The last tarsal unit (tarsus 4) can be pilose (many fine, short, appressed setae) and/or setose (few long, upright setae). The number of stridulatory pegs on the very lateral surfaces of abdominal tergites 1–6 (T1–6) is the last feature that may be used easily. Generally they are numerous and may be present not only on T1–3 but also on T4–6. A few species have greatly reduced numbers and extent.

Males and females, especially the former, have highly characteristic terminalia (Fig. 2A, B). With adult males care must be taken as to which abdominal tergite, T8 or T9, is lobed and the relationship of the thickening (if any) of T9 with the position and size of the T10 falci (a pair of hook-like structures on the tergite's surface, set close together or wide apart). These, too, provide a very easy indication of the instar for they are very weak or absent in all but the last two instars. In the penultimate instar they are simple rounded knobs. In the adult they are blackened hooks. *Hemiandrus* "alius" is the only species in which the male has sharp, almost bare tips to the cerci, a useful feature to distinguish it from the similar, but far more common, *H. maculifrons*. The suranal plate, a blunt, triangular plate, is immediately behind and between the paranal processes and overlies the anus. The paranal processes can be blunt lobes as in *H. maculifrons* (Fig. 2A) or sharp cones or spines as in many other species (Fig. 2B).

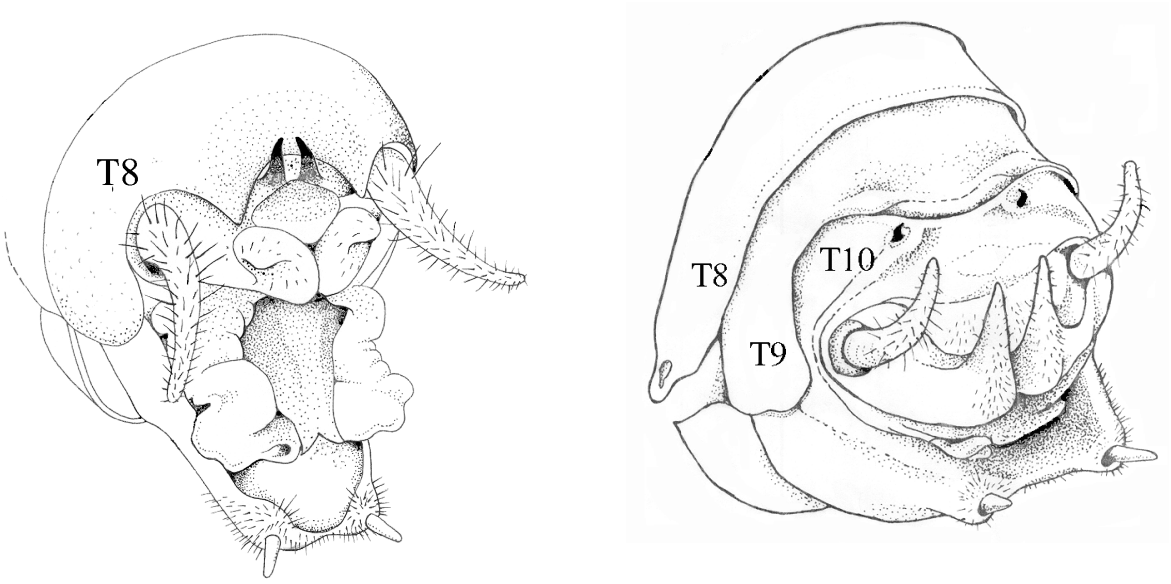

Figure 2. A—*Hemiandrus maculifrons* male terminalia (internal lobes are shown fully expanded). B—*Hemiandrus focalis* male terminalia.

In adult females the state of the area between sternites 6 and 7 is very important. There is a median or submedian pair of apparently glandular depressions immediately underneath the S6 overhang. These may be associated with lobes or, in two species, a prominent flexible process which itself is weakly bilobed at the tip (Fig. 3A). Ovipositor length: long and fully sclerotised, medium and partly sclerotised, or short and rather soft (Fig. 3A, B, C) is also species-characteristic. There is little difference between the species with short ovipositors except in the presence/absence and size of the apical styles (Fig. 3B). These styles are mostly present in the younger instars and progressively get smaller in the last two instars and are often absent in the adult, as is the case for all species with long ovipositors. Females of the common *Hemiandrus maculifrons* are easily determined by the presence of a small notch in the midline of tergite 7.

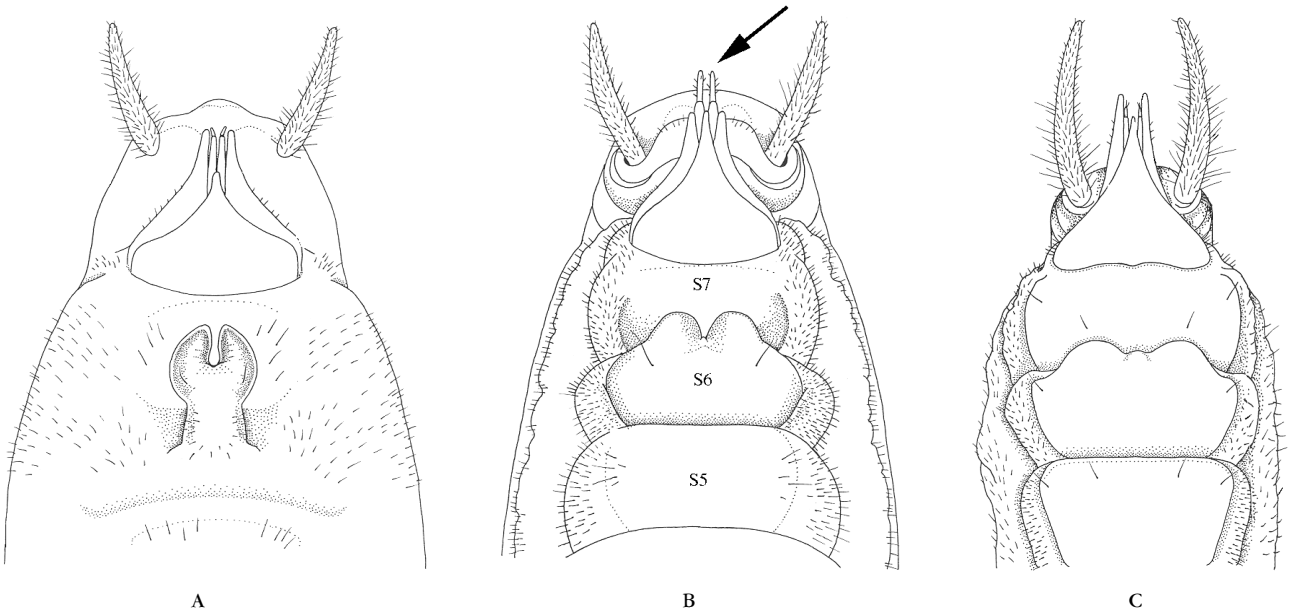

Figure 3. Ventral view of female S6–7 margins and terminalia.
A—*Hemiandrus pallitarsis,* B—*Hemiandrus bilobatus*, C—*Hemiandrus* "vicinus".
Note the relative shapes of the small segments at the tip of the styles (arrowed on 3b).

3.2 GENERAL BIOLOGY AND HABITATS

In general, individuals are solitary and are confined for long periods (days if not weeks) to cavities in the soil or dense moss. Rarely do they occupy holes within logs and even more rarely holes in trees as do *Hemideina* species. *Hemiandrus maculifrons* prepares tunnels in dense moss (Cary 1981) and lays its eggs in the walls. *Hemiandrus focalis* and *H.* "furoviarius" burrow into stony silts whilst *H.* "horomaka" burrows into loess or fine volcanic soils. All form a very fine filigree cap to the burrow. The pores allow air into the burrow but keep out much of the rain. In a small chamber at the tunnel's end the female lays and cares for its eggs. This probably occurs also in the other short-ovipositor species. If weta activity and numbers are indicative of tunnel density, tunnels can be highly localised within what appears to be a uniform habitat. At Marfell's Beach, *H.* "promontorius" was trapped readily in two traps, but not in another two, even though all traps were within metres of each other. A similar impression of localised distribution was gained when turning stones to collect *H. focalis* on the Garvie and Old Woman Ranges.

Egg development takes from about 7 weeks to 18 months. All species that have short ovipositors and which probably nurse their eggs and young would have relatively short developmental times, e.g. 50 days in *H.* "horomaka" (Wahid 1978). Those species which lay their eggs in soil or moss could have a stasis in development, and some eggs take as long as the 18 months of *H. maculifrons* (Cary 1981). Weta pass through 6 to 9 instars during the Spring–Summer–Autumn period. Those in colder climes probably take two years to develop to adult as *H.* "furoviarius" does (Wyngaarden 1985). The large, alpine *H. focalis* may even take three years.

3.3 PREDATORS

Evidence from analysis of one kiwi gut (a road kill near Mt Egmont National Park) (pers. obs.—material in National Insect Collection, Landcare Research) shows that *H. pallitarsis* at least is an important food for this bird. Over 20 specimens were present. *Hemiandrus* "furoviarius" was found in many hedgehog gut samples (Moss 1999) and is known from cat scats (Ryan 1994). It is likely that all species are subject to similar predation. Rooting signs in the very sites where *Hemiandrus* spp. have their burrows also suggest that weta could be taken by pigs. Certainly, if ground weta are present where pigs root, damage to the burrows and disturbance of broods would lead to population decline, even if there was no direct predation. Weta have been seen in gut contents of stoats and ferrets, but individual species have not been identified.

3.4 FOOD

Cary (1983) and Wyngaarden (1995) analysed the gut contents of many individuals of *H. maculifrons* (as *H.* "gracilis") and *H.* "furoviarius", respectively. These species are certainly omnivorous, as are other ground weta (*H. focalis, H.* "saxatilis", *H.* "onokis", *H.* "alius", and *H.* "vicinus", pers. obs.). Although Wahid (1978) records *H.* "horomaka" as vegetarian, it certainly also eats insects (pers. obs.).

4. Conservation status

4.1 COMMON SPECIES

4.1.1 Widespread species

Hemiandrus maculifrons (Walker, 1869)
Hemiandrus pallitarsis (Walker, 1869)
Hemiandrus focalis (Hutton, 1897)
Hemiandrus fiordensis (Salmon, 1950)
Hemiandrus "madisylvestris"
Hemiandrus "alius"

These species are all relatively widespread (Figs 4–7). *Hemiandrus focalis* and *H. fiordensis,* however, have very disjunct populations (see below).

4.1.2 Restricted species

Hemiandrus bilobatus Ander, 1938
Hemiandrus "evansae"
Hemiandrus "horomaka"
Hemiandrus "onokis"
Hemiandrus "otekauri"

Hemiandrus "saxatilis"
Hemiandrus "timaru"
Hemiandrus "vicinus"

These species are found in very specific areas or habitats. Most seem to be tolerant of some human disturbance of the habitat. *Hemiandrus* "horomaka" is endemic to Banks Peninsula (Fig. 6) and loess or dry soils in the immediate vicinity. It is very tolerant of human modification, provided the soil is not disturbed for long periods. It has been taken in undug areas of gardens and in *Pinus* plantations. Similarly, *H.* "onokis", the North Canterbury species (Fig. 6), is known from exotic plantations at Hanmer, and *H.* "timaru" in South Canterbury. *Hemiandrus* "evansae" (Fig. 4) is in the Dunedin loess and similar soils. *Hemiandrus bilobatus* (Fig. 6) is in the Wellington district and very tolerant of human disturbance. *Hemiandrus* "otekauri" is in the Waipoua Forest and, possibly, on the tip of Coromandel Peninsula (one specimen known). *Hemiandrus* "saxatilis" is confined to Stewart Island and its western islets (Fig. 7). *Hemiandrus* "vicinus" (Fig. 6) is in the Marlborough Sounds.

4.2 RESTRICTED BUT PROBABLY NOT ENDANGERED

Hemiandrus subantarcticus (Salmon, 1950)
This is confined to the Snares Islands where it is common.

Hemiandrus "kapiti"
Another island species.

Hemiandrus "disparalis"
Present in high-rainfall forests of western Nelson and northern Westland.

Hemiandrus "okiwi"
This species is a close relative of the Dunedin *H.* "evansae". It is in the ranges east of Nelson.

Hemiandrus "porters"
Known only from subalpine shrub vegetation at Porters Pass, Canterbury.

Hemiandrus "promontorius"
Known only from Cape Campbell, Marlborough.

Hemiandrus "richmond"
This species is a close relative of the Northland *H.* "otekauri". It is in the ranges east of Nelson.

Hemiandrus "furoviarius"
Hemiandrus "turgidulus"
These two species are from the Mackenzie Basin river beds and Cromwell sand dunes respectively. On morphological grounds they are not particularly closely related as was first thought (as communicated to DOC staff verbally and by letter, pers. comm. and Wyngaarden 1985) and for conservation purposes they should be treated quite separately.

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