Biology

Crickets are generally omnivorous but are strongly tied to certain types of habitat. At a given locality the crickets that live there seem 'stratified' that is, there is a complement of species in each distinctive part of a given habitat. Some live on or in the ground, others live in various situations above ground be it on bark, under leaves, on twigs in foliage such as grass and herbaceous vegetation. Probably the majority of species at a given site can be found on or in the ground. A few species are associated with coastal mangroves. These crickets can escape danger by scuttling down stems and trunks of the mangroves seeking refuge underwater. Several species undergo large population explosions from time to time and these can cause concern for agriculturalists. The Black Field Cricket, *Teleogryllus commodus* (Walker), p. 78 and recently its congeneric relative, the Oceanic Field Cricket,

Large number of the Pygmy Cricket, *Pteronemobius ornaticeps*, p. 336, attracted to lights in Humpty Doo, NT. Encroachment of human populations has caused the population of this cricket to increase beyond what would be considered normal. Photo: K. McLachlan.

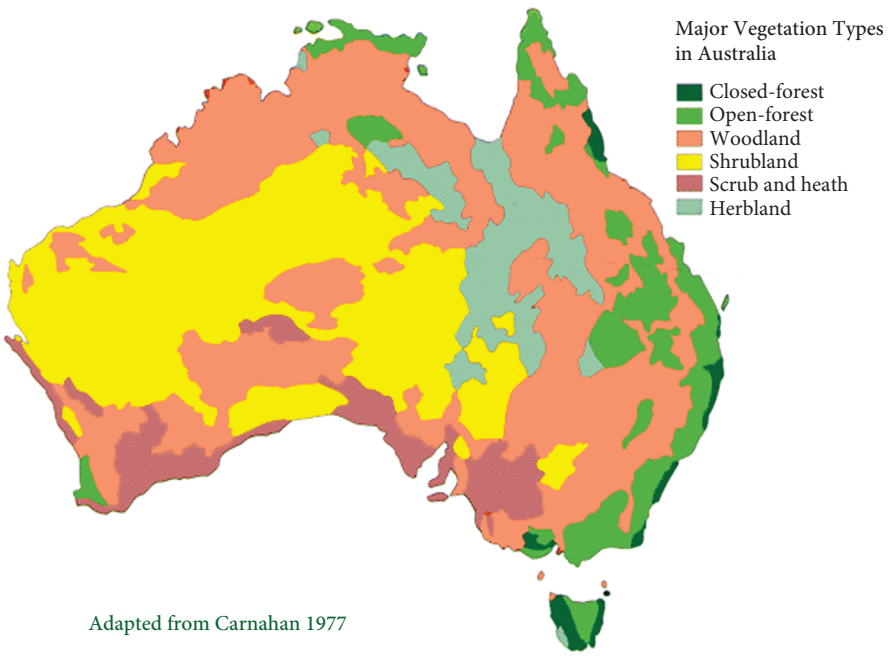
T. oceanicus (Le Guillou), p. 79, have had outbreaks in recently-developed agricultural areas in both the southern areas and the continent's northern tropics. Pastures in the southern portion of Australia can be damaged from time to time by the Small Black Ground Cricket, *Velarifictorus* (*Buangina*) *pikiara* (Otte and Alexander), p. 113. Two species are confirmed as introductions to Australia. The House Cricket, *Acheta domesticus* (Linnaeus), p. 67 and The Indian House Cricket, *Gryllodes sigillatus* (Walker), p. 123 are used as feeders in the pet trade, p. 56. The House Cricket has not permanently established itself in Australia (see p. 67), but the Indian House Cricket is often common in cities as well as in nature, p. 123. Problems are caused when it gets behind walls or under large appliances or other equipment. Its incessant, repetitive calling is disturbing to some people. As agriculture expands into the hinterlands of the Australian continent, more cricket species will undoubtedly emerge as problems in one way or other and as threats to agriculture. Similarly with the influx of tourism and the continuous visits of container ships, more exotic insects can be expected to arrive in Australia.

Mass of *Teleogryllus oceanicus*, p. 79, at lights in the Kimberley Region, WA. Periodic outbreaks of this cricket may be associated with favourable conditions that may have been caused by irrigation for agriculture.

The Black Field Cricket, *Teleogryllus commodus*, p. 78, collected on a ship in the open ocean. This is an example of transport of a potential pest to distant areas. Photo: G. Tate.

Ecological distribution

As noted above many crickets have very restricted ecological tolerances. Some are associated with a certain plant groups or ecotypes. Grasses seem to harbour *Oecanthus, Euscyrtus, Beybienkoana, Eurepa, Aphonoides,* some *Salmanites*, for example. Shrubs are preferred by *Tamborina, Xabea* and many others. Many crickets live on or in the ground, as with *Bobilla* and *Pteronemobius*, others live in burrows of their own construction (*Apterogryllus* in burrows over a metre deep!) or in cracks in dry clay soils. Some species of *Gymnogryllus* and *Mjobergella* tunnel in rotting wood. Some Mogoplistinae, Nemobiinae, Gryllinae live in the bases of vegetation or in leaf litter. Many live among the interstices of dense grasses even in well used athletic fields. Ant nests are the home of Ant Crickets (Myrmecophilidae). They seem to have some



Vegetative associations of Australia. Note the relatively small landmass that the northern tropics occupy. Yet, this area has among the great diversity of Australian crickets. From Carnahan (1976) in Atlas of Australian Resources. Canberra: Dept of Natural Resources.

sort of mutual association with their ant hosts. Other crickets in the Mogoplistinae and Phalangopsinae spend the day within termite mounds or sheltered in the shady folds of larger mounds but emerge after dark. They can be found on the surface of the mounds feeding and interacting with one another at night. Many crickets spend the daylight hours under loose bark, often in groups. These include some species of *Myara, Riatina* and some *Eurepa* species. The surface of bark is the habitat for *Pseudotrigonidium* and many other Phalangopsinae. Understorey vegetation harbours many Trigonidiinae, Mogoplistinae as well as the large *Cardiodactylus* crickets. Tree-tops seem to be the favoured sites of many *Madasumma* and some *Tamborina*. A strange situation sometimes presents itself with introduced plants. The Singapore Daisy, *Sphagneticola trilobata*, is a Central American ornamental plant that has become established in north Queensland. It is an attractive ground cover but it is quick to colonise cultivated and

Unidentified phalangopsine nymph on termite mound at night, nr Mt Molloy, Qld.

Mound of termite, *Nasutitermes* sp, near Dimbulah, Qld.

Pseudotrigonidium australis, male, on rainforest tree trunk at night.

Cricket life cycles and development

Crickets have rather simple life cycles. If they live in a warm, consistent climate with no extreme seasonal changes, they can have continuous growth and reproduction (overlapping generations). These species have a *homodynamic life cycle*. This form of life cycle is common with crickets and other insects in the northern tropics. Often at a given locality, adults and young crickets can be found together at most times of the year. On the other hand, depending on where you are in the tropics, there can be a prolonged dry season. Some of the crickets in these localities may not have a homodynamic life cycle but a *heterodynamic life cycle*. That is, they are very seasonal and their development is dependent on seasonal changes. For example, in the southern part of the Australian continent, most cricket species spend the winter months in the egg stage. There may be species that have one or life cycle or the other depending on where they occur geographically.

Diapause is known to occur in many species. It is a delay in development that can occur in the egg stage or at some point in development from nymph to adult. Diapause is a way for a species to cope with irregular and suboptimal environmental conditions. In the southern part of Australia, egg and juvenile diapause is known in the Black Field Cricket, *Teleogryllus commodus*. Its relative the Oceanic Field Cricket, *T. oceanicus*, has been found to have no diapause where it occurs in places like Tahiti and parts of north Queensland. However, in *T. oceanicus* in Australia, there seems to be seasonality and, perhaps, even diapause in its northern populations. This seems to be a contradiction but is another example of a cricket that deserves further study of its biology.

Crickets are in the group of insects that undergo *gradual metamorphosis*. This is true of all the orthopteroid orders, for example Orthoptera, Blattodea, Mantodea and Phasmida. The hemipteroid insects are also an example of a group that undergoes gradual metamorphosis. Examples of some insects that undergo *complete metamorphosis* are those in the orders Hymenoptera, Diptera and Coleoptera. These groups have a larval and pupal stage before the adult. When a cricket egg hatches, the little cricket is called a *nymph*. As it grows, it moults several times. The cricket between moults is called an *instar*. First instar nymphs can be very different in appearance from their adult counterparts. It is often impossible to determine a species from a first instar unless you have previous experience with the species. Each cricket species seems to undergo a precise number of moults leading to adulthood but this has been largely unstudied in the Australian species. The smallest number of instars seems to be five. This has been recorded in the Tree Crickets, Oecanthinae (p. 231). The largest number has been recorded in the House Cricket, *Acheta domesticus* (p. 67), with 14. But a range in variation can even

First instar nymph of *Riatina nangkita*. First instars can appear very different from adults (see p. 171).

Adult of the same specimen *Riatina nangkita*.

be found within a given species. This probably depends on various environmental factors such as food, time of year and climate.

Moulting is accomplished usually at night. Reasons for this seem simple. When a cricket moults, it is highly vulnerable to predation. In addition, wind can cause a fragile cricket to get knocked off its perch and not undergo a successful moult. Moulting is usually accomplished after dark when the cricket is less vulnerable to predators and winds are calm and, most importantly, the humidity increases. These conditions assist the cricket in *ecdysis* – the act of moulting. An observer can determine if a cricket is ready to moult. The cricket appears somewhat swollen and a bit lethargic. It eventually finds a suitable place. In most arboreal species, this can take place on the underside of a leaf or twig. Once the cricket has assumed its desired position, it grasps the surface with its tarsi, assuring a firm grip. The cricket undergoes some hormonal changes and its body swells. This causes a split down the longitudinal dorsal surface of the body. The cricket then begins to remove itself from its old skin. This it does by moving forward. This process takes a bit of time but all must be completed by mid evening. Once removed from its skin, the cricket takes in air and grows. The skin remains pliable for a short period and during this time the cricket consumes the old skin. This recycles some of the chemicals contained in the skin and also adds bulk to the gut. This helps the gut to regain its normal shape and form and not collapse on itself. The sides of the fore- and midgut, as well as the inner surface of the fine *Malpighian tubules*, are part of the exoskeleton and are also shed during the moulting process. Once the moulting process is completed, the cricket hardens and is probably able to feed by mid morning.

What is important for identification is to know whether a specimen is an adult or not. With the number of wingless species it can be difficult to determine if the insect in hand is mature or not. If a female, check to see if the ovipositor is developed or reduced. Immature females often have ovipositors whose valves separate. Adult males are a bit more difficult to distinguish. Checking of the concealed genitalia will reveal if the specimen is mature. Immature males have reduced or poorly sclerotised genitalia. With a little experience, one can be confident that a specimen is an adult or

Morphology

The body plan of a cricket is often considered as typical for an unspecialised insect. In order to understand this book, a basic knowledge of cricket morphology is necessary (Fig. 5).

Head

The head of a cricket is often considered typical for a chewing in a *hemimetabolous* insect (Fig. 6). The head is usually rounded with the dorsal part composed of the *occiput* and *vertex*, the latter of which is extended between the antennal bases onto the front of the insect as a *frontal rostrum*. There is a *median ocellus* and often, but not always, two *lateral ocelli*. These can vary in size depending upon the species. Their function is obscure but may have to do with the reception of polarised light. Cricket antennae are simple filamentous structures. Their length relative to the length of the body is often helpful in identification. The antennae may have bands as a result of one or more segments being darker coloured than the others. These are termed 'annulate' or, if unbanded, 'concolorous'. The antennal surface can be hairy or smooth depending upon the species. The antennal colour is often distinctive. The first two segments of the antennae are the *scape* and the *pedicel* respectively. They can be modified with a tooth or a tubercle in some species. The shape of the eyes is often described as ovoid, elongate, bulging, reduced or shallow depending on the amount of bulge. All are important features to observe. Eye colour and pattern are distinctive for the species but colours and patterns often fade or disappear entirely after death. The sides of the head, the cheeks, are called the *genae* (Fig. 6). The front of the head is the *frons* beneath which is a suture called the *fronto-clypeal suture.* This is the boundary of the *clypeus* and the tongue-like structure called the *labrum*. The mandibles are suited for chewing. The maxillary and labial palpi are five-segmented and three-segmented respectively and are relatively similar among species.

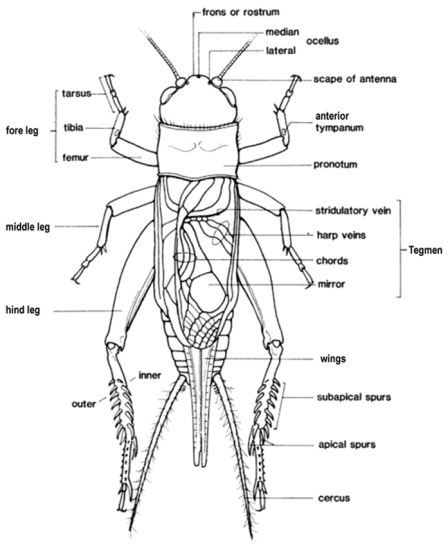


Fig. 5. Morphology of typical cricket.
Modified from Otte and Alexander (1983), with permission.

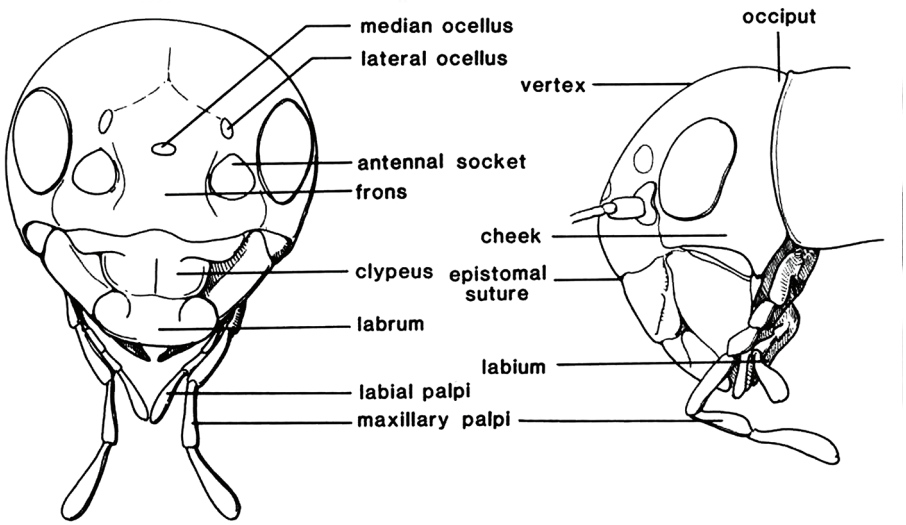


Fig. 6. Principal regions and structures of the cricket head. Modified from Otte and Alexander (1983), with permission.

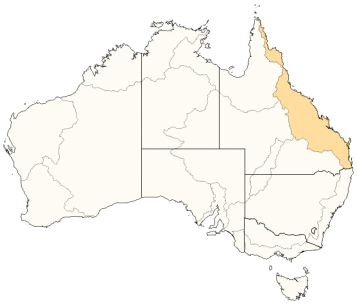
Legs

Crickets generally have short legs. There are exceptions, of course. The tarsi are three-segmented with the first segment called the *metatarsus*. On the hind legs the metatarsus can be greatly lengthened and can be armed dorsally with spines or teeth (Fig. 7). The shape of the second tarsal segment is particularly important in cricket classification. This segment may be described as small and compressed or depressed, or heart-shaped.

We refer to the first pair of legs as the forelegs – *fore tibia*, *fore femur;* the middle legs –*middle tibia* or *middle femur*; and the hind legs simply as the hind legs or *hind femur* or *hind tibia*. On the fore tibia of many crickets there may be the tibial auditory structure or *tympanum* (Fig. 5). The tympanum is an ovoid opening covered by a light-coloured membrane. The tibial auditory structure may be on one or both sides of the fore tibia. It may be absent from one side or the other, and may be of slightly different size and shape on one side or the other. The tibial auditory structure is most likely used to receive the calls. Interestingly, these structures are generally similar in both sexes within a species. Generally, species that produce no auditory signals lack or have reduced tibial auditory structures altogether.

Spurs v. spines

Distinction between what is meant by a spur or a spine is important in using this book. Spurs and spines occur on the legs of crickets. The most important of these structures are on the dorsal surface of the hind tibiae (Fig. 7). Some authors refer to all spine-like protuberances as simply spines. Otte and Alexander differentiated between



Loxoblemmus bilo.

to distinguish the species. The frons bears a narrow white stripe descending from the median ocellus, narrowing ventrally. Lateral lobes of pronotum pale for most of ventral third. File as in Table 4.

Body length: males 10.5 mm; females 11.0 mm; ovipositor 6.5 mm.

L. bilo is a member of the NE Coastal Community, Qld.

Loxoblemmus pallens (Serville)

QUEENSLAND FLAT HEADED CRICKET

Originally 1 of 2 species included in *Loxoblemmus* but the curious head seemed to be the only character distinctive enough to separate this genus from *Comidogryllus*, so the 2 were combined with *Loxoblemmus* the older name and giving it priority. *L. pallens* is distinctive in several other characters as well. The protrusion of the head is more exaggerated in males and more developed than in *L. nurroo*, the sister

Loxoblemmus pallens, adult male, short-winged morph (top); long-winged morph (bottom).

Loxoblemmus pallens, adult male – note protruding head (left); tooth on antennal scape (right).

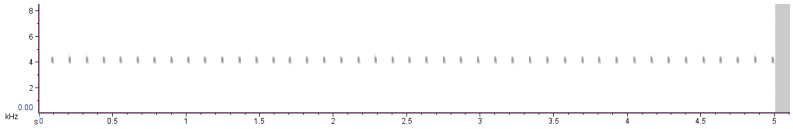
Loxoblemmus pallens, adult female, short-winged morph.

Loxoblemmus pallens, nymph, early instar.

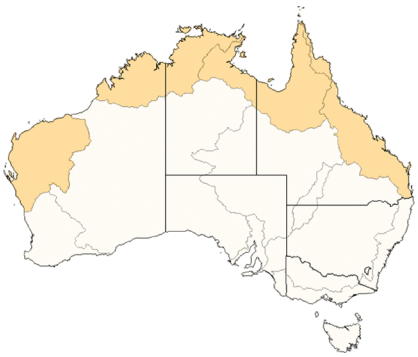
Loxoblemmus pallens, adult female. Note mite which was underneath the left tegmen.

species described in Otte and Alexander. In addition, males have a peculiar hook on the scape of the antenna. This hook is lacking in females and in *L. nurroo*. The frons has the distinctive stripe spanning the lateral ocelli. Head with broad whitish streaks on occiput. Disk of pronotum mottled as in other *Loxoblemmus* species; lateral lobes with more extensive white covering most of the lower half; a broad longitudinal stripe. Tegmen with mirror sometimes divided. Tibial auditory tympanum only on posterior surface. All legs with dark grey or brown spots. Song a slow trill produced after dark. This species does not seem to live in burrows but freely on the ground round grass clumps or under leaf litter. It can be found with other members of the genus, especially *L. adina*. Despite this, it is often very difficult to find.

Body length: males 14.5 mm; females 16.5 mm.



Loxoblemmus pallens, calling song. Male from Iron Range, Qld.



Loxoblemmus pallens.

L. pallens is a member of the NE Coastal Community, Qld.

Genus *Teleogryllus* Chopard (Southern Black Field Crickets)

Teleogryllus is a large genus of similar-appearing black field crickets occurring in southern climes, especially in the Pacific region. Where they occur they are usually common and often come to lights. The calling song is distinctive for each species. It is often the easiest way to tell species apart, especially if more than 1 species lives in the same locality. The male genitalia are somewhat distinctive only in 1 Australian species, *T. marini.*

Teleogryllus commodus, adult male.

Teleogryllus commodus, adult female.

Teleogryllus commodus, 2nd last instar male. The creamish white margin on the 2nd abdominal segment is known only for Australian *Teleogryllus* species (top); last instar female (bottom).

The Marginipennis Group

This group is characterised by the fastigium of the vertex being wider than the scape. The clypeus is spotted but does not extend to the top of the head. The body colour is reddish brown with distinct pale bands along the lateral margins of the dorsal field beginning on the pronotum and extending onto the tegmina. The surface of the pronotum is brown and irregularly speckled, but pale laterally; the lateral lobes are pale dorsally, but black ventrally. Tegmina with a milky streak between M and R veins; the Sc and R veins are pale of yellow; the tegmina are laterally black below the R vein. Dorsal surface of abdomen black.

Eurepa marginipennis (White)

SOUTHERN LONGTAIL

Fairly easy to separate from other species with the combination of the frontal fastigium being ~1.3 times as wide as the antennal scape and the tegmen being 2.3 times as long as wide and the mirror length ~1.4 times its

Eurepa marginipennis, stridulating male on *Banksia menziesii* at night near East Cannington, WA. Photo: S Mawson.

Eurepa marginipennis, adult female. Queens Park, Perth, WA. Photo: S Mawson.

Eurepa marginipennis, adult male.

Eurepa marginipennis, adult female.

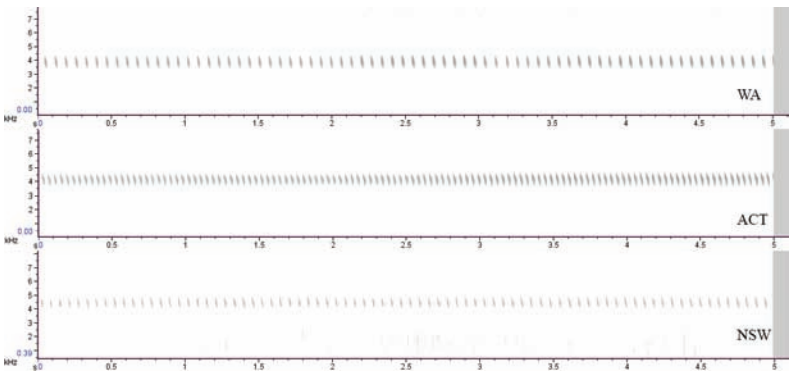
Eurepa marginipennis, late instar female.

width. This species shows considerable variation across its broad range. This is especially true of the length of the ovipositors of females. This species lives on small trees. Males sing from ~1 m from the ground, often partially concealed by a piece of bark. Singing males are extremely wary and should be approached with caution.

Body length: both sexes 11.0 mm; cerci 15.0 mm; ovipositor 16.0–35.0 mm.

E. marginipennis is a member of the Murray–Darling Basin Community, NSW and SA, the Gulf and W Plateau Communities, SA, and the NW Coastal, SW Coastal and W Plateau Communities, WA.

We conclude that a complex of related species exists, now considered to be under the name '*marginipennis*'. The calling songs and differences in the male genitalia suggest this. This complex of species is widespread



Eurepa marginipennis, calling song, Dalwallinu, WA; Black Mountain, ACT; Round Hill, NSW.

Eurepa marginipennis.

over the southern and western portions of the continent. We present a few disparate examples.

Eurepa sp. near *marginipennis* (White)

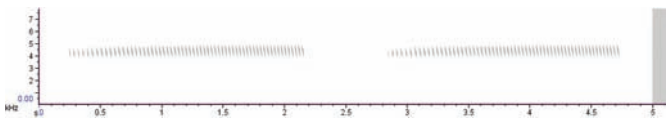
It resembles *E. marginipennis* but differs in the morphology of the male genitalia and its calling song.

Eurepa sp. near *marginipennis*, adult female.

Eurepa sp. near *marginipennis*, adult male; male genitalia – note ventral flanges.

Eurepa sp. near *marginipennis*, late instar female nymph.

Eurepa sp. near *marginipennis*.



Eurepa sp. near *marginipennis*, calling song.

Genus *Eurepella* Otte & Alexander

Eurepella is a large genus of 21 known species that are associated with grasses. The genus occurs broadly across the continent in suitable habitats. Males sing from grass stems, often from the tops of spinifex clumps where they hide during the day. Chacteristics of *Eurepella* are shown in Figs

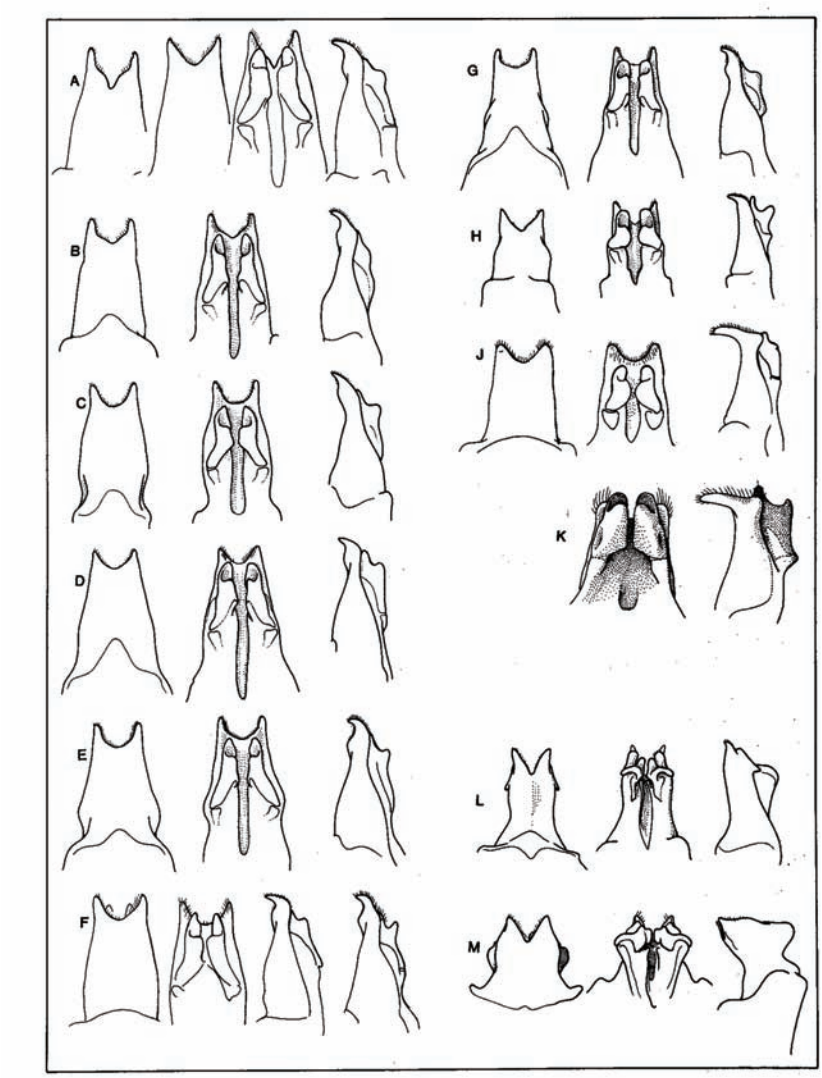


Fig. 21. Some male genitalia of *Eurepella* species, each at various angles. (A) *E. quarriana*; (B) *E. wanga*; (C) *E. waninga*; (D) *E. mjobergi*; (E) *E. kulkawirra*; (F) *E. meda*; (G) *E. ballina*; (H) *E. narranda*; (I) vacant; (J) *E. lewara;* (K) *E. nakkara*; (L) *E. tumbiumba*; (M) *E. budyara*. Modified from Otte and Alexander (1983), with permission.