A field guide to the dung beetles (Scarabaeidae:Scarabaeinae and Aphodiinae) common in pastures in South-western Australia

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Abstract
A key to 4 native and 7 introduced species of dung beetles (Scarabaeidae:Scarabaeinae and Aphodiinae) common in pastures in south-western Australia is provided, together with notes on their distribution and biology. Scanning electron micrographs are given to assist in the separation of the species and distribution maps are provided.

Introduction
The species considered here are dung feeding beetles of the family Scarabaeidae (subfamilies Scarabaeinae and Aphodiinae). There are 19 species of Scarabaeinae and 7 species of Aphodiinae which are endemic to the south-western region of Australia, many of which are described by Mathews (1972, 1974), with new records by Riddell-Smith et al (1983 and unpubl data). The adults of all these endemic species are trapped in undisturbed vegetation (Riddell-Smith et al 1983), during the cool humid period of the year from May to September (Riddell-Smith & Hall 1984a). Four of the endemic Scarabaeinae are also trapped in pastures, but only Onthophagus ferox Harold is common (Riddell-Smith & Hall 1984b). Six species of cosmopolitan Aphodiinae are present in pastures, of which Aphodius pseudostriatus Balthasar is most common (Snowball 1942, Riddell-Smith & Hall 1984b).

To increase breakdown of cattle dung in pastures throughout Australia, CSIRO has been introducing species of Scarabaeinae from Africa and Europe. Over 500 releases of beetles of 14 species have been made in south-western Australia between 1972 and 1986, of which 9 species are known to be established by 1987. Seven species are common. Since 1978 these introduced species have become dominant members of the dung beetle fauna in pastures in south-western Australia.

Because introduced dung beetles are now abundant in pastures, there is considerable interest in which species are present, their biology and seasonal abundance. In this field guide we summarize data we have collected over the past 10 years on the biology and distribution of species common in pastures. We have omitted both introduced and endemic species which are not commonly encountered. The distribution of some of these species may change in the future, and further introduced species may become abundant. A key is provided to separate the 4 native and 7 introduced species which are common in pastures in south-western Australia. Only adults are described and data on occurrence and abundance refer to the adult stage.

Identification of species

Description of characters
Males and females of all species except A. pseudostriatus can be distinguished by examining the ventral abdominal segments (Figs 1B and C). In the males the segment before the pygidium is constricted in the mid-line, whereas in the female it is of even width. Horn size in horned beetles varies and some specimens may be worn or damaged, and thus a combination of characters should be used for identification.

Figure 1 A Stylized dung beetle showing parts referred to in key. Underneath of abdomen showing method of sexing scarabaeinae B males and C females.
A small shining beetle (4-5 mm long) which is elongate and brown. This accidentally-introduced species occurs widely in Australia and in other countries (P Hammond, pers. comm.).

There are two patterns of seasonal abundance in south-western Australia. At sites north of Perth, beetles are common in all seasons and fly during the day. At sites south of Perth they are most common in summer and autumn (December to May) and fly at dusk. Some individuals are found throughout the year at all sites.

Distribution: (Fig 7A) Widespread throughout the region, where it is common in pastures, but rare in undisturbed vegetation.

b) Euconicellus fulvus (Graee), (Figs 2B, G, H)

Brownish-yellow beetle (7-11 mm long) with a plain brown pronotum. An introduced species from Europe. The strain released is from France.

This species is abundant in summer and autumn. It breeds during summer and flies during the day.

Distribution: (Fig 7B) Current records are from Bridgetown and near Bunbury.
Figure 3 Dung beetles. Elytra covers pygidium in A. A. pseudohorridus, but not in B E. jubes. C A. pseudolamellus, D & E F. pallipes male; F F. pallipes female; G E. fulus male; H E. fulus female. Scale lines, 1 mm.
Figure 3 Dung beetles. Foreleg of A Onitis sp. and B Euconiticellus sp., C E. intermedius male; D E. intermedius female. E Head of O. alexis female; F Head of O. aegyptius female; G Hind femur of O. alexis male; H Hind femur of O. aegyptius male. Scale lines: 1 mm.
Figure 4 Dung beetles: A & B. O. taurus males; C. O. taurus females; D, E & F. O. bimodis males; G & H. O. bimodis females. Scale lines: 1 mm.
c) Euoniticellus intermedius (Rechel). (Figs 3C,D)
A brownish-yellow speckled beetle (7-11mm long) with a small horn on the head of the male. An introduced species from southern Africa. One of the first species to be released in the region in 1972.

Adults are present all year round with peaks of abundance in winter and in summer, and breeds mainly at these times. Beetles fly during the day. *E. intermedius* is common in pastures near Moora, adjacent to sites of dung beetle studies in undisturbed vegetation (Ridddell-Smith & Hall 1984a). Out of 19109 scarabaeine and sphodrine dung beetles trapped during 1982-1983 only 8 are *E. intermedius*. There is no evidence that they are competing with endemic beetles.

Distribution: (Fig 7C) Mainly in the hotter parts of the region from Geraldton to Perth and eastward to Bruce Rock. This species is adapted to dry conditions. Adults can breed in very dry, sandy soil (Barkhouse & Ridddell-Smith 1986).

d) Euoniticellus pallipes (Fabricius). (Figs 2D,E,F)
A brownish-yellow beetle (6-11mm long) with dark-brown to black speckles. An introduced species native to Europe and Asia. The strains released are from Iran and Turkey.

Adults are most abundant in summer and autumn, and breed mainly from January to March. Low numbers are also seen in spring. Beetles fly during the day.

Distribution: (Fig 7D) Southern half of the region, from Perth to Bruce Rock, but not present along the south coast.

e) Oritta alecta Klug. (Figs 3E,G)
A robust large beetle (12-19mm long) with greenish pronotum and brown elytra. An introduced species from southern Africa. The strain released is the cold-adapted strain from summer rainfall regions.

This species emerges in November and is abundant for a month; the second generation emerges in March. The species spends the winter as larvae in brood masses in the soil. Beetles fly at dusk.

Distribution: (Fig 7E) Mainly in the warmer drier parts of the region from Geraldton to Pinjarra, and Perth to Cunderdin.

f) Oritta aegyptia Fabricius. (Figs 3F,H)
The largest of the dung beetles present in pastures (18-23mm long). A coloured beetle with greenish pronotum and brown elytra. An introduced species from southern Africa. The strain released is a winter-rainfall strain.

The biology of this species is very similar to that of *Oritta alecta*. Beetles fly at dusk.

Distribution: (Fig 7F) Mainly in drier areas between Cunderdin and Williams, and from Pinjarra to Hyden. The distribution of this species tends to be more southerly than that of *Oritta alecta*. 
Figure 6 Dung beetles. A & B O. vermiculatus males; C O. vermiculatus female; D & E O. haagi males; F O. haagi female; G Head of O. vermiculatus male; H Head of O. haagi male. Scale lines: 1 mm.
Figure 7 A - F Distribution maps for *Aphodius, Euoniticellus* and *Onitis* spp. Full circles represent establishment and open circles represent releases where the species has not yet been recovered.
Figure 8 A - E Distribution maps for Onthophagus spp. Full circles represent establishment and open circles represent releases where the species has not yet been recovered. F Locations mentioned in text.
g) *Onthophagus binodeis* Thunberg, (Figs 4D-H)
A matt black beetle (7-12mm long) with a lobe on the pronotum. An introduced beetle from southern Africa. Nearly all releases are of the winter rainfall strain.
This species is very abundant in summer and autumn, and in lower numbers in winter. Mainly breed in spring but some breeding also occurs during the summer. Flies during the day. Out of 19109 scarabaeine and aphodidung beetles trapped in undisturbed vegetation over two years at six sites (Ridgwell-Smith & Hall 1994a) there are 120 *O. binodeis*. There is no evidence that they are competing with endemic beetles.

Distribution: (Fig 8A) Mainly in the higher rainfall areas along the coast from Moore to Esperance. Does not persist in dryer areas. More abundant at sites with some summer moisture or irrigation. Adults cannot breed in dry, sandy soils (Barkhouse & Ridgwell-Smith 1986).

h) *Onthophagus furax* Harold. (Fig 5)
A large robust shining black beetle (12-20mm long) with one horn on its head and two on the pronotum. This is a native species.
Adults are active during the cool humid period of the year (Ridgwell-Smith & Hall 1984a,b). To the north of Perth this is from May to September and to the south from May to December. It is most abundant in May and June and breeds in the spring. Adults fly at night and are commonly found at lights. It is rarely seen during the summer, although a few individuals are found at this time along the south coast, and some emerge after summer thunderstorms at Cunderdoo.

Distribution: (Fig 8B) Widespread throughout the south-west region. There are two unconfirmed records from Alice Springs. It is also found in undisturbed vegetation, where it is more common at jarrah forest and heath sites than in karri forest (Ridgwell-Smith et al 1983).

i) *Onthophagus haasi* Harold. (Figs 5D,E,F,H)
A black, shining beetle (8-10mm long) with a single horn or a lamina with two points on the head. This is a native species.
Adults are active during the cool humid period from May to September. It is most abundant in May, June, August and September and breeds in the spring. Adults fly during the day. Adults are rarely found during the summer, except along the south coast.

Distribution: (Fig 8C) Mainly in the higher rainfall areas along the coast from Perth to Bremer Bay. There is one unconfirmed record from Norseman. It is present also in undisturbed vegetation, where it occurs in jarrah forest and heath. It appears to be more common near swamps.

j) *Onthophagus taurus* (Schreber). (Figs 4A,B,C)
A shining black beetle (7-10mm long) with two long curving horns on the head of the male. This is an introduced species, and the strains released are from Greece, Spain, Italy and Turkey.

It is most abundant in the summer and breeds in the spring. Adults fly during the day. Beetles are more abundant at sites with summer moisture or irrigation and breeding continues at these sites during the summer.

Distribution: (Fig 8D) Moora to Margaret River, and from Pinjarra to Williams.

k) *Onthophagus vermiculatus* Frey. (Figs 6A,B,C,G)
A small black beetle (5-8mm long) with bronze reflections. This is a native species.
Adults are present mainly during the cool humid period from March till November.

Distribution: (Fig 8E) Perth to Albany in undisturbed vegetation including karri forest, jarrah forest and heath. It appears in pastures near the south coast at Albany.

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References


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