and by use of Barber-traps in areas, where *Zuphium* species had been captured at light or where they could be likely exspected (wet ground, borders of pools and rivers), only one further specimen could be discovered. Thus, *Zuphium* species must lead an extremely secret way of life, perhaps in deep earth cracks, beneath deeply imbedded stones or boulders or hidden in vegetation or leaf litter. Perhaps they do not live always in the immediate vicinity of water, as suppo-

Fig. 13. Distribution of *Zuphium australe australe* Chaudoir (●), *Z. australe millstreameanum* subspec. nov. (■), *Z. australe incertum* subspec. nov. (▼).

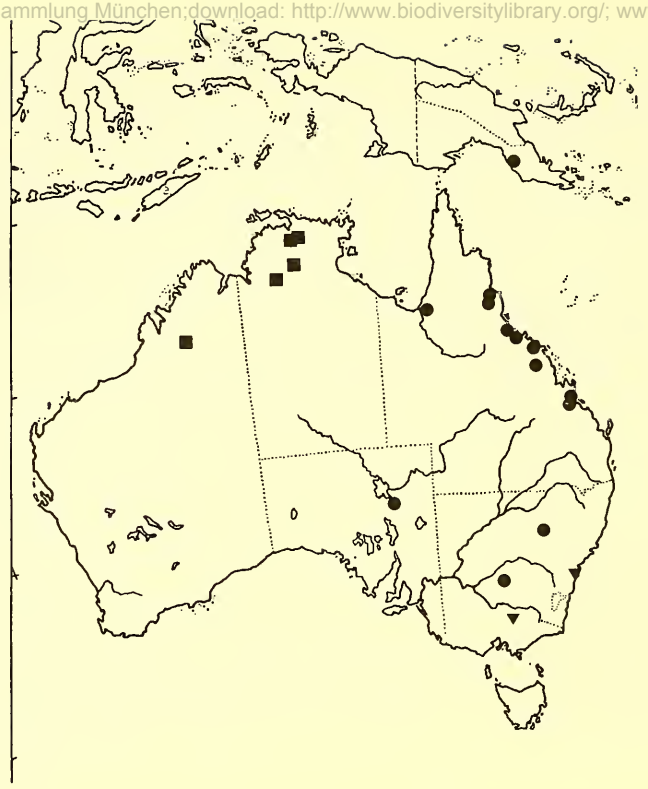


Fig. 14. Distribution of *Zuphium thouzeti thouzeti* Castelnau (●), *Z. thouzeti minor* subspec. nov. (■), *Z. castelnaui* Gestro (▼).

sed, but possibly rather far away from water or other wet places, as specimens have been captured at light where no water was present in the neighbourhood. On these grounds the suggested ranges of the species are most likely rather incomplete and tentative. The increasing use of light traps will perhaps change the known ranges very much and it is likely to be exspected, that still new species should be discovered.

With regard to the material at hand the current distribution can be described as following (figs. 13–15): Of the five Australian species (doubtful species as *Z. pindan* and *Z. fitzroyense* not considered) *Z. australe* and *Z. thouzeti* are by far most widely distributed. Both species occupy vast areas, but they overlap only in some rather narrow zones. *Z. australe* is distributed over much of Victoria, South Australia, the southernmost and southwestern parts of Queensland, and southern Western Australia, subspecies live also in northern Northern Territory and in the Hamersley Range in Western Australia. In most areas, however, relatively many specimens were discovered in more interior areas. Thus, *Z. australe* is perhaps more a dry country species. *Z. thouzeti* ranges over eastern Queensland, New South Wales, and northernmost South Australia, and inhabits also New Guinea. A subspecies lives in northernmost Northern Territory and in the Kimberley area of Western Australia. Both species overlap only in southern Queensland, northern New South Wales, and in Northern Territory, but actually *Z. thouzeti* seems to be more northernly distributed, while *Z. australe* is a southern species.

Z. castelnaui, Z. moorei, and *Z. macleayanum,* on the other hand, occupy rather limited areas. *Z. castelnaui* lives in (? southern) New South Wales and eastern Victoria, both other species in northern and northwestern Australia. Thus, three species and additional three subspecies occur only in tro-

pical northern Australia, two species in the south, and only one species in the northeast. This pattern of distribution is in harmony with the idea, that *Zuphium* is a pantropical faunal element immigrated into Australia from the north. As environmental conditions change very much towards southern Australia, such tropical-subtropical species find less adequate conditions there and become rarer. Perhaps also geological, geographic, or climatic barriers are important with regard to the rarity or the lack of species in some southern areas.

Concerning origin and history of the fauna it is presumably to be accepted that *Zuphium* came from southeastern Asia to Australia, because *Zuphium* is a rather modern taxon and was perhaps not a part of the old fauna of "Gondwanan" origin. According to the way in which such immigrations into Australia took place (Darlington 1961, 1971; Baehr in press), the immigration of the oldest stock presumably proceeded via New Guinea and the Cape York Peninsula. From there the original stock would have spread southwards and westwards over the rest of Australia. When accepting this idea, there are, however, some problems. The immediate vicinity of the immigration route, northeastern Queensland, is rather poor in species, as only *Z. thouzeti* occurs there. Because all other Australian species live in southern or, particularly, in northwestern Australia, only one stock, *Z. thouzeti* or its direct ancestor could have immigrated into Australia. He then diversified, but this took place only at the southern and western fringe of its range. Similar conditions as in Queensland exist in New Guinea, where also just one species, *Z. thouzeti,* occurs. In southeastern Asia *Zuphium* species are also rather poorly represented so far yet known. But we know nothing about any possible close relations of the Asiatic and Australian faunas. Thus, the true origin of the Australian Zuphiines remains obscure.

The idea of a northern origin of the Australian *Zuphium* species is in harmony with the supposed more advanced status of the southern and western *Zuphium* species and subspecies, as compared with the eastern *Z. thouzeti.* An exception of this pattern is perhaps *Z. macleayanum,* if its supposed primitive features do not actually constitute secondarly evolved advanced characters. If that should be true, then *Z. macleayanum* is well in accordance with the theory mentioned above. But if the characters of

Fig. 15. Distribution of *Zuphium macleayanum* spec. nov. (■), *Z. moorei* spec. nov. (●).

Z. macleayanum are primitive, indeed, then another possibility is to be considered. Distribution and primitive status of *Z. macleayanum* could then be evidence of another immigration route into Australia, namely across the Timor Sea directly to northwestern Australia. That immigration of *Z. macleayanum* or its ancestor does not exclude the immigration of other species along Cape York Peninsula, but then Australia would have been colonized twice and in different ways by *Zuphium* species. As mentioned above, there is much too less known about the fauna of southeast Asia for settling of these assumption. But we should bear in mind the possibility of such an independent immigration directly into northern Australia for further considerations.

Be that as it may, at any time there was very likely an east to south and an east to west migration of species within Australia. In the south the original stock split into *Z. australe* and *Z. castelnaui.* The last changed its habits perhaps to a more subterranean life. In the north and northwest, however, a migration to the west took place, where the most derivative species (and subspecies) now live. Perhaps the southern parts of the known range of *Zuphium* in Western Australia have been colonized from south, with the result that *Z. australe millstreameanum* in the Hamersley Range is now the northernmost post of that species in the West.

With regard to geographical and climatic history of Australia this would imply the slightest changes in the environment of *Z. thouzeti* in geological time, as northeastern Australia experienced always a more or less wet tropical or subtropical climate and was least affected by the generally increasing aridity of Australia since about last 10 millions of years. The northwestern and western populations, as well as the southwestern populations and those of interior Australia would have experienced more severe changes in their environmental conditions. As a consequence most northwestern and western species and subspecies are now isolated by rather large areas of unsuitable, dry country.

That isolation is the reason for the far greater species diversity in northwestern Australia as compared with eastern Australia. Due to the increasing aridity various refugial centres formed in the North and Northwest. The most important ones are Arnhem Land, the Kimberley Division, and the Hamersley Ranges. The importance and diversity of these refugia, with regard to Carabids, was already stressed by Freitag (1979) for Cicindelinae and by Baehr (1985 a, b) for some other Zuphiine genera. It is to be expected, that in future still more examples of this high degree of diversity will be discovered. So far known, northern and northwestern Australia contains in some Carabid groups much more species than eastern Queensland which was so far believed to hold by far the most diverse fauna of every part of Australia. The idea, that the fauna of Queensland is not as rich as that of northwestern Australia, however, is only applicable to the tropical and subtropical open country, perhaps only to the more hygrophilous fauna there.

Thus, the diversity of the faunas of northern and northwestern Australia is especially due to the existence of several refugia along a supposed migration route from northern Queensland across the northern part of Northern Territory to the Kimberley's and more southern parts of Western Australia. The evolution of these refugia, however, was by no means a simple event, but it was interrupted by wetter periods. That is the reason for the mosaic distribution of more or less well evolved endemic species and subspecies, respectively, in the same area, because during wetter times perhaps new immigrations into the refugia took place. Speciation was most intensive in the westernmost and most isolated refugia, especially the Kimberley's and the Hamersley area, no matter, in which direction colonization of the refugia took place.

With regard to *Z. australe millstreameanum* the Hamersley refugium seems likely to have been colonized from the south. There are vague indications, that this also happened in other species in that area (Baehr 1985 b), but most species in the Hamersley area show a northern origin.

Most of the considerations above are rather tentative, especially, because the next relatives of the Australian species are unknown. Therefore, no exact informations on time of origin of the species or time of arrival in Australia nor about their evolutionary rate within Australia are available. Certainly, however, the genus *Zuphium* lives for a rather long time in Australia. This is demonstrated by the very wide distribution of the genus over nearly the whole of Australia and by the presence of endemic spe-

cies or subspecies in various refugia, some of which were presumably colonized twice and contain now more distinctly separated taxa as well as less separated ones.

Literature

Baehr, M. 1984: Revision der australischen Zuphiinae 1. Gattung *Acrogenys* Macleay (Insecta, Coleoptera, Carabidae). – Spixiana **7**: 115–134

— — 1985 a: Revision of the Australian Zuphiinae 3. The genus *Pseudaptinus* Castelnau (Insecta, Coleoptera, Carabidae). – Spixiana **8**: 33–57

— — 1985 b: Revision of the Australian Zuphiinae 4. The genus *Parazuphium* Jeannel (Insecta, Coleoptera, Carabidae). – Spixiana, **8**: 295–321

— — (in press): Revision of the Australian Zuphiinae. 2. *Colasidia monteithi* sp. nov. First record of Leleupidiini in Australia. – Mem. Qld. Mus.

Basilewsky, P. 1951: *Leleupidia luvubuana,* nov. gen. et nov. sp. (Col. Carabidae). – Rev. Zool. Bot. Afr. **44**: 175–179

— — 1953: Révision des Leleupidiini (Col. Carabidae, Zuphiinae). – Rev. Zool. Bot. Afr. **47**: 263–281

— — 1963: Révision des Galeritinae d'Afrique et de Madagascar (Coleoptera, Carabidae). – Ann. Mus. Roy. Afr. Centr. **120**: 1–93

Bedel, L. 1914: Catalogue raisonée des Coléoptères du Nord d'Afrique, Paris 1895–1914

Castelnau, F. de, 1867: Notes an Australian Coleoptera, 1–139

— — 1868: Notes on Australian Coleoptera. – Trans. Proc. Roy. Soc. Victoria **8**: 95–225

Chaudoir, M. de, 1862: Matériaux pour servir à l'étude des Carabiques III. – Bull. Soc. Imp. moscou **35**: 275–320

Csiki, E. 1932: Coleopterorum Catalogus. Carabidae. Pars 124

Darlington, P. J. Jr. 1961: Australian Carabid beetles V. Transition of wet forest faunas from New Guinea to Tasmania. – Psyche, Cambridge, **68**: 1–24

— — 1968: The Carabid beetles of New Guinea III. Harpalinae continued. Perigonini to Pseudomorphini. – Bull. Mus. Comp. Zool. Harvard **137**: 1–253

— — 1971: The Carabid beetles of New Guinea IV. General considerations, analysis and history of the fauna, taxonomic supplement. – Bull. Mus. Comp. Zool. Harvard **142**: 129–337

Dejean, M. de, 1825: Spécies général des Coléoptères de la collection de M. le Compte Dejean. I. Paris

Freitag, R. 1979: Reclassification, phylogeny and zoogeography of the Australian species of *Cicindela* (Coleoptera: Cicindelidae). – Aust. J. Zool. Suppl. Ser. **66**: 1–99

Gestro, R. 1875: Note sopra alcuni Carabici. – Ann. Mus. Civ. Stor. Nat. Genova **7**: 850–894

Gistl, J. 1839: Systema Insectorum **I. 2**

Habu, A. 1967: Carabidae, Truncatipennes group (Insecta: Coleoptera). – Fauna Japonica, 1–338, Tokyo

Jeannel, R. 1942: Coléoptères Carabiques II. – Faune de France **40**. Paris

— — 1949: Coléoptères Carabiques de la Région Malgache. – Faune de l'Empire Francais **10**

Jedlicka, A. 1963: Monographie der Truncatipennen aus Ostasien. Lebiinae – Odacanthinae – Brachyninae (Coleoptera, Carabidae). – Ent. Abh. Mus. Tierk. Dresden **28**: 269–579

Lacordaire, T. 1851: Histoire naturelle des Insects. – Génera des Coléoptères **1**: 67–149

Latreille, P. A. 1806: Genera Crustaceorum et Insectorum **I**, Paris

Latreille, P. A. & M. de Dejean, 1822: Histoire naturelle et Iconographie des Coléoptères d'Europe **I**. Paris

Macleay, W. 1888: The insects of King's Sound and its vicinity. – Proc. Linn. Soc. New South Wales **3**: 443–480

Motschoulsky, V. 1850: Die Käfer Rußlands. Moscou

Reichardt, H. 1967: A monographic revision of the American Galeritini (Coleoptera, Caranidae). – Arq. Zool. Sao Paulo **15**: 1–176

Sloane, T. G. 1920: The Carabidae of Tasmania. – Proc. Linn. Soc. New South Wales **45**: 113–178

Schmidt-Göbel, H. 1846: Faunula Coleopterorum Birmaniae, 1–94

Dr. Martin Baehr
Zoologische Staatssammlung
Münchhausenstr. 21
D-8000 München 60