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Revision of the Australian Zuphiinae
6. The genus Planetes Macleay
Supplement to the other genera

(Insecta, Coleoptera, Carabidae)*

By **Martin Baehr**

Abstract

As last part of a general revision of the Australian Zuphiinae the Australian species of the genus *Planetes* Macleay are revised. The known species *P. australis* (Macleay) is redescribed and following species are newly described: *P. magelae* spec. nov., *P. angusticollis* spec. nov., and *P. millstreamensis* spec. nov.

The phylogenetic status of genus *Planetes* is briefly discussed. The differences between the Australian species are discussed and presented in a key. The Australian species are very similar, two species groups, however, can be recognized: 1. *P. australis* and *P. magelae*, 2. *P. angusticollis* and *P. millstreamensis*. 1st group shares some derivative characters, and *P. magelae* seems to be most derivative.

The known distribution of the species is mapped and the zoogeography of the genus in Australia is discussed. Apparently *Planetes* is a northern faunal element which immigrated rather recently from southern Asia. Subsequently the genus spread over northern tropical Australia and evolved new, endemic species in each of the main faunal refugia in northern and northwestern Australia.

The supposed phylogenetic relations of all Australian Zuphiine genera are shown in a cladogram, based on characters discussed in previous papers. Presumably, the Australian Zuphiine fauna is composed of a younger group of genera, fairly recently immigrated into Australia from the north *(Planetes, Colasidia, Zuphium, Parazuphium)*, and of an older faunal element of obscure origin and faunal history *(Acrogenys, Pseudaptinus)*. However, there are indications to a possible relation of *Planetes* to the primitive, endemic genus Acrogenys.

A taxonomic supplement to genera previously treated is added.

Introduction

The taxonomic status of *Planetes* is rather controverse. While Darlington (1968) ranked the genus amongst Zuphiini without mentioning any other subdivisions, Basilewsky (1963) and Reichardt (1967) included *Planetes* in subfamily Galeritinae or tribe Galeritini, respectively. Basilewsky (l. c.), however, gave *Planetes* the rank of an own tribe Planetini within Galeritinae. Habu (1967) placed *Planetes* as a subtribe Planetina within tribe Zuphiini, where Planetina has equal status to subtribes Galeritulina and Zuphiina. Jedlicka (1963) ranked *Planetes* as an own tribe Planetini and removed it from either Galeritulini or Zuphiini.

It is rather difficult to find out, which classification matches best the phylogenetical affinities of *Planetes*. Whereas Darlington (1968) and Jedlicka (1963) do not give any proofs for their classification, Basilewsky (1963), Reichardt (1967), and Habu (1967) draw the attention to the asymmetrically dilat-

* Supported by a travel grant from the Deutsche Forschungsgemeinschaft (DFG).

ed and clothed ♂ tarsi of *Planetes* and of Galeritini (-na), which is perhaps a (syn)apomorphic character of both taxa. Nevertheless, HABU did not explicitely establish a close relation of Planetina and Galeritulina on this character, whereas REICHARDT and BASILEWSKY do. REICHARDT (1967), however, in his key to tribes says, that the scapus of antenna is shorter than 2nd and 3rd segments together in Galeritini (including *Planetes),* which is certainly wrong in *Planetes.* He further considers a subdivision of his Galeritini unnecessary and places *Planetes* closer to genera *Galerita* and *Ancystroglossus* than to *Progaleritina* and *Eunostus,* unfortunately on the wrong statement „elytra lacking both basal seta-bearing puncture and setose marginal punctures". Perhaps, he never saw a *Planetes* in nature. This wrong observation, perhaps in association with the additional small secondary costae in *Planetes* and in some Galeritine genera led REICHARDT to his phylogenetic tree, where *Planetes* is next related to *Galerita,* whereas *Progalerita* and *Galerita* are much less closely related.

Actually, there are different stages of elytral sculpture within Galeritini (sensu BASILEWSKY 1963). Some genera have only primary intervals costiform, but they lack secondary costae *(Diabena, Galeritiola),* other genera possess also secondary costae *(Galeritula, Galeritella).* Without doubt the presence of similar secondary costae in *Planetes* is a convergent evolution, as Galeritini (sensu BASILEWSKY 1963) possess some undoubtedly synapomorphic characters, e. g. development of a narrow „neck", palpi with apical segment securiform, 1st antennal segment elongate and scapiform.

It is evident from the discussion above, that genus *Planetes* is perhaps rather closely related to Galeritini, but, on the other hand, that it cannot be included into Galeritini. Thus, I prefer to rank the genus as own subtribe Planetina constituting a tribe Galeritini, together with Galeritina, within Zuphiinae. As I do not know the American genus *Ancystroglossus* other than by description, I am not able to decide, whether *Ancystroglossus* should also belong close to *Planetes,* as REICHARDT (1967) says.

So far only one species of *Planetes* was described from Australia, namely *P. australis* (Macleay) from North Queensland. However, a *Planetes* is recorded from northwestern Australia (MACLEAY 1888), which likely represents another species. But is has been never described or mentioned otherwise.

Few is known on life history of *Planetes* in Australia. DARLINGTON (1968) notes that he collected *Planetes* in New Guinea and Australia „in swamps and beside standing water" and that they „often fly to light". Since most individuals at hand were captured at light, very little is actually known on habitat choice of *Planetes* species.

Generally, *Planetes* is considered a paleotropical genus with some species in Africa, but most in southern Asia, where the genus penetrates as far east as Japon. In Australia, *Planetes* is considered an immigrant from the north, the more, as *P. australis* occurs also in New Guinea (DARLINGTON 1968).

Australian specimens of *Planetes* are very rare in collections. By far most specimens at hand were collected since last 30 years, either by Darlington in North Queensland, or by Britton and others in Northern Territory. Additional rich material was captured by the author in Northern Territory and Western Australia in November–December 1984. Altogether the revision is based on 139 specimens.

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–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.

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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 – British Museum Natural History, London
BMH – Bernice P. Bishop Museum, Honululu
CBM – Collection M. Baehr, München
CMC – Collection B. P. Moore, Canberra
MCZ – Museum of Comparative Zoology, Cambridge/Mass.
MMS – Macleay Museum, Sydney
NMV – National Museum of Victoria, Melbourne
QM – Queensland Museum, Brisbane
SAM – South Australian Museum, Adelaide
UQ – University of Queensland Collection, Brisbane
ZSM – Zoologische Staatssammlung, München

Methods

Measurements

Measurements were made under a stereomicroscope with an ocular micrometer with 40× to 64× magnification. Overall length has been measured from tip of labrum to apex of elytra.

Distribution maps

Distribution maps are based only on label data of examined specimens. Label data of older specimens impossible to localize and also pure state records are not indicated in the maps.

Characters

The most important character for distinguishing of species is shape and size of aedeagus, especially shape of apex. Aedeagus carries two rather symmetrical, sclerotized lamellae ventrally in the orificium. Although range of body size overlaps in some species, size may be helpful for immediate recognition of species. In some species shape of pronotum is also determinative. Eye size and size of temples is rather different, size of temples varies from about $^1/_4$ of length of eyes in some species to about $^1/_{10}$ of eye length in others. In the last species posterior border of eyes is nearly perpendicular to head. But there is some sexual variation in length of temples in some species, ♀♀ tend to possess relatively smaller eyes. Pilosity of elytra is a good character for distinguishing of groups of species. Colour of appendages is different in some species, this difference is recognizable without difficulties in full-coloured specimens, but it may be difficult to see in immature specimens.

In most other respects, e. g. mouth parts, antennae, chaetotaxy, and sculpture of elytra the Australian *Planetes* are very similar.

All species are winged.

Classification

Subfamily Zuphiinae

For synonymy, for further comments, and for diagnosis see Baehr (1985 a). For determination of the genus *Planetes* see key to Australian and New Guinean genera of Zuphiinae in Baehr (1984).

Subribe Planetina

For limitation and taxonomic status of the subtribe see introduction, Basilewsky (1963), and Habu (1967). These authors present also extensive diagnoses and synonymies. The subtribe contains perhaps only the genus *Planetes* (and *Heteroglossa,* if this genus is justified), but see Reichardt (1967).

Genus Planetes

Planetes Macleay, 1825, p. 28
Csiki, 1932, p. 1567
Basilewsky, 1963, p. 8
Jedlicka, 1963, p. 464
Habu, 1967, p. 261
Reichardt, 1967, p. 11
Darlington, 1968, p. 220

For further information see Csiki (1932).

Type species: *Planetes bimaculatus* Macleay, 1825

Diagnosis

Head only slightly constricted to a neck. Eyes large, protruding, temples short, at most $^1/_4$ of eye size. Mentum with a prominent, sometimes incised tooth. Glossa somewhat produced medially, with about 10 bristles. Paraglossae membraneous, elongate, apex free. Palpi pilose, rather short. Terminal segments not considerably enlarged. Labrum six-setose. Posterior supraorbital seta inserted in front of posterior border of eyes. Posteriorly and ventrally of eyes a row of long bristles. 1st antennal segment not very elongate, nor scapiform, about as long as 2nd and 3rd segments together, with one long tactile seta and several short erect setae. Pronotum transverse to heart-shaped, two pairs of marginal setae present. Elytra depressed, intervals costate with two secondary costae between them. Basal pore present, marginal pores and setae present and elongate. Upper surface densely punctate and pilose. Last abdominal segment with 6–10 setae in both sexes. 1st–3rd segments of ♂ anterior tarsus slightly asymmetrical, with two oblique rows of adhesive hairs each. Aedeagus not deformed, orificium with two sclerites. Right paramere smaller than left. All Australian species are winged.

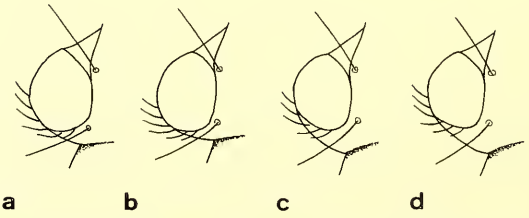

Fig. 1. Left side of head, showing length ratio eye/temple of Australian *Planetes*. a. *P. australis* (Macleay); b. *P. magelae* spec. nov.; c. *P. angusticollis* spec. nov.; d. *P. millstreamensis* spec. nov.

Key to Australian species of Planetes

1. Pronotum more or less heart-shaped (Figs. 3c, d), narrower, ratio width/length less than 1.1. Lateral channel of pronotum deeper, lateral border recurved inside of anterior angles. Temples longer, about $^1/_4\times$ as long as eyes (Figs. 1c, d). Mandibles elongate, lateral border nearly straight (Fig. 2b). Lateral border of elytra meeting base in a more or less obtuse angle (Figs. 4b, c). Only primary costae with a row of hairs each side (Fig. 5b), altogether 13 rows from 1st to 7th interval . . . . . 2.
– Pronotum transverse, not distinctly heart-shaped (Figs. 3a, b), ratio width/length 1.15 or more, lateral channel shallow, lateral border not distinctly recurved inside of anterior angles. Temples very short, at most $^1/_6$ of length of eyes or shorter (Figs. 1a, b), posterior border of eyes nearly perpendicular. Mandibles short, lateral border curved regularly (Fig. 2a). Lateral border of elytra meeting base without angle (Fig. 4a). Each interval with a row of hairs, altogether 19 rows from 1st to 7th interval (Fig. 5a) . . . . . 3.

2. Pronotum strongly heart-shaped, anterior angles distinctly produced (Fig. 3c). Pronotum widest at or before first quarter, in front of anterior lateral seta. Elytra long and slender, ratio length/width about 1.8. . . . . *angusticollis* spec. nov.

– Pronotum less heart-shaped, anterior angles little produced (Fig. 3d). Pronotum widest at first third, slightly behind anterior lateral seta. Elytra less slender, ratio length/width about 1.67. Aedeagus very short and stout, apex short, slightly turned up (Fig. 9) . . . . . *millstreamensis* spec. nov.

3. Larger, 8.7–9.9 mm, average in ♂♂ 9.3 mm, in ♀♀ 9.6 mm. 1st antennal segment and tibiae not perceptibly darkened. Temples slightly longer, eyes less strongly protruding. Aedeagus stouter, apex more upturned (Fig. 7). . . . . *australis* (MACLEAY)

– Smaller, 7.8–8.7 mm, average in ♂♂ 8.2 mm, in ♀♀ 8.45 mm. 1st antennal segment and tibiae on outer surface darkened. Temples slightly shorter, eyes more strongly protruding. Aedeagus more delicate, apex depressed, less upturned (Fig. 8) . . . . . *magelae* spec. nov.

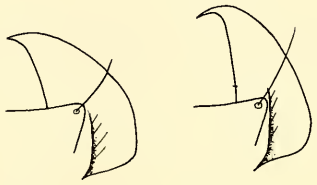

Fig. 2. Mandibles of Australian *Planetes*. a. *P. magelae* spec. nov.; b. *P. angusticollis* spec. nov.

Description of species

Planetes australis (Macleay, 1871)
(Figs. 1a, 3a, 7, 10)

Polystichus australis Macleay, 1871, p. 82
Planetes australis, CHAUDOIR, 1872, p. 139
CSIKI, 1932, p. 1567
DARLINGTON, 1968, p. 221

Holotype: „*Polystichus australis* Macl. Rockhampton" (written by Macleay) (ANIC). The unique specimen cannot be sexed, because it still consists of meso- and metathorax, elytra and abdomen, which, however, has been eaten.

Locus typicus: Rockhampton, Queensland.

Appointment of specimens to this species is especially due to size of elytra.

Diagnosis: The largest Australian species, characterized by its transverse pronotum, not darkened appendages, and by large aedeagus with upturned apex.

Description:

Length: 8.7–9.9 mm, width: 3.35–3.5 mm.

Colour: Black, mouthparts, antennae and legs dark yellow to light brown, 1st antennal segment and tibiae not perceptibly darker.

Head: Eyes large, protruding, temples short, $^1/_6$–$^1/_8$ of length of eyes, shorter in ♂, slightly longer in ♀. Posterior border of eyes slightly oblique. Palpi rather elongate, last segment of maxillary palpus about 3.5× as long as wide. Mandibles rather short, lateral border evenly rounded, tip just sligthly hooked.

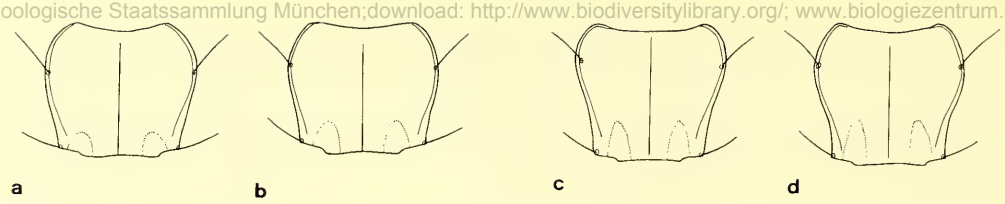

Fig. 3. Pronota of Australian *Planetes*. a. *P. australis* (Macleay); b. *P. magelae* spec. nov.; c. *P. angusticollis* spec. nov.; d. *P. millstreamensis* spec. nov. Not to scale.

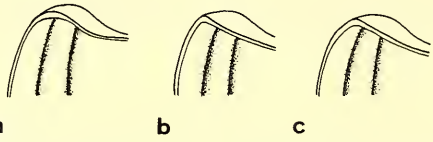

Fig. 4. Elytra at shoulders of Australian *Planetes*. a. *P. magelae* spec. nov.; b. *P. angusticollis* spec. nov.; c. *P. millstreamensis* spec. nov.

Pronotum: Transverse, about 1.15–1.2× as wide as long. Anterior angles not produced, widely rounded off. Lateral channel not recurved inside at anterior angles. Base about as wide as apex, lateral border just slightly concave in front of posterior angles. Base laterally strongly oblique. Lateral channel shallow, basal grooves rather short, shallow. Pronotum widest just behind anterior lateral seta, at or slightly behind first third.

Elytra: Elongate, nearly parallel, ratio length/width about 1.65–1.75. Shoulders rounded, lateral border meeting base without angle. Each costa with a row of hairs, altogether 19 rows from 1st to laterally of 7th interval.

Aedeagus: Large and stout. Apex rather elongate, tip of apex considerably turned up. Dorsal surface near apex perceptibly bent down.

Variation: Little apart from some variation in size and shape of pronotum, which in some specimens may be slightly more concave in front of posterior angles. Elevation of secondary costae also varies to some extent, they are mostly somewhat lower than primary costae. Different size of temples is a secondary sexual character.

Distribution (Fig. 10): Northeastern Queensland, south to Rockhampton; New Guinea.

Material examined (23 specimens):

Queensland: 1 (sex?), Rockhampton, Holotype! (ANIC); 1 ♀, Hitchinbrook Island, Gayundah Cr. 7.–15. XI. 1984, Monteith, Cook & Thompson (QM); 1 ♂, 1 ♀, Cairns (ANIC); 5 ♂♂, 9 ♀♀, v. Cairns, II. 1958, Darlington (CBM, MCZ); 1 ♂, Stewart River, 5 km w. Pt. Stewart, 25.–27. VI. 1978 (QM); 1 ♂, Qld, French Coll. (NMV).

New Guinea: 1 ♀, se. Popondetta, 1.–4. IX. 1963, Sedlacek (BMH).

Without locality, perhaps Queensland: 1 ♂, 1 ♀ (UQ).

Activity period: Records are from February (Darlington's series), June, September, and November.

Habits: Perhaps in swamps and near standing water, under debris and vegetation, flies to light.

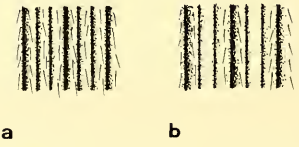

Fig. 5. Pattern of pilosity on elytra of Australian *Planetes*. a. *P. magelae* spec. nov.; b. *P. angusticollis* spec. nov.

Planetes magelae spec. nov.
(Figs. 1b, 2a, 3b, 4a, 5a, 6, 8, 10)

Types: Holotype: ♂, 12°35′ S, 132°52′ E, Magela Creek, 2 km N of Mudginbarry HS, N. T., 14. XI. 1972, M. S. Upton (ANIC). Paratypes: 2 ♀♀, same locality, same date (ANIC), 1 ♀, 12°22′ S, 133°01′ E, Magela Creek, N. T., 1 km NNW of Mudginbarry HS, 25. V. 1973, Matthews & Upton (ANIC); 54 ♂♂, 33 ♀♀, NT, Magela Creek, 3 km n Mudginberry, 3. XI. 1984, at light, M. & B. Baehr (BMH, BMNH, CBM, MCZ, NMV, QM, SAM, ZSM); 1 ♀, 12°48′ S, 132°42′ E, Nourlangie Creek, 8 km N of Mt. Cahill, N. T., 19. XI. 1972, M. S. Upton (ANIC); 1 ♂, Oenpili, N. T., from P. Cahill Cr., 5. XII. 1928 (NMV); 1 ♂, 1 km W of Baralili Ck. crossing on Arnhem Hwy nr Jabiru, M. W. Light, 25. VI. 1980, M. B. Malipatil (CMC); 1 ♀, N. T. Junction of Arnhem Hwy & Oenpelli Road, M. V. Light, 26.–27. VI. 1980, M. B. Malipatil (CMC); 2 ♂♂, 1 ♀, 12°22′ S, 133°01′ E, 6 km SW by S of Oenpelli, NT., 6. VI. 1973, Upton & Feehan (ANIC); 2 ♀♀, 12°23′ S, 132°57′ E, 5 km NNW of Cahill's Crossing, East Alligator River, N. T., 28. V. 1973, E. G. Matthews (ANIC); 2 ♀♀, 7 km NW by N of Cahill's Crossing, East Alligator River, N. T., 27. V. 1973, E. G. Matthews (ANIC); 1 ♀, 12°23′ S, 132°56′ E, 7 km NW by N of Cahill's Crossing, East Alligator River, N. T., 9. VI. 1973, Upton & Feehan (ANIC); 1 ♂, same locality, 4. XI. 1972, at light, E. Britton (ANIC); 1 ♂, 12°46′ S, 132°39′ E, 12 km NNW of Mt. Cahill, N. T., 20. V. 1973, E. G. Matthews (ANIC); 1 ♀, 12°47′ S, 132°51′ E, Baroalba Creek Springs, NT., 19 km NE by E of Mt. Cahill, 28. X. 1972, at light, E. Britton (ANIC); 2 ♂♂, 1 ♀, Coastal Plains Rsrch Stn., C.S.I.R.O., nr Darwin, N. T. at light, 6. VI. 1966, E. C. B. Langfield (ANIC); 1 ♂, 1 ♀, same locality, same collector, IX. 1966 (ANIC); 1 ♂, 1 ♀, Fogg Dam, n. Coastal Plains Res. Stn., NT, 5. XI. 1984, at light, M. & B. Baehr (CBM); 1 ♀, Daly R. Mission, NT., 6. VI. 1974, at light, J. Hutchinson (ANIC).

Locus typicus: Magela Creek, n. of Mudginberry, Northern Territory.

Diagnosis: A medium sized species with transverse, not cordiform pronotum, distingushed from *P. australis* by smaller size, darkened 1st antennal segment and tibiae, and by less stout aedeagus with less thickened apex.

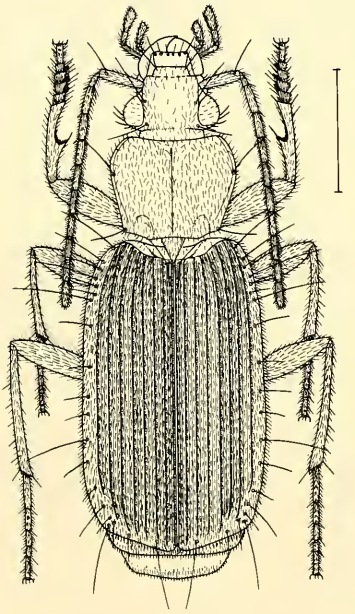

Fig. 6. *Planetes magelae* spec. nov., ♂ holotype (ANIC). Scale: 2 mm.

Description:

Length: 7.8–8.7 mm, width: 2.9–3.1 mm.

Colour: Black, mouthparts, antennae, and legs dark yellow to light brownish, 1st antennal segment and outer surface of tibiae considerably darkened.

Head: Eyes large, strongly protruding, temples very short, about $^1/_{10}$ of length of eyes or still less, not much larger in ♀♀. Posterior border of eyes nearly perpendicular. Palpi rather elongate, last segment of maxillary palpus about 3.5× als long as wide. Mandibles short, lateral border regularly curved, tip just slightly hooked.

Pronotum: Transverse, about 1.15–1.2× as wide as long. Anterior angles not produced, widely rounded off. Lateral channel not recurved inside of anterior angles. Base about as wide as apex, lateral border very slightly concave in front of posterior angles. Base laterally strongly oblique. Lateral channel inconspicuous, shallow. Basal grooves rather shallow, circular. Pronotum widest just behind anterior lateral seta, at or slightly behind first third.

Elytra: Elongate, parallel, ratio length/width about 1.65–1.7. Shoulders rounded, lateral border meeting base without angle. Secondary costae not much lower than primary costae. Each costa with a row of hairs, altogether 19 rows from 1st to laterally of 7th interval.

Aedeagus: Elongate, less stout than in *P. australis*. Apex rather elongate, tip not much turned up, nor thickened. Dorsal surface near apex not perceptibly bent down.

Variation: Little apart from some variation of size and of shape of pronotum. Tip of aedeagus in some specimens slightly more turned up. Dark colour of 1st antennal segment and of tibiae visible also in not fully mature specimens.

Distribution (Fig. 10): Extreme northern part of Northern Territory.

Material examined (114 specimens): Only type series.

Activity period: Specimens have been collected in May, June, and from August to December, most, however, in November, but several specimens also during dry season (May, June). The lack of records from January to April is certainly due to the inaccessibility and inhospitability of Arnhem Land during wet season which lasts from mid of December to April.

Habits: Most specimens were captured at light, near billabongs and creeks, and near East Alligator River. The specimens from the large series collected by the author at Magela Creek flew to light near the edge of a large billabong, single specimens were observed under plant debris near water.

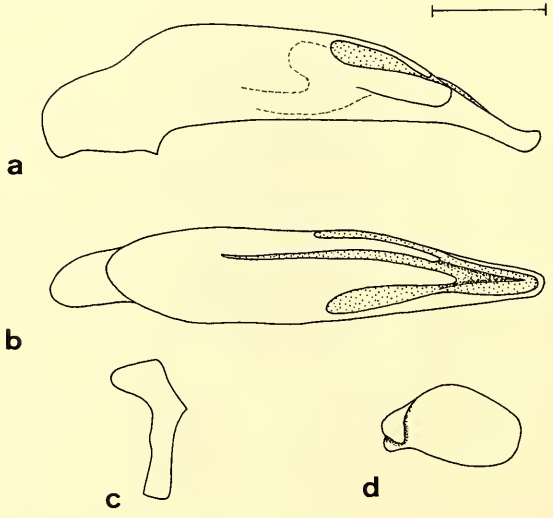

Fig. 7. *Planetes australis* (Macleay), aedeagus. a. left side; b. ventral side; c. rigth paramere; d. left paramere. Scale: 0.5 mm.

Planetes angusticollis spec. nov.
(Figs. 1c, 2b, 3c, 4b, 5b, 10)

Holotype: ♀, Bessie Spring, 16°40′ S, 135°51′ E, 8 km ESE of Cape Crawford, NT., 26. X. 1975, M. S. Upton (ANIC).

Locus typicus: Cape Crawford, northern Northern Territory.

Diagnosis: A medium sized, narrow species, characterized by heart-shaped pronotum widest near apex, by relatively large temples, and by angulate shoulders.

Description:

Length: 8.25 mm, width: 2.8 mm.

Colour (specimen perhaps not fully coloured): Elytra nearly black, pronotum and head dark brown, mouthparts, antennae, and legs dark yellowish.

Head: Eyes not very large, not so strongly protruding, temples large, about $^1/_4$ of length of eyes. Posterior border of temples rather oblique. Palpi rather short, terminal segment of maxillary palpus less than 3× as long as wide. Mandibles narrow, elongate, lateral border in middle nearly straight, tip strongly hooked. Surface of head rather densely setose.

Pronotum: Rather narrow, heart-shaped, ratio width/length 1.08. Base narrower than apex, sides concave in front of base. Pronotum widest at first fourth, in front of anterior lateral seta. Border not strongly curved inwards to anterior angles. Anterior angles produced, strongly rounded, lateral channel recurved inside of anterior angles. Base laterally moderately oblique. Lateral channel conspicuous, deep, basal grooves deep, oblong. Pilosity of surface fairly elongate, slightly hirsute.

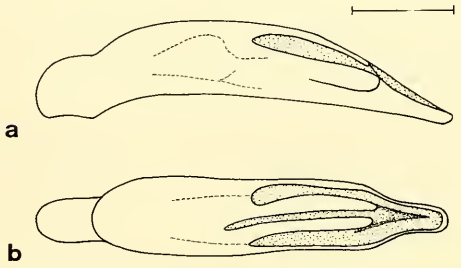

Fig. 8. *Planetes magelae* spec. nov., aedeagus. a. left side; b. ventral side. Scale: 0.5 mm.

Elytra: Narrow, elongate, parallel, ratio length/width about 1.8. Lateral border meeting base in a distinct, obtuse angle at shoulders. Primary costae considerably more prominent than secondary costae. Only primary costae with a row of hairs each side, altogether 13 rows from 1st to laterally of 7th interval.

Aedeagus: Unknown.

Variation: Unknown.

Distribution (Fig. 10): Only known from type locality, northern part of Northern Territory.

Material examined (1 specimen): Only holotype.

Activity period: Type collected in October.

Habits: Unknown.

Planetes millstreamensis spec. nov.
(Figs. 1d, 3d, 4c, 9, 10)

Holotype: ♂, Fortescue River near Millstream, WA, 3.–5.XII. 1984, at light, M. & B. Baehr (ANIC).
Locus typicus: Millstream, Western Australia.

Diagnosis: A medium sized species, characterized by heart-shaped pronotum widest behind first third, by relatively large temples and slightly angled shoulders. The aedeagus is small and very stout.

Description:

Length: 8 mm, width: 2.8 mm.

Colour: Black, mouthparts, antennae, and legs light brown.

Head: Eyes not strongly protruding, temples rather large, about $^1/_4$ of length of eyes. Posterior border of eyes strongly oblique. Palpi rather short, terminal segment of maxillary palpus less than 3× as long as large. Mandibles slender and elongate, lateral border in middle nearly straight, tip rather strongly hooked. Surface of head moderately pilose.

Pronotum: Rather narrow, heart-shaped, ratio width/length about 1.08. Base about as wide as apex, sides concave. Pronotum widest at first third, slightly behind anterior lateral seta. Anterior angles not much produced, widely rounded, lateral channel recurved inside of anterior angles. Base moderately oblique laterally. Lateral channel fairly conspicuous, basal grooves rather deep, oblong. Pilosity of surface not hirsute.

Elytra: Medium sized, ratio length/width 1.67. Lateral border meeting base in a very obtuse angle at shoulders. Primary costae considerably more prominent than secondary costae. Only primary costae with a row of hairs each side, altogether 13 rows from 1st to laterally of 7th interval.

Aedeagus: Small and short, but rather bulky, considerably curved. Apex short, slightly turned up. Left paramere very large and wide.

Variation: Unknown.

Distribution (Fig. 10): Only known from the vicinity of Millstream, Western Australia.

Material examined (1 specimen): Only holotype.

Activity period: Holotype collected in December.

Habits: The unique specimen flew to light in the wide, but at this locality and at this time completely dry, sandy bed of Fortescue River.

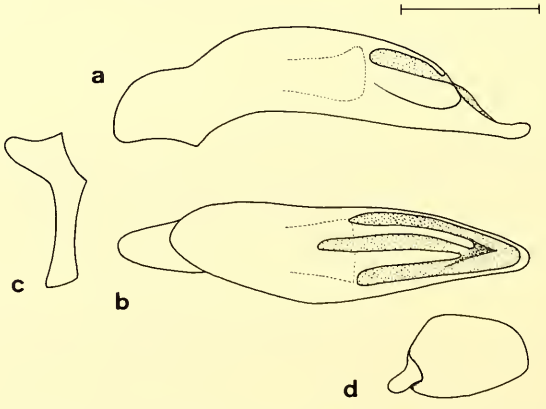

Fig. 9. *Planetes millstreamensis* spec. nov., aedeagus. a. left side; b. ventral side; c. right paramere; d. left paramere. Scale: 0.5 mm.

Doubtful species

There is a notice of a *Planetes* from the vicinity of King's Sound, northern Western Australia by Macleay (1888). He says, that his specimen is "altogether a smaller insect than those from the East Coast, and may be another species, but I cannot make out any good specific difference". I saw the specimen from the Macleay Collection (MMS), but as only the partly damaged elytra are left, virtually nothing can be said about the specific status of that insect. Judging from size of elytra, the individual was presumably not longer than 8 mm, perhaps it was yet smaller. Presumably, it does not belong to either *P. australis* or *P. magelae*, because primary costae are by far stronger developed than secondary costae. Perhaps it belongs near to the *P. angusticollis* – *P. millstreamensis*-group.

Taxonomic supplement to other genera

Since publication of the first parts of the revision of the Australian Zuphiinae some important new material came to light, in particular some museum specimens, received to late to be included into the first parts, but also material recently collected by the author in northwestern Australia.

Genus *Acrogenys* (see Baehr 1984)

Acrogenys hirsuta Macleay, 1864

1 ♀, Moreton Bay, Qld., Pascoe Coll. (BMNH); 6 ♂♂, 2 ♀♀, Rockhampton, Qld. (BMNH); 1 ♀, Queensland, Masters, Fry Coll. (BMNH); 1 ♀, Queensland, Coll. Simson (BMNH); 1 ♀, N. Australia, Pascoe Coll. (BMNH).

All records are from within known range of this species.

Acrogenys laticollis Baehr, 1984

1 ♂, Union Reefs, WA (BMNH).

In the British Museum an additional specimen from the type locality of this newly described species was discovered. It is a topotype.

Genus *Pseudaptinus* (see Baehr 1985 a)

Pseudaptinus fulvus (Castelnau, 1867) (Fig. 11)

1 ♀, Cunnamulla, Qld. (SAM); 2 ♀♀, New South Wales, Fry Coll. (BMNH); 2 ♀♀, Mt. Painter, Flinders Range, South Australia (SAM).

The Queensland and South Australia records extend the known range of this species considerably (see Fig. 11), and provide further evidence, that it is an inland species.

Pseudaptinus brittoni Baehr, 1985

1 ♂, 1 ♀, Fortescue River, Hamersley Range (SAM); 3 ♂♂, 1 ♀, Fortescue River near Millstream, WA 3. XII. 1984, at light, M. & B. Baehr (CBM); 1 ♂, 1 ♀, Hooley Creek, 68 km nw Wittenoom, WA, 2. XII. 1984, at light, M. & B. Baehr (CBM).

The species was so far known only from the immediate vicinity of Millstream, Western Australia. The new records indicate a wider inland distribution of the species along the Fortescue River valley.

Pseudaptinus iridescens Baehr, 1985 (Fig. 12)

12♂♂, 11♀♀, 17 km ne Willeroo, NT, at light, 8.XI.1984; 2♀♀, 75 km e Timber Creek, NT, 10.XI.1984; 1♀, Victoria River, 11 km e Timber Creek, NT; 1♂, 1♀, Ord River near Ivanhoe, WA, 12.XI.1984; 1♂, 135 km n. Hall's Creek, WA, 14.XI.1984; 1♂, 1♀, Ord River, 105 km n Hall's Creek, WA, 15.XI.1985; 1♂, Mary River, 135 km wsw Hall's Creek, WA, 18.XI.1984; all at light, all leg. M. & B. Baehr (CBM, ZSM).

As mentioned by Baehr (1985a), this species is perhaps the most widely distributed *Pseudaptinus* in Australia, records are lacking only from South Australia and from most of Western Australia. The numerous new records now render it the best known species of *Pseudaptinus* in Australia. It seems to be rather widely distributed in northern and northwestern Australia, where it has been now discovered as well near running or standing waters, as well as in localities far away from any open water. In spite of careful searching, however, no specimen was captured by other collecting methods than by lighting. Perhaps this species (and other *Pseudaptinus* species) has a very secret way of life imbedded in the earth or deeply hidden in earthcracks, at least during the very hot time just before onset of wet season. Because of the numerous new records a revised distribution map is presented (Fig. 12).

Pseudaptinus monteithi Baehr, 1985 (Fig. 13)

1♀, Murray Bridge, SA, 28.XI.1887 (SAM); 1♀, Lake Callabonna, SA, A. Zietz (SAM); 1♂, New South Wales (SAM); 1♂, Fortescue River, Hamersley Range, WA, Dodd (SAM); 1♀, Hooley Creek, 68 km nw Wittenoom, WA, at light, 2.XII.1984, M. & B. Baehr (CBM).

The records from South Australia and from Western Australia extend the range of this species to a considerable degree. The known range is shown in the revised distribution map (Fig. 13). *P. monteithi* is also an inland species, but most exactly localized records are from the vicinity of creeks, rivers, or lakes.

Pseudaptinus hirsutulus Baehr, 1985

1♂, Magela Creek, 3 km n Mudginberry, NT, 3.XI.1984, at light, M. & B. Baehr (CBM).

This record is from within range of this species, but is it so far the first capture of that species in summer. This is perhaps due to the inaccessibility of this area and the difficulties in collecting in Arnhem Land during wet season.

Genus *Parazuphium* (see Baehr 1985b)

Parazuphium mastersii (Castelnau, 1867)

1♀, Bogan River, NSW, J. Armstrong (BMNH).

Record from within the known range of this species.

Genus *Zuphium* (see Baehr 1986)

Zuphium thouzeti thouzeti Castelnau, 1867

1♂, Townsville, Qld., 8.II.1902, Dodd (BMNH); 1♂, Queensland, Simson (BMNH).
Both specimens belong to the nominate race of that species.

Discussion

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

The systematic position of the genus *Planetes* has been discussed in introduction and will be treated below in this paper. Within the Australian Zuphiine fauna *Planetes* is in some respects very derivative, in others it is more generalized than most Zuphiines. Apomorphic characters of *Planetes* are:

1. Elytral intervals costiform
2. Presence of secondary costae on elytra
3. Regular pattern of elytral pilosity, each costa or each primary costa with a row of hairs
4. Asymmetrical shape and clothing of ♂ protarsus

In comparison with the highly evolved genera *Zuphium* and *Parazuphium*, *Planetes* shows several generalized characters, that are evidence of a basal branching off of *Planetes* from the main Zuphiine stock (see Fig. 14 and discussion below). Because of the numerous generalized characters, *Planetes* comes rather near to *Acrogenys*, which is perhaps the most primitive Australian Zuphiine genus. Both genera, however, share perhaps some apomorphic characters, as f. e. the asymmetrical shape and clothing of ♂ protarsus (less well developed in *Acrogenys*) and the tendence to develop ridge-like intervals (but perhaps convergently), and they may be thus rather closely related.

Within Australian species of *Planetes* two species groups are recognizable:

1. group: *P. australis*, *P. magelae*
2. group: *P. angusticollis*, *P. millstreamensis*

Distinctive characters of these groups are (1. group first):

1. Transverse – heart-shaped pronotum
2. Small, perpendicular – large, oblique temples
3. Short, wide, laterally curved – elongate, narrow, laterally straight mandibles
4. Elongate, narrow – stouter, shorter palpi
5. Rounded – more or less angulate shoulders
6. A row of hairs on each stria – a row of hairs only laterally to each primary costa
7. Secondary costae rather similar to primary costae – secondary costae much smaller than primary costae

In most characters it is hardly possible to decide, which character state is generalized or derivative, respectively, because no attempt has been made towards a phylogenetical analysis or a reconstruction of the „Grundplan" of the whole genus. But certainly these species groups reflect phylogenetical units. Suggestions can be made only for 6th and 7th characters which seem to be developed to an apomorphic state in 1st group. With respect to 6th character attention is to be drawn to the more primitive genus *Heteroglossa* which has a row of hairs only laterally to primary costae, too, according to Habu (1967). This character state is thus perhaps plesiomorphic. Similar shape of primary and secondary costae is perhaps apomorphic, since this state is the logic consequence of the development of secondary costae. Moreover, a similar character state transformation is also seen within Galeritina.

If these assumptions are true, then 1st group is perhaps more derived in some respects, than 2nd group. Within 1st group, *P. magelae* represents a slightly more derivative state than *P. australis*.

Distribution

Like most other Australian Zuphiines specimens of genus *Planetes* are rare in most collections. Moreover, over 95 % of the specimens available were collected within last 30 years, most even within last 10 years. This rarity indicates either a rather secret way of life of the species, or that they are distributed in very remote areas. That the last assumption is true at least for one species, is indicated by the rich material of *P. magelae*, collected by Britton and others and more recently by the author in Northern Territory, where the species does not seem to be very rare. But this might be different in other parts of Australia, f. e. in north Queensland.

Anyway, it is worth noting, that we certainly know far to less on distribution and habits of the Australian species. Perhaps, still more species will be discovered in future, and the known ranges of the described species are likely to change, when more material, especially from virgin areas is available.

With regard to the material at hand the current distribution is (Fig. 10): *P. australis* occurs in north Queensland (and New Guinea), south at least to Rockhampton, but perhaps not west of Great Dividing Range. It is the single species in Queensland. Two species live in Northern Territory: *P. magelae* in the northernmost part, from Arnhem Land west to Daly River, and *P. angusticollis* in northeastern Northern Territory. *P. millstreamensis* is so far only known from type locality at Fortescue River in Western Australia. An additional record, perhaps of a new species, is from Kimberley Division in northwestern Australia.

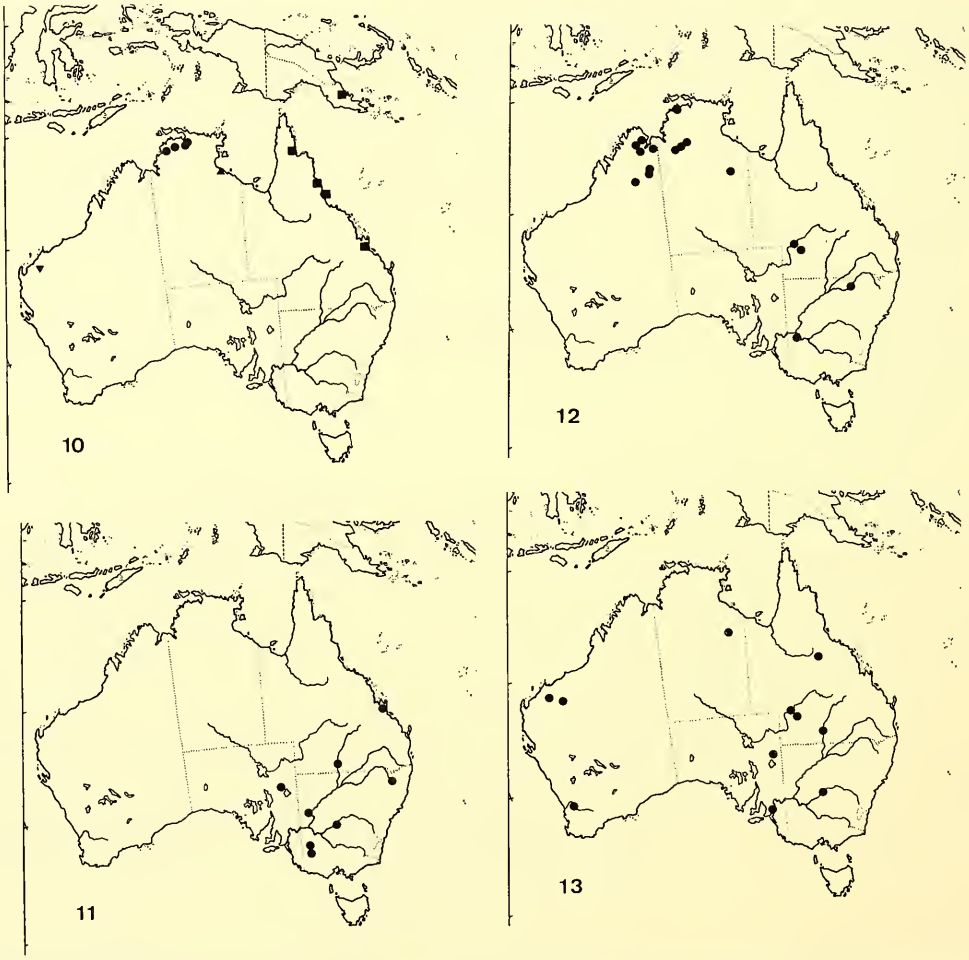

Fig. 10. Distribution of *Planetes australis* (Macleay): ■; *P. magelae* spec. nov.: ●; *P. angusticollis* spec. nov.: ▲; *P. millstreamensis* spec. nov.: ▼.

Fig. 11. Distribution of *Pseudaptinus fulvus* (Castelnau).

Fig. 12. Distribution of *Pseudaptinus iridescens* Baehr.

Fig. 13. Distribution of *Pseudaptinus monteithi* Baehr.

All Australian *Planetes* occur in northern, tropical-subtropical Australia. This distribution pattern is in harmony with the idea, that *Planetes* is an Old World tropical faunal element, that immigrated into Australia from the north. The occurrence of one Australian species, *P. australis,* in New Guinea strengthens this assumption, and it clearly demonstrates, that immigration of *Planetes,* at least of the *australis*-group, took place via New Guinea and Cape York Peninsula. With regard to present distribution, *P. magelae* seems to be a rather recently evolved off-shoot of *P. australis,* which evolved in the course of the immigration of the *P. australis* stock into Northern Territory. Due to very unsatisfactory information on distribution of the species of 2nd group, history of this group is rather obscure. In some respects *P. angusticollis* is rather similar to *P. cordens* Darlington from New Guinea, which belongs perhaps to the same group. This close relation of Australian species to some species from New Guinea indicates, that the species of 2nd group or the stock from which they evolved, immigrated also from New Guinea. The actual immigration route, however, is obscure.

Although no clear zoogeographical conclusions can be drawn in view of present unsatisfactory information, distribution pattern points to a migration of species from Queensland to Northern Territory and to Western Australia. Due to very close relationships of all species this migration occurred presumably rather recently, perhaps during one of the last glaciation periods, when wetter climate in northern Australia permitted such migrations (see Freitag 1979, Kemp 1981). As a consequence of increasing aridity during Interglacials several refugial centres formed in northern and northwestern Australia, where the invaded populations were subsequently isolated and where they eventually evolved into new taxa. Apparently, isolation in these refugias continued just long enough to permit evolution of separate species.

This isolation is the reason for the greater species diversity in northern and northwestern Australia, in spite of the less suitable environmental conditions in these refugias, than in eastern Queensland. Thus, each refugium, Arnhem Land, Kimberley Division, Hamersley Range, has its peculiar species, while whole eastern Australia has also only one species.

Phylogenetic relations within the Australian Zuphiine fauna

Phylogenetic state and possible relations of the Australian genera are shown in Fig. 14, using characters discussed in the previous papers on Australian Zuphiinae (Baehr, 1984, 1985 a, b, 1986, in press) and above in this paper. The cladogram is based on following apomorphic characters, some, however, evolved possibly convergently in different groups and some are morphoclinic characters:

1. Very small size
2. Light colour
3. Very small eyes
4. Extremely elongate head behind eyes
5. Strongly enlarged, glandular terminal segment of labial palpus
6. Moniliform antennae
7. Strongly compressed neck
8. Complete loss of continuous elytral striae
9. Wing reduction
10. Asymmetrical shape and clothing of ♂ protarsus
11. Tendence to evolve costiform intervals

11'. All intervals costiform

12. Aedeagus with two sclerotized lamellae
13. Multiplication of anterior lateral seta on pronotum
14. Wing reduction
15. Presence of secondary costae
16. Regular pattern of pilosity of elytra
17. Light colour

18. Moderately elongate basal antennal segment
19. Tendence to reduction of tactile setae at odd intervals
19'. Complete lack of tactile setae at odd intervals
20. Depressed body
21. Strong contraction of neck
22. Enlarged temples with posterior supraorbital seta far removed from eye
23. Elongate, scapiform basal antennal segment
24. Slender, elongate antennae
25. Weak striation of elytra with just slightly convex intervals
26. Dense and depressed pilosity of elytra
27. Very elongate antennae
28. Very elongate palpi
29. Small size
30. Light colour
31. Strongly enlarged, square posterior part of head
32. An additional (temporal) seta behind eye, medially of posterior supraorbital seta
33. Additional tactile setae on basal antennal segment
34. Advanced posterior angles of pronotum
35. Short and inconspicuous or missing posterior lateral seta of pronotum
36. Very weak striation of elytra with depressed intervals
37. Distinctly sinuate and excised apex of elytra
38. Tendence of aedeagus and parameres to become deformed

Especially relation of Planetes and *Acrogenys,* or of *Planetes* with main body of Zuphiinae, respectively, is unsettled, because decision is difficult, whether characters 10, 11, and 12 are convergently evolved or not.

The Australian Zuphiine fauna as a whole

Compared with the faunas of other regions, f. e. Africa or South Asia, the Australian Zuphiine fauna is rather rich and diverse. 30 species are thus far known from Australia which are distributed in the six genera *Acrogenys, Pseudaptinus, Colasidia, Planetes, Zuphium,* and *Parazuphium.* Compared with the regions mentioned above, Australia is especially rich in rather generalized species of genera *Acrogenys* and *Pseudaptinus,* which are both lacking from Africa and South Asia. Only the neotropical Zuphiine fauna is equally diverse and contains also many primitive forms. This leads to the question, whether Australia was either a centre of evolution of Zuphiinae, or whether it is merely a refugium for ancient groups, which were displaced by modern (northern) groups elsewhere.

For settling of this question the Australian Zuphiine fauna must be critical considered. With respect to distribution patterns and phylogenetical states the Australian Zuphiine fauna is obviously composed from two different groups. One group comprises generalized, "ancient" genera as *Pseudaptinus* and perhaps *Acrogenys* with apparently no relatives elsewhere in the Old World, the second consists of either modern genera *(Zuphium, Parazuphium)* or very peculiar genera which are perhaps well separated from main body of subfamily for a long time *(Planetes, Colasidia),* and which possess both close relatives in South Asia and in Africa, but not or less so in the New World. This pattern leads to the conclusion, that colonization of Australia occurred in two different ways. The modern genera and the aberrant groups (Leleupidiini, Planetina) certainly immigrated from north via South Asia and perhaps New Guinea, and this immigration occurred rather recently, with the consequence, that the Australian and Asiatic (and New Guinean) forms are closely related. In several genera this immigration is perhaps not yet finished. The migration route was either the Cape York Peninsula or, in some cases, the immigration took perhaps place directly into Northern Territory or northwestern Australia.

The ancient Zuphiine groups in Australia, however, live in this continent for a long time, as no relatives have been discovered in other regions except for Neotropis and southern Nearctis.

In the view of these considerations it must be denied, that Australia was a main evolution centre of Zuphiinae, because most of its fauna is rather young and clearly of northern origin. Australia is rather a refugium, where some old taxa were able to survive in spite of several recent invasions of modern forms. With respect to genus *Acrogenys,* perhaps the most archaic Zuphiines survived in Australia. It is speculative, whether in Africa or South Asia such old forms died out or whether they did not occur at any time.

To conclude, the diversity of the Australian Zuphiine fauna is mainly the result of three events: 1. The very long isolation of the continent, that enabled several ancient forms to survive. 2. The fairly recent contact of Australia to the Old World tropics, that caused an intensive immigration of northern species into Australia. 3. The migrations of populations within northern Australia in times of wetter climate with subsequent evolution of several new, endemic species in the various refugia throughout northern Australia.

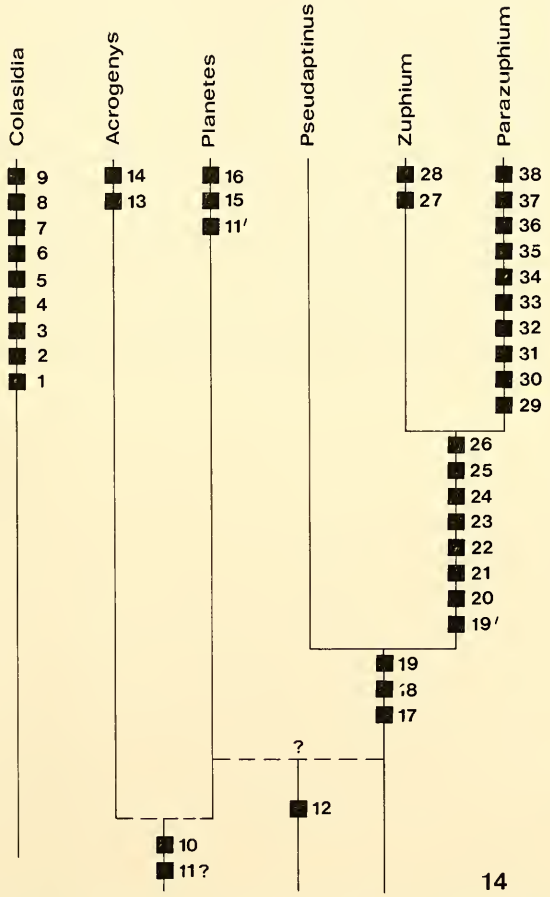

Fig. 14. Cladogram of the supposed relations of the Australian genera of Zuphiinae. Only apomorphic characters shown. 11', 19': strongly apomorphic characters, perhaps end of morphoclines. ?: character state perhaps convergently evolved. For explanation of numbers see text.

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