WESTERN AUSTRALIAN museum

Information Sheet

Earth-borer Beetles

(Geotrupidae: Bolboceratinae)

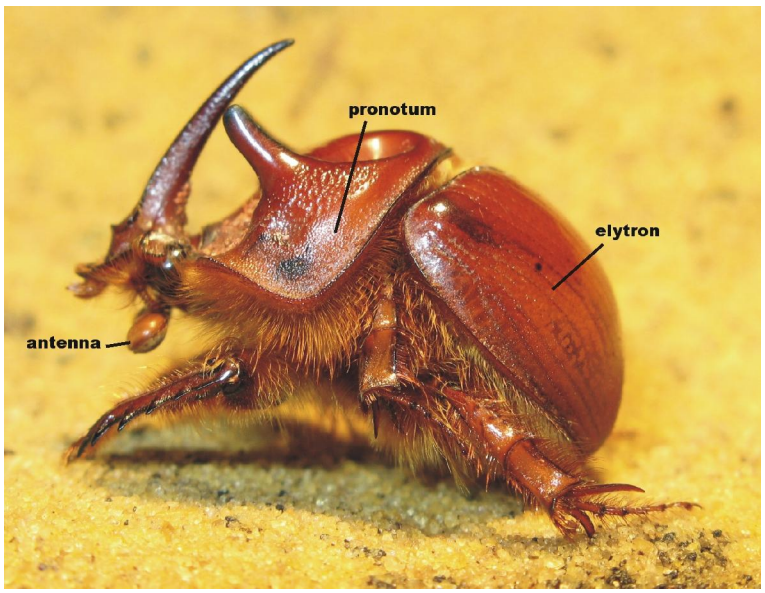
Earth-borer beetles are members of the scarab-group and have become of special interest in recent years because of their association with underground fungi, particularly those that form symbiotic associations with plant roots. Such fungi (termed 'mycorrhizal') assist plants to obtain essential minerals from the soil and many (if not most) of our native plants are dependent on the fungi for their health. The beetles have been reported to feed on the underground fruiting bodies of the fungi and may therefore be important in spreading their spores. Recent studies at the WA Museum in collaboration with the WA Herbarium have been aimed at determining which particular kinds of fungi are eaten by each species of earth-borer. Studies have also focused on revealing the life-histories of the beetles which are extremely poorly documented.

A common south-western Australian earth-borer beetle, Blackbolbus frontalis*, male*

How to recognize earth-borers

Earth-borer beetles resemble other scarab-group beetles in general form (short, domed body, spiny legs and short antennae with terminal clubs) but can be distinguished by the following combination of characters:

- Antennae terminating in relatively large, subspherical or egg-shaped clubs formed from three segments (see images below).
- Pronotum strongly developed and, viewed from the side, extending lower than lateral margin of wing case or 'elytron' (see image below).



Left: *terminology of body parts.*

Above: *Underside view of head showing detail of knobbed antennae.*

Furthermore, the beetles range in size from 5-30 mm in length, are usually brown (ranging from light tan to dark tan), rarely black (most dung beetles are black); spines or projections are often present on the head

and/or prothorax of males of some species (but similar spines and projections can occur in dung-beetles and other scarab-like groups); many of the beetles squeak when handled.

The earth-borer subfamily (Bolboceratinae) occurs almost world-wide but is best represented in Australia where 166 species grouped into ten genera are recognized. Western Australia has 100 of the species and eight of the genera. The beetles occur virtually over the whole State inhabiting a wide variety of habitats but are most common in areas with sandy or sandy loam soils and are less common or absent from areas with predominantly hard or stony soils.

Habits of earth-borers

Earth-borers, though common inhabitants of our bushlands, are seldom seen. With few exceptions, they emerge to fly only after dusk and then only after heavy rain when the soil is damp. They are strong and noisy fliers and tend to be attracted to lights. This is when they are most likely to be seen. Most of the time, they remain hidden in burrows in the ground.

Usually, each burrow is marked on the surface of the ground by a characteristic pile of excavated soil. Termed a 'push-up', the pile is formed as the beetle pushes loads of loosened damp sand up from below. Periodically, a column of damp sand is forced out of the burrow entrance like tooth-paste from a tube. One by one, the columns dry, topple over and accumulate to form a pile of cylindrical lumps looking much like a cluster of mammal droppings (see image left). The shafts excavated are quite round in cross-section, just slightly wider than the beetles excavating them, and usually descend vertically from a few centimetres up to 2 metres or more. Typically, the beetles plug the shafts above them with compacted soil and are usually found at the lower ends.

The adult beetles are known to feed on the fruiting bodies of soil-dwelling fungi and these include what can loosely be called 'truffles'. These fruiting bodies form within the soil and remain closed (unlike mushrooms, puffballs and earth-stars which dehisce to release their spores into the air). Truffles rely on animals eating them to disperse their spores. Other kinds of fungi are consumed as well (for more information see Houston & Bougher 2010).

Immature stages are known for very few earth-borers. The only published accounts of life-history stages note that the females produce just one relatively enormous egg at a time (this has been shown more recently to apply to several more species - see image left) and deposit it in a brood cell packed with humus-like material. The few larvae known are completely white with poorly developed limbs. Recent observations suggest that not all species have the same life-histories and work is continuing in this area.

Given the low rate of egg-production, it is clear that the beetles must be long-lived in order to lay a sufficient number of eggs to sustain the population.

References:

Houston, T.F. & Bougher, N.L. (2010). Records of hypogeous mycorrhizal fungi in the diet of some Western Australian bolboceratine beetles (Coleoptera: Geotrupidae, Bolboceratinae). *Australian Journal of Entomology* **49**(1): 49-55.

Howden, H., Howden, A. & Holloway, G. (2007). Digging down under: Australian Bolboceratini, their habits and a list of species (Coleoptera: Scarabaeoidea: Geotrupidae). *Zootaxa* 1499: 47-59.

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