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TRIDACTYLIDS AND TETRIGIDS (ORTHOPTERA) FROM SULAWESI, INDONESIA

by

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Abstract

The tridactylids and tetrigids from the Project Wallace and other expeditions to Sulawesi are identified and where available notes on their biology are appended. Two widespread south-east Asian species constitute the surprisingly small tridactylid fauna so far known. Four tetrigid species new to science are described, six new to Sulawesi are listed, and the presence of 13 previously recorded there is confirmed. Two tetrigid species described from Sulawesi are synonymised. The tetrigid faunas of North, Central, and South Sulawesi are distinct; they may have arrived on different fragments of continental plate and failed to mix appreciably. The prospects for a radical revision of the Tetrigidae of the region are outlined.

Introduction

Hancock (1915) lists 47 Indian tetrigid specimens which he reworked after Kirby (1914) had determined them. They agreed fully on the identity of only two specimens; moreover, of the nine specimens which Kirby labelled *Hedotettix gracilis* De Haan, Hancock deemed there to be six species in four genera (none of them *Hedotettix*). Again, within the 13 specimens which Kirby regarded as *Euparatettix personatus* (Bolivar), Hancock found eleven species in five genera. These discrepancies suggest that not only are tetrigids a "difficult group" but that one of the difficulties is the wide disparity between one worker's appreciation of infra-specific variation and another's.

A successful revision of the group, now overdue, may depend on establishing a numerical basis for deciding what constitutes variation within species, genera etc. We hope to use the long series which were collected during Project Wallace to this end. If no such basis is established, further revisions may simply pit another set of concepts against those implicit in previous revisions, and add to the synonymy. There are so few reliable characters that recourse to a multivariate ordination, using numerous characters in combination, is a possible solution.

A particular difficulty with tetrigids from the islands of the Oriental Region is that many species are weak flyers or apterous, so that gene flow between the islands is likely to be far below that once thought needed for genetic cohesion between the populations. The large number of endemic genera is one obvious consequence, but we also meet instances where a species found on one island is very similar, but not identical, to a related species from another island. Whether it should be described as new becomes an existentialist problem, where decisions are made with inadequate evidence to support them. In view of the high degree of endemism in south-east Asian tetrigids, the attribution of a given specific name to material from widely separated continents is questionable.

Cousin (1961) has drawn attention to the existence of "sibling" species (espèces sosies) in gryllids, whereby populations doubtfully separable morphologically but long isolated geographically, e.g. in Africa and South America, may be capable of hybridising and giving rise to fertile offspring. White (1978: 32) questions the role of cohesive forces (gene-flow) in preventing speciation, and notes that we have no means of measuring them even approximately. He considers it legitimate to regard the origin of genetic isolating mechanisms rather than subdivision of the gene-pool as the prime cause of speciation. Since tetrigids have, superficially at least, uniform caryotypes the prospects for unequivocal resolution of their taxonomic problems by cytogenetic analysis seem remote. However, the shapes of different species are characteristic, and

susceptible to numerical analysis.

A partial revision of south-east Asian tetrigids is under way, based on the multivariate analysis of 80 morphological characters assessed on each specimen. This analysis will be described elsewhere. Provisional identifications are offered here for tetrigids, as Kevan (1966) recommends, although tridactylids are definitively identified from the male genitalia (Blackith & Blackith, 1979). To avoid repetition, all collecting localities are Indonesia, Sulawesi and unless otherwise stated, in the Dumoga-Bone National Park, Sulawesi Utara. All material collected by us is dated between 3.i.1985 and 28.iii.1985; for long-lived insects in an almost unvarying habitat on the equator, with, locally, no clear rainy season, further precision as to dates seems pointless.

For biogeographical purposes we consider Sulawesi to be divided into three regions; north of the equator; central (between the equator and latitude 4°S); and south of latitude 4°S. These arbitrary divisions are based on major gaps between areas where collecting has been done.

Anatomical nomenclature follows Albrecht (1953) except that the armament of the hind tibiae is called teeth, rather than spinules, which implies articulation. Several characters useful in tetrigid taxonomy have received little or no attention in the literature; two that are used here are the organisation of the thoracic pleura (fig. 1) particularly the presence or absence of a visible suture on the mesepisternum, and the arrangement of prominent sensilla on the inner face of the hind femora, proximal to the genicular region (fig. 2). These sensilla are often arranged in two groups, a central cluster roughly half-way between the dorsal and ventral margins of the inner face, and a row or cluster much nearer the dorsal margin. In some species, there is a process or fold in the dorsal carena of the hind femur here called the pregenicular fold, proximal to the ante-genicular tooth (fig. 2b). Two characters that our long series show to be sufficiently unreliable to be more of a hindrance than a help are the colour pattern and the relative lengths of the pulvilli on the first segment of the hind tarsi.

Abbreviations: BMNH = British Museum (Natural History); LEM = Lyman Entomological Museum (Macdonald College of McGill Univ., Quebec); MB = Museum Bogorensis, Java, Indonesia; MNHNP = Muséum National d'Histoire Naturelle, Paris; NMI = National Museum of Ireland, Dublin; RNHL = Rijksmuseum van Natuurlijke Historie, Leiden.

TRIDACTYLOIDEA: Tridactylidae

Tridactylus riparius Saussure, 1877

Material studied: 10♂, 10♀ (Blackith); 5♀, 7.vii.1985 (Butlin); 3♂, 5♀, 15—18.ix.1985 (Ashe).

There is no discernable variation in the abundance of this species over the nine months covered by these collections, the first ever made, so far as we can judge, from Sulawesi.

T. riparius occurs on silt and silt-filled gravel banks along the Dumoga, Bone, Toraut, Tumpah and Pononontuna Rivers. A creek on the left bank of the Toraut upstream from the Maze was chosen for a capture – recapture experiment. This was an area of 12 sq. m. covered with long sparse grass and inhabited by frogs and water-snakes. On 2.ii.85, 25 males and 18 females were marked with a spot of yellow oil paint on the pronotum and released. Two days later 102 males and 55 females were captured of which four and one respectively, were marked. A simple Lincoln Index calculation suggests that the population contained 637 males and 990 females, roughly 128 individuals per sq. metre. We think this is as dense a population as occurs in the region.

Tridactylus opacus Walker, 1871

Material studied: 2♂, 15-18.ix.1985 (Ashe).

These few specimens were taken in a Malaise trap near "The Maze" on the Toraut River.

Both species of *Tridactylus* range from India to Sulawesi, but neither occurs in Australia (K. K. Günther, 1978).

TETRIGOIDEA: Tetrigidae

As there is no substantially complete or agreed classification of this family into sub-families it will be treated provisionally as an entity.

Diotarus pupus Bolivar, 1887 (fig. 2d)

Material studied: 4♂, 4♀, Edwards' Camp; 1♂, '1440' summit; 1♂, 1♀, Gunung Muat, on crests of ridges in forest, among leaf litter (Blackith).

New to Sulawesi, but occurs in the Philippines.

Hirrius montanus Günther, 1937

Material studied: 1♂, Sulawesi Tengah, Mount Tambusiasi, 1200 m, 3-13.iv.1980 (Brendell) (BMNH).

Described from south Sulawesi.

Eucriotettix aff. **dammermanni** Günther, 1938 (fig. 2c)

Material studied: 10♂, 18♀, widely distributed within the Dumoga-Bone National Park (Blackith); 1♂, 28.vi.1985 (Butlin); 2♂, 18.ii.1985 (Holloway); 1♀, Plot A (BMNH Fogging Team) (BMNH).

This is a strong flyer and was often taken at lights.

Kevan (1966) comments that the taxonomy of the large genus *Eucriotettix* Hebard is "in rather a chaotic state so that accurate determinations are virtually impossible". *E. dammermanni* was described from Sevesi Island (between Java and Sumatra) and, if the identification is correct, is new to Sulawesi where it seems to be associated with running water.

Eucriotettix ridleyi Günther, 1938

Material studied: 1 ♂, 1 ♀, Hog's Back Camp, on forest floor (Blackith); 1 ♂, same data, on logs, 29.vi.1985 (Butlin).

Described from Singapore. If the identification is correct, it is new to Sulawesi. The species is unusual in having no sensilla immediately proximal to the genicular area inside the hind legs.

Scelimena celebica (Bolivar, 1887)

Material studied: 3♂, 5♀ (Blackith).

This is the only species of Günther's "Scelimenae verae" found during the expedition. It inhabits rock-strewn river banks and gullies with running water in rain-forest, often at low light intensities where no other riverine tetrigid can survive. As Humbert, quoted by Bolivar (1887) notes, it swims and takes off from water, flashing its striking blue wings. We collected it wherever there was permanent running water in deep shade and boulders with a matrix sufficiently porous to allow continuous algal growth on which it feeds (Blackith, in press). Described previously from North Sulawesi, where it is apparently endemic.

Between 28.i.85 and 25.iii.85 an isolated population in a deep gully about 5 m below the forest floor, through which a stream runs into the left bank of the Toraut in the Maze, was subjected to five successive capture-recapture experiments. A different coloured or positioned mark was placed on the pronotum on each occasion, using dots of oil-paints. Between 24 and 47 adults were marked on each occasion. Numbers, rates of immigration, and death, were calculated by Jolly's method as programmed by Davies (1971).

The population was enclosed by areas inhospitable to the species except up-stream, and a few individuals including one marked specimen, were found 150 m away from the experimental area, which occupied 12 sq. m. of the stream bed. By the end of the experiment, about half the individuals bore paint. The maximum population was estimated as 214, with standard error of 64. Probabilities of survival were never significantly less than unity, and estimates of recruitment or loss never significantly greater than zero.

Our impression is that the population is remarkedly stable, with long-lived adults, much more than three months, and few nymphs. It is hard to conceive of environmental factors likely to trigger substantial change, apart from non-seasonal phenomena such as vulcanicity, windblows, or man's activity.

However, Dr. R. Butlin (personal communication), who took part in Project Wallace between June and August 1985, examined the population several times during that period and saw no marked individuals. Various currently unverifiable explanations suggest themselves; there may have been a sharp onset of mortality, or the marks may have worn off.

Tondanotettix modestus Günther, 1937

Material studied: 1♂, Edwards' Camp, on ridge in leaf litter (Blackith); 2♂, 2♀, Gunung Mogogonipa, on logs, 5.vii.1985 (Butlin).

Described from north Sulawesi. The metepisternum has a large (0.25 mm) rounded process with no obvious sensilla, apparently engaging with the ventral margin of the pronotum.

Tegotettix corniculatus celebensis Günther, 1937

Material studied: 1♀, Sulawesi Tengah, Ramu River Area, nr. Morowali (Brendell) (BMNH).

Described by Günther, as a subspecies of *Tegotettix corniculatus* (Stål), from south Sulawesi.

Euparatettix celebicus (Hancock, 1907)

Material studied: 2♀, Sulawesi Tengah, Ramu River Area, nr. Morowali, 27.i—20.iv.1980 (Brendell) (BMNH).

Described from south Sulawesi in the genus *Hedotettix* Hancock, this species is said by Günther (1937) to be closely allied to *E. personatus*, *E. tricarinatus*, and *Paratettix histricus*, all three of which occur on the island, and may have speciated there.

Euparatettix personatus (Bolivar, 1887)

Material studied: 2♂, 2♀, Sulawesi Tengah, Ramu River Area, nr. Morowali, 27.i—20.iv.1980 (Brendell) (BMNH).

Recorded by Günther (1937) from south Sulawesi.

Paratettix tricarinatus Bolivar, 1887

Material studied: 3♂, 3♀, Sulawesi Tengah, Ramu Camp, Kolonodale area, at black light, 29.i.1980 (P. G. Kevan) (LEM); 1♂, 3♀, Sulawesi Utara, Gua Kapur, on Limestone with grass cover, 7.viii.1985 (Butlin).

The Ramu Camp specimens bear a label with the same determination by D. K. McE. Kevan. Described from the Philippines, new to Sulawesi.

Paratettix aff. **mimus** Bolivar, 1887

Material studied: 5♂, Sulawesi Tengah, Ramu Camp, Kolonodale Area (P. G. Kevan) (LEM).

P. mimus was described from the Philippines, but is new to Sulawesi.

Hedotettix costatus Hancock, 1912

Material studied: 1♂, 1♀, 1.vii.1985 (Butlin); 5♀, Sulawesi Utara, nr. Dolodua, from egret's crop, 5.iv.1986 (C. Vermeulen).

These specimens might well be *H. gracilis* De Haan and *H. costatus* may itself be a synonym of *H. gracilis*; *H. costatus* is recorded by Günther (1937) from south Sulawesi. The species seems to be adapting to life in paddy fields.

Loxilobus insidiosus Bolivar, 1887

Material studied: 1♂, 2♀, Lombongo Village (Blackith); 2♂, 2♀, Lombongo Village, 6.viii.1985 (Butlin); 2♀, Manado (Blackith).

Kevan (1966) notes that the genus *Loxilobus* Bolivar is almost certainly polyphyletic and its taxonomy chaotic. The above species has a wide range from Malaysia to the Philippines, and Günther (1937) records it from north Sulawesi.

Loxilobus rugosus celebensis Günther, 1937

Material studied: 3♂, 3♀, Lombongo Village, along tributaries of the Bone River (Blackith).

Günther (1937) described this form as a subspecies of *L. rugosus* Bolivar, which is a Bornean species. However, during the description he calls it *L. celebensis*, probably indicating that it had virtually specific rank in his mind. The type locality is south Sulawesi.

Systolederus ophthalmicus Bolivar, 1887

S. carli celebensis Günther, 1937: 189. **Syn. nov.**
S. fruhstorferi Günther, 1937: 189. **Syn. nov.**

Material studied: 8♂, 10♀ (Blackith); 2♂, 6.viii.1985 (Butlin); 1♀, 28.viii.1985 (Kirk-Spriggs) (BMNH); 1♂, x.1985 (Ashe).

Günther (1937) erected *S. carli celebensis* and *S. fruhstorferi* because of differences in the relative lengths of the pulvilli on the first segment of the hind tarsi and in colour patterns. He was unable to see the type of *S. ophthalmicus* and had to rely on Bolivar's limited description based on a single female. Inspection of this type and of a long series of specimens from the Toraut region of Minahassa shows that colour pattern and the relative lengths of the pulvilli fall into the category of characters which are collectively useful but individually unreliable.

There is an apparently continuous range of relative lengths (denoting the lengths of the pulvilli seriatim by pl, p2 and p3) from pl = p2 = p3 (as Bolivar claims for the type of *S. ophthalmicus*), through p3 = pl + p2 (as in the description of *S. carli celebensis*) to rare specimens with p3 > pl + p2 as in the description of *S. fruhstorferi*. In fact, careful measurement of Bolivar's type shows that pl = p2 = 0.20, but p3 = 0.25 mm on both legs.

No character has been found to distinguish forms within this range, although the sensory pads on the tips of the maxillary palps (when examined at X 160) do appear to be smaller and more elliptical in the one specimen we have attributable on Günther's description to *S. fruhstorferi*; this may be idiosyncratic.

The locally common species inhabits boulders in fairly open rivers, not in deep shade, particularly the Tumpah River and a waterfall some 4

km north-east of Lombongo. Aspects of its biology have been described by Blackith (in press), and it appears to be endemic to north Sulawesi.

Coptotettix alfurus Günther, 1937

Material studied: 3♂, 4♀, Huntuk trail and '1440' summit (Blackith); 6♂, 7♀, Gunung Poniki, leaf-litter and sphagnum, 14—15.viii.1985 (Butlin); 1♂, 3♀, Gunung Mogogonipa, 30.vii.1985 (Butlin); 1♀, Gunung Poniki, 18.x.1985 (Monk) (BMNH).

An apterous, high altitude, form living in leaf-litter, with several colour patterns. Described from south Sulawesi.

Coptotettix interruptus Bolivar, 1887

Material studied: 4♂, 3♀, streams feeding the Bone River (Blackith); 1♂, 6.vii.1985 (Kirk-Spriggs) (BMNH); 1♀, Gunung Muat, Lakes Bungalow, 14.vii.1985 (Butlin).

The possibility that this is the alate form of *C. alfurus* seems to be discounted by the fact that the two forms live in quite different habitats, at different altitudes. Described from Java, previously recorded from Sulawesi by Günther (1937).

Hyboella overbecki Günther, 1939

Material studied: 1♂, Gua Kapur, nr Gorontalo, leaf litter in woods on limestone, 7.viii.1985 (Butlin); 1♂, Gunung Poniki, Ice Station Zebra, 14.viii.1985 (Butlin).

Previously recorded from Java and Sumatra (Günther, 1955) and new to Sulawesi. The Gua Kapur specimen is teneral.

Probolotettix corticolus sp. n.
(figs. 2b, 3)

Holotype, ♀, Indonesia: Sulawesi Utara, Dumoga-Bone National Park, 13.iii.1985 (Blackith) (RNHL).

Paratypes, 2♂, 2♀, same data (Blackith) (BMNH; LEM; NMI; MB).

Head and anterior segments of pronotum as in fig. 3. Vertex (4.7 mm). wider than eye (4.0 mm). Frons visible throughout, in side view, between eyes. Scape dorso-ventrally compressed, pedicel sub-spherical. Lateral carenae of vertex joining median carena of fastigium, terminating caudad in small black horns adpressed to inner

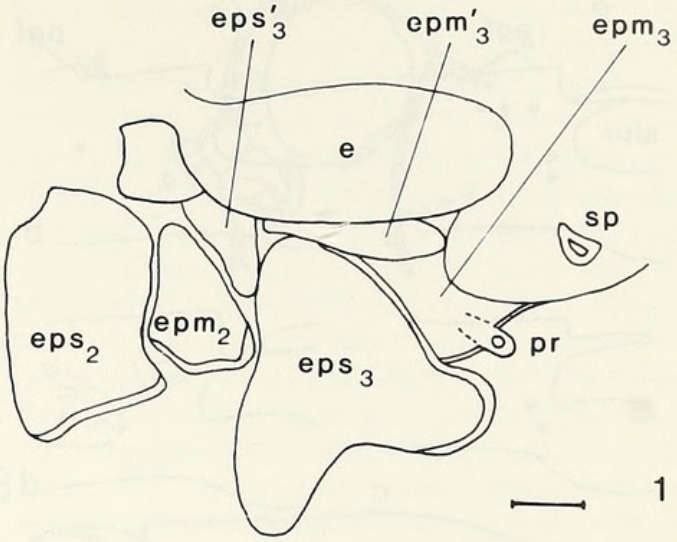


Fig. 1. *Probolotettix kevani* sp. n. Organisation of pleural segments of meso- and metathorax. e = elytron, sp = spiracle, eps_2 = mesepisternum, epm_2 = mesepimeron, eps'_3 = meta-anepisternum, eps_3 = metakatepisternum, epm'_3 = meta-anepimeron, epm_3 = metakatepimeron, pr = (proprioceptive) process on metakatepimeron. Scala-line 0.25 mm.

eye margins. Palps only slightly elliptical in cross section.

Vertical furrows of pronotum c and d deep, becoming obsolete towards median carena, linked at base by deep transverse furrow k. Furrow e obsolete. Prozonum upturned against back of head. Infrascapular area (viewed × 160) with smooth lower carena. Pronotal disc brown, maculate black. Elytra elliptical (1.6 mm × 0.6 mm). Wings fully developed, exceeding pronotum by about 1.4 mm. Cells in cubital area black, cross-veins white. Transverse suture on mesepisternum weakly developed.

Ventral carenae of fore-and mid-femora without fringe of long golden hairs. Fore-femora lobed. Hind femora with eight fragae on outer face, but no callosities. Five conspicuous white sensilla on inner face of hind femora, proximal to genicular area. The largest sensillum measures 0.6 mm × 0.45 mm. Hind tibia with six teeth on outer, five on inner, margins. Pulvilli on first segment of hind tarsi 0.6, 0.6 and 1.4 mm long. Ovipositor valves slender (upper valve 1.2 mm × 0.3 mm).

Other material studied: 2♂, 3♀ standing over a label "*Criotettix* sp." in the National Museum of Ireland have more robust ovipositor valves (0.9 × 0.5 mm) and are from Java. It seems unwise to designate these specimens as paratypes although they appear to belong to *P. corticolus*.

This species was found on the bark of trees, whether upright or fallen, in deep forest along

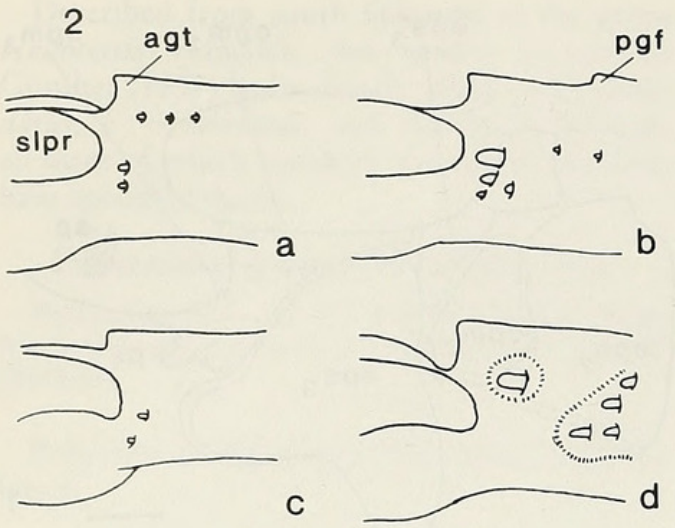


Fig. 2. Arrangement of sensilla on internal face of hind tibia. (Diagrammatic). slpr = semilunar process, agt = antegenicular tooth, pgf = pre-genicular fold; a, *Probolotettix kevani* sp. n.; b, *Probolotettix corticolus* sp. n.; c, *Eucriotettix* aff. *dammermanni* Günther; d, *Diotarus pupus* Bolivar. Scala-line 0.5 mm.

the Huntuk trail in the area between the Toraut and Tumpah rivers. Records of partly corticolous tetrigid species are scattered throughout the literature, but in this case the species has been found only on bark.

Probolotettix kevani sp. n.
(figs. 1, 2a, 4)

Holotype, ♂, Indonesia: Sulawesi Tengah, Ramu Camp, Kolonodale area, 5.ii.1980 (P. G. Kevan) (LEM).

Paratypes, 4♂, 2♀, Sulawesi Utara, Dumoga-Bone National Park (Blackith); (BMNH, NMI, MB, MNHNP); 1♂, 2♀, same locality, 17.v—16.vii.1985 (Butlin) (LEM, BMNH, NMI); 1♀, same data, at light, 19.vii.1985 (Butlin) (RNHL); 1♂, Gunung Poniki, at light, 15.viii.1985 (Butlin) (RNHL); 1♀, same locality, 6.vii.1985 (Kirk-Spriggs) (BMNH).

Body colour brown, dorsal areas of epimera black, raised pronotal disc bordered russet, pigmented across pronotum, anterior part black, posterior yellow. Eyes globular, ocelli large (0.18 × 0.12 mm) frons arcuate in profile, prozonal carenae of pronotum divergent cephalad, mesepisternal suture obsolete, elytra 1.1 × 0.5 mm, wings exceeding pronotum by 2 mm.

Fringe of white setae on ventral carena of mid-femora. Hind tibia with eight teeth on inner, seven on outer, margins. Sensilla on inner face of hind femora as fig. 2a, pregenicular fold on dorsal carena. Pulvilli on first segment of hind tarsi produced into sharp points. The species is distinguished from *P. corticolus* by the arcuate frons, and the lateral carenae of the vertex which are distinctly higher than the median carena in profile (fig. 4).

The species differs from all those assigned to the genus by Günther (1939) in having the vertex visible between the eyes in profile, a feature which it shares with *P. corticolus*. It is, however, very similar to *P. sundaicus* Günther from which it differs, apart from the projection of the vertex, in size, although *P. sundaicus* appears to be confined to western Indonesia.

The species is widespread in Sulawesi Utara and inhabits river banks together with *S. ophthalmicus*. It flies strongly and comes to light readily.

P. kevani is also the predominant species recovered from the crops of egrets and herons feeding in and around paddy fields in areas of north Sulawesi from which forest had been cleared. It appears to be able to thrive in rice-growing areas. These specimens, recovered by Dr. Charlotte Vermeulen, were sent to me accompanied by specimens collected directly from the paddy fields, many of which proved to be *P. kevani*.

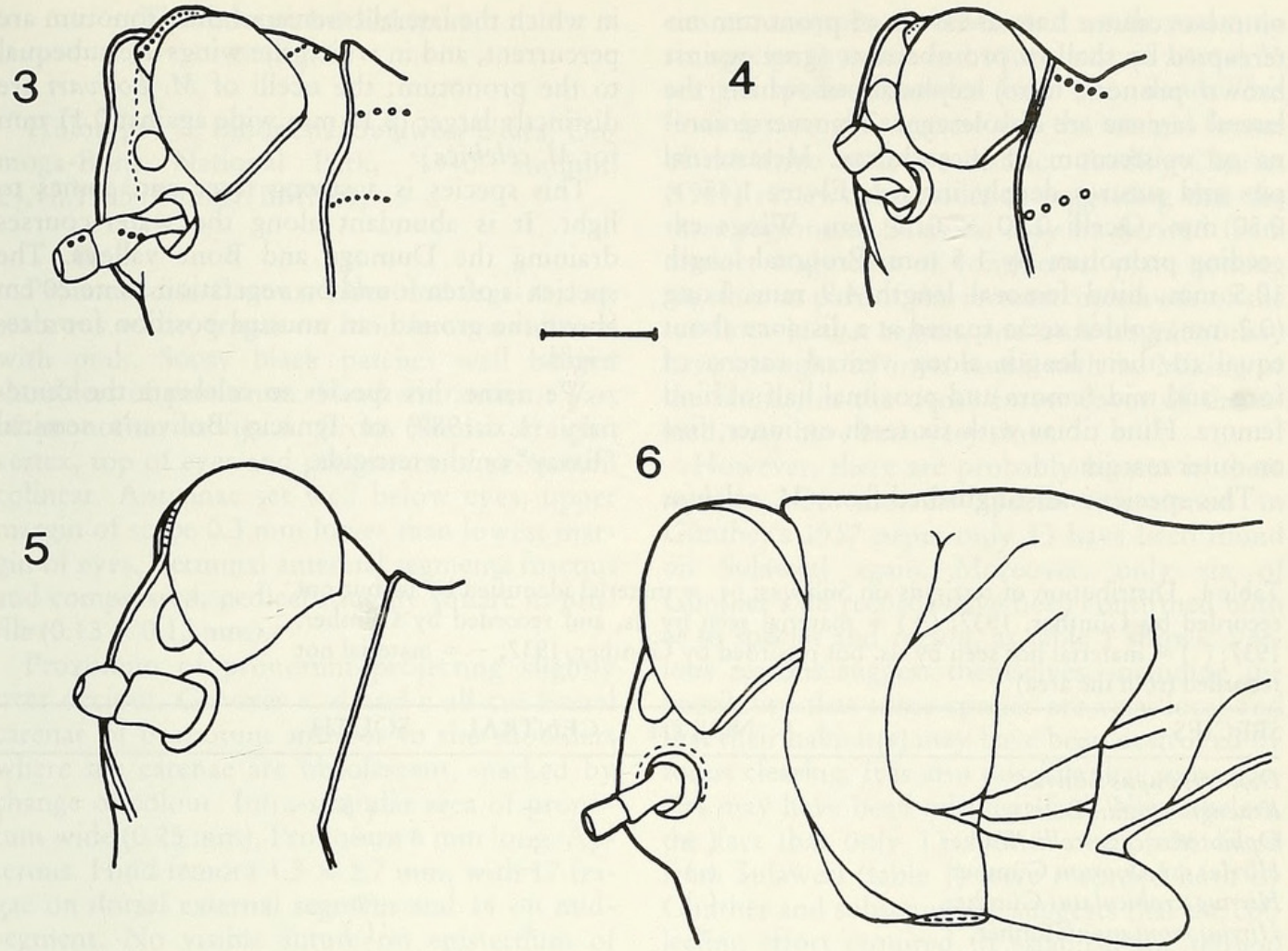
Although there is some overlap, the number of teeth on the inner and outer margins of the hind tibiae of *P. kevani* is greater (6—11, modal value 9) than in *P. corticolus* (5—7, modal value 6). This result is unexpected, because Descamps (1976) found that corticolous species generally had more hind tibial teeth than other acridids.

Mazarredia celebica Bolivar, 1887

Material studied: 1♂, '1440' summit, 4.x.1985 (K. Monk) (BMNH); 1♂, Gunung Ambang, 1200 m, Fog 7, 18.ii.1985 (BMNH fogging team) (BMNH).

The genus *Mazarredia* Bolivar was erected for 13 south-east Asian species ranging from Sri Lanka to the Philippines. One of these, *M. celebica*, was described from a single female from north Sulawesi. Bolivar notes that the depressions behind the "shoulders" of the pronotum, characteristic of the genus, are weakly developed in this small species, which makes it a passage form to several other genera of the region.

Later, Bolivar (1909) segregated *M. celebica* into the genus *Xistrella* Bolivar. However, Günther (1955) expresses the view that *Xistrella* should be returned to a group of genera includ-



Figs. 3—6. Upper part of head in profile of: 3, *Probolotettix corticolus* sp. n., holotype ♀; 4, *P. kevani* sp. n., paratype ♀; 5, *Mazarredia bolivari* sp. n., paratype ♀; 6, *Thoradonta butlini* sp. n., head and anterior part of pronotum, holotype ♀. Scala-line 0.5 mm.

ing *Mazarredia* pending further revision, with which we provisionally concur. Günther's earlier major revision of 1938—1939 had been unable to include *M. celebica* as the type was unavailable to him.

We have been able to examine Bolivar's type and compare it with two specimens from the Project Wallace expedition. The 80-character morphometric analysis shows that the Project Wallace specimens are virtually identical with the type. It seems that this is a high-altitude species of some rarity, in view of the paucity of specimens discovered.

Sulawesian species of *Mazarredia* can be distinguished from those of *Probolotettix* by the absence, in *Mazarredia*, of sensilla proximal to the genicular area of the internal face of the hind femora. However, the boundaries of these genera need clarification. *M. celebica* has patches of scabrous cuticle on either side of the unpaired ocellus, possibly homologous with the fastigial foveolae of gomphocerine acridids.

Mazarredia bolivari sp. n.
(fig. 5)

Holotype, ♀, Indonesia, Sulawesi Utara, Dumoga-Bone National Park, at u-v. light, 30.i.1985 (Holloway) (BMNH).

Paratypes, 4♂, 5♀, same data (Blackith) (BMNH; LEM; NMI; MB; MNHNP; RNHL); 1♀, Sulawesi Tengah, nr. Morowali, Ramu River at light, 27.i—20.iv.1980 (Brendell) (BMHN).

Leaden grey body colour flecked with dull yellow. Head slightly exserted, eyes raised just above the pronotum. Frons just visible before upper part of eyes. Vertex slightly narrower than an eye, with minute horns on lateral carenae. Maxillary palps compressed. Anterior margin of pronotum tilted sharply upwards towards head. Pronotum weakly depressed behind shoulders. Panier (saddle-bag)-shaped processes

on mesozonum. Lateral carena of pronotum interrupted by shallow protuberance (grey against brown pronotal disc) cephalad of which the lateral carenae are obsolescent. Transverse carena on episternum of mesothorax. Metasternal pits and sutures deeply incised. Elytra 1.45 × 0.50 mm. Ocelli 0.20 × 0.17 mm. Wings exceeding pronotum by 1.5 mm. Pronotal length 10.5 mm, hind femoral length 4.9 mm. Long (0.2 mm) golden setae spaced at a distance about equal to their length along ventral carena of fore- and mid-femora and proximal half of hind femora. Hind tibiae with six teeth on inner, five on outer margin.

This species is distinguished from *M. celebica* in which the lateral carenae of the pronotum are percurrent, and in which the wings are subequal to the pronotum; the ocelli of *M. bolivari* are distinctly larger (0.17 mm wide against 0.11 mm for *M. celebica*).

This species is a strong flyer and comes to light. It is abundant along the water-courses draining the Dumoga and Bone valleys. The species is often found on vegetation some 20 cm above the ground, an unusual position for a tetrigid.

We name this species to celebrate the centenary (1.xi.1987) of Ignacio Bolivar's seminal "Essay" on the tetrigids.

Table 1. Distribution of tetrigids on Sulawesi (+ = material identified by us but not recorded by Günther, 1937; (+) = material seen by us, and recorded by Günther, 1937; ( ) = material not seen by us, but recorded by Günther, 1937; − = material not recorded from the area)

SPECIES	NORTH	CENTRAL	SOUTH
Diotarus pupus Bolivar	+	−	−
Kraengia apicalis Bolivar	−	−	( )
Ophiotettix cygnicollis Walker	( )	−	−
Hirrius sarasinorum Günther	( )	−	−
Hirrius scrobiculatus Günther	( )	−	−
Hirrius montanus Günther	−	+	( )
Criotettix bispinosus Dalman	−	−	( )
Eucriotettix dammermanni Günther	+	−	−
Eucriotettix ridleyi Günther	+	−	−
Scelemina celebica (Bolivar)	(+)	−	( )
Tegotettix armatus Hancock	( )	−	−
Tegotettix c. celebensis Günther	−	+	( )
Bullaetettix sarasinorum Günther	−	( )	( )
Tondanotettix meridionalis Günther	−	−	( )
Tondanotettix modestus Günter	(+)	−	−
Pseudoparatettix luwuensis Günther	−	( )	−
Euparatettix celebicus Hancock	−	+	( )
Euparatettix personatus Bolivar	−	+	( )
Paratettix tricarinatus Bolivar	+	+	−
Paratettix mimus Bolivar	−	+	−
Paratettix femoralis Bolivar	−	−	( )
Paratettix histricus Stål	−	−	( )
Hedotettix costatus Hancock	+	−	( )
Indatettix sp.	( )	−	−
Loxilobus insidiosus Bolivar	(+)	−	−
Loxilobus r. celebensis Günther	+	−	( )
Spadotettix heinrichi Günther	( )	−	−
Systolederus ophthalmicus Bolivar	(+)	−	( )
Coptotettix alfurus Günther	+	−	( )
Coptotettix interruptus Bolivar	+	−	( )
Hyboella overbecki Günther	+	−	−
Probolotettix corticolus sp. n.	+	−	−
Probolotettix kevani sp. n.	+	+	−
Mazarredia celebica Bolivar	(+)	−	−
Mazarredia bolivari sp. n.	+	+	−
Thoradonta butlini sp. n.	−	−	

Thoradonta butlini sp. n.
(fig. 6)

Holotype, ♀, Indonesia, Sulawesi Utara, Dumoga-Bone National Park, '1440' summit, 24.vii.1985 (Butlin) (BMNH).

Pronotal disc flavous, sides and legs darker, scabrous white, fragae on hind femora suffused with pink. Sooty black patches well behind shoulders of pronotum. Head and anterior part of pronotum as fig. 6. Frons almost straight, vertex, top of eyes and prozonum of pronotum colinear. Antennae set well below eyes, upper margin of scape 0.3 mm lower than lowest margin of eyes. Terminal antennal segments fuscous and compressed, pedicel roughly square in profile (0.13 × 0.13 mm).

Prozonum of pronotum projecting slightly over occiput. Grooves c, d and e all cut lateral carenae of pronotum anterior to the shoulders where the carenae are obsolescent, marked by change of colour. Infra-scapular area of pronotum wide (0.25 mm). Pronotum 6 mm long. Apterous. Hind femora 4.3 × 1.7 mm, with 17 fragae on dorsal external segment and 14 on mid-segment. No visible suture on episternum of mesonotum, no sensilla on internal face of hind femora proximal to the genicular area. Hind tibia with seven teeth on inner margin, six on outer margin. Hind femora just projecting beyond pronotum. Metaspinal pits exceptionally deep and wide.

This species is unique among known members of the genus, which is allied to *Mazarredia*, in having the lateral lobes of the pronotum smoothly rounded, but is otherwise representative of the genus, with modifications appropriate to an apterous species.

Discussion

There is little biogeographical information to be gleaned from the tridactylids, both species of which are widespread from India to Indonesia. The paucity of species, and the apparent absence of records from expeditions earlier than Project Wallace in Minahassa, suggests that the tridactyloids may have reached Sulawesi only recently, as the distribution is grossly unbalanced.

The comparison of tetrigid records in the three regions (table 1) into which we divide the island is striking; only two species are recorded from both the north and centre, only five species are common to centre and south, and only six species to north and south, out of a total 36 tetrigid species recorded from the island. This finding strongly suggests that the tetrigid faunas of the three areas are distinct. Audley-Charles (1981) reviews the evidence suggesting that the three regions of Sulawesi may be derived from distinct fragments of continental plate coming together as part of the tectonic upheavals of the sea-floor in that region, and each fragment may have brought its own fauna with it. Mixing of the faunas, in the dense forest cover of the island, may have been very slow.

However, there are probably biasses in these records. Of the 25 species mentioned in Günther's 1937 paper only 13 have been found on Sulawesi again. Moreover, only six of Günther's 28 records have been confirmed both as to species and region, as table 1 shows. Various reasons suggest themselves, including the possibility that some species are very local and that their habitat(s) may have been destroyed by forest clearing. It is also possible that some species may have been misidentified. Nevertheless, the fact that only 13 species out of 36 listed from Sulawesi (table 1) were recorded both by Günther and subsequently suggests that the collecting effort required to establish the tetrigid fauna with any precision is much greater than has been available so far.

A curious bias is the apparent predominance of small forms in the Sulawesian tetrigid faunas. It is hard to know quite what size distribution to expect, but forms with a pronotum length of more than 12 mm seem notably wanting. Only two of the usually large "scelimenae verae" with pronotum lengths ranging from 15 to 25 mm are confirmed as present on the island. If it is true that tridactylids have arrived on the island relatively recently it may also be true that part of the tetrigid fauna was also late in arriving geologically speaking and that there has not been time for all available niches to be occupied.

It seems that there are (at least) three distinct tetrigid faunas on the island which have not fully mixed. Since this conclusion is likely to hold, to some extent, for other orthopteroids, it may help to explain Ramme's (1940) conclusion when writing of orthopteran biogeography "Aber noch immer ist Celebes in vieler Bezeihung einer Sphinx" (Even today, the Celebes is in many ways a Sphinx).

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