

A SURVEY OF THE DUNG BEETLES FROM THE UPPER LOCKYER VALLEY



Geoff Monteith & Kathryn Ebert

A consultancy report prepared for the Citizens of the Lockyer, Inc. and funded by the Lockyer Valley Regional Council.



Onthophagus thoreyi



Lockyer Valley Regional Council proudly supported the conduct of this project.

REGIONAL COUNCIL

Report on a survey of dung beetles (Coleoptera: Scarabaeinae) from the Upper Lockyer Valley, Queensland

A Consultancy Report to the Citizens of Lockyer, Inc.

Final Report - June 2016

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Cover image:

Front view of a male ***Onthophagus thoreyi***, a common day-flying native dung beetle in open eucalypt forests of the Upper Lockyer.

(Photo: Geoff Thompson and Andy Wang, Queensland Museum)

Project supported by the Lockyer Valley Regional Council.



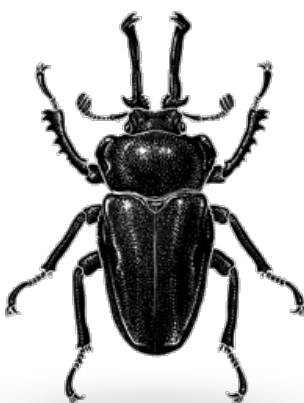
CONTENTS

Acknowledgements.....	2
The Upper Lockyer Survey Area.....	3
Introduction to Dung Beetles.....	4
Sampling Dung Beetles.....	4
The Upper Lockyer Dung Beetle Survey.....	6
Survey sites and zones.....	6
Processing the collections.....	8
Discussion of survey results.....	9
Species Pages Introduction.....	14
Data tables:	
Table 1. Collection sites.....	16
Table 2. Dung Beetles species list.....	18
Table 3. Community volunteers.....	19
Table 4. Community collections.....	20
Table 5. African species.....	21
Table 6. Rainforest species.....	22
Species pages:	
Native Ball Rollers.....	23
Native Nest parasites.....	28
Native Buriers.....	31
African Species.....	53

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Entomological Society of Queensland



THE UPPER LOCKYER SURVEY AREA

The area surveyed is an area of broken topography centred on a point almost exactly 15 km SE of the CBD of the city of Toowoomba. It is about 12 km square and comprises the whole drainage of Stockyard and Millard Creeks, the upper part of the drainage of Flagstone Creek and the northern part of the drainage of Ma Ma Creek. All these drainages merge just above the town of Gatton with the main stream of Lockyer Creek. The basement rocks are largely sandstones which are exposed as low cliff lines and gorges in some places. A few areas of better basaltic soils occur on top of the sandstone. The vegetation was originally principally eucalypt and brigalow forests with vinescrub/rainforests developed in favoured sites, either in well watered gorges in the sandstone or on the better soils on the plateaus. The area was farmed fairly intensively in the past with substantial clearing of vegetation on creek flats and lower hillslopes. Much of this area is now rather degraded with extensive development of lantana thickets. However good remnants of most vegetation types still exist and a substantial area of good vinescrub is preserved in the Dwyers Scrub Conservation Park. Areas of other rainforest types occur in the narrow valley of Sawpit Gully (Fig. 1) and some original brigalow dominated scrubs occur in the upper valley of Millard Creek.



Fig. 1. Rainforest vines in Sawpit Gully.

INTRODUCTION TO DUNG BEETLES

The dung beetles comprise a large, worldwide group of stout-bodied beetles which specialise in feeding on dung of animals. They are a sub-group of the very large group of beetles which go under the general name of “scarabs”. Other familiar sorts of scarabs that don’t feed on dung include Christmas beetles, rhinoceros beetles, cane beetles and stag beetles. Technically, the true dung beetles belong to the subfamily Scarabaeinae within the family Scarabaeidae.

Dung beetles find dung by smell using their highly sensitive antennae which can detect the direction in which freshly deposited dung lies. Most have wings and can fly to dung, but a few species, mostly in rainforest, have lost the powers of flight and walk in search of dung. Some species are active only at night, others only in the daytime. Dung beetles use dung as a food source for their larvae (the grub stage). After arrival at a dung mass they dig burrows in the ground and transport dung down into underground nest chambers where they lay a single egg in each dung chamber. The eggs hatch to larvae which eat the dung and eventually transform into a new generation of adult dung beetles.

Most species make their nest burrows directly at the site of the dung and these are called “**dung buriers**”. Others form the dung into balls which they carry or roll away from the original dung source before making their nest burrows. These are called the “**ball rollers**”. A few small species don’t collect their own dung but lay their eggs in nest burrows made by other dung beetles, like cuckoos, and these are the “**nest parasites**”. In Australia a few species have evolved to use rotten mushroom material instead of dung for feeding their larvae.

Dung beetles are considered highly beneficial to ecosystems. They remove dung from the soil surface and thus reduce its role in both disease/parasite transfer and in fly breeding. They ensure that the dung nutrients are incorporated into the soil and their burrowing activities provide valuable soil aeration.

There are about 450 native species of Australian dung beetles. These evolved to use the dry, pelletized dung of native mammals, such as kangaroos. Europeans brought cattle to Australia which produce large masses of semi-liquid dung, quite different from that of native Australian mammals. The native dung beetles could not cope adequately with dung of this nature and a serious problem arose with the non-dispersal of cattle dung in Australia. In the 1970s and 1980s, to alleviate this problem, CSIRO introduced to Australia a suite of African and Mediterranean dung beetles which were adapted to the dung of large ruminant herbivores, such as cattle, and there are now 23 of these foreign species established here.

Dung beetles are beneficial insects which are diverse and well-studied around the world. They are easy to sample using baited traps and are relatively easy to identify. For these reasons they have been widely used as an environmental monitoring group in many parts of the world, including Australia where there is a national database of 100,000 dung beetle records available that can be used to place local surveys into national context. The Queensland Museum has the largest collection of databased Australian dung beetles and this collection is a major resource for identifying and assessing local dung beetle survey collections.

SAMPLING DUNG BEETLES

Dung beetles usually exist in relatively high numbers in bushlands and survey collecting has negligible effect on their populations. Three main trapping methods were used to sample the dung beetles of the Upper Lockyer during this survey:

(1) Short term baited pitfalls (Fig. 2). Dung beetles are easily trapped by using the odour of fresh dung to lure them into a container sunk into the ground as a small pitfall trap. For the Upper Lockyer survey we used 250 ml plastic cups as the pitfall receptacle. These were sunk in the ground using a trowel so that their mouth was flush with the ground surface. Balls of bait about 60 mm in diameter were wrapped in squares of



Fig. 2. A baited pitfall trap and its rain cover. Inset: Items used in baited pitfall trapping of dung beetles.

kitchen cloth (Chux®) and tied off with short lengths of garden tie-wire. These baits could be suspended in the mouth of the pitfall by tying the bait to a wire peg pushed into the soil beside the cup. About 20 mm deep of detergent water was poured into each pitfall cup and a rectangular rain-shelter of polycarbonate roofing was pushed into the ground so that it leaned at an angle over the baited trap. Beetles fly or walk to the bait and fall into the cup where they quickly drown in the detergent water. Since some species feed on mushrooms, traps are set in pairs with one baited with macropod dung and one baited with decaying mushrooms. The traps are set at least 2 m apart and are normally maintained for 24 hrs before clearing. When the traps are emptied, the beetles are strained from the detergent water and preserved in ethanol until identification takes place.

(2) Flight intercept traps (Figs. 3 & 4). Many dung beetles fly low around the environment searching for fresh dung. These can be trapped by erecting a transparent panel with which they collide, dropping down into a trough of preservative below. Such traps can be maintained for a relatively long period at one position, and with periodic sampling of the catch, can build up a through coverage of the dung beetle species in the area. They can also be baited with dung or mushroom baits hung in front of the panel (Fig. 3). The trough is part-



Fig. 3 (left): Flight intercept trap baited with dung. **Fig. 4.** (right): Using a small kitchen sieve to strain the catch from the trough of a flight intercept trap.

filled with propylene glycol, a non-toxic fluid that preserves specimens that fall in but does not evaporate. Every 3-4 weeks the trap is serviced by straining the insects out of the fluid and storing the catch in ethanol (Fig. 4). The glycol is replaced in the trough.

(3) Mercury Vapour Light Trap (Fig. 5). Insects are strongly attracted to the low wavelength, ultra-violet light which is given out by mercury vapour (MV) bulbs. If a MV bulb is suspended in front of a white

fabric sheet night-flying insects can be selected for collection as they arrive and rest on the sheet. Since many dung beetles fly strongly at night in search of dung, especially soon after dusk, a MV lights operated in the bush with a portable generator is a useful way to collect these night flying species, some of which rarely come to normal baited traps.

THE UPPER LOCKYER DUNG BEETLE SURVEY

The survey was undertaken during the summer of 2015/16 and built on preliminary trapping which had been carried out in March 2015 by Geoff Monteith and which detected 17 native species and 2 African species collected from 9 sites. Summary of the visits and activities during the 2015/16 summer is as follows:

Visit 1 (1-2 November 2015). G.Monteith, K.Ebert and R.Hobson set up 18 flight intercept traps at 14 different sites. Baited pitfalls were run overnight at three sites.

Visit 2 (1-2 December 2015). G.Monteith, K.Ebert and B.Robinson camped overnight on Stephens plateau and ran MV light. All but one of the 18 FIT traps were serviced. Baited pitfall trapping was carried out at 8 sites.

Visit 3 (2 Jan 2016). G.Monteith and R.Hobson installed 8 malaise traps at 6 sites. Some FIT traps were cleared. Baited pitfalls were set at 5 sites and serviced by R.Hobson on Jan 4.

Visit 4 (8-10 Jan 2016). Entomological Society of Queensland camped at Stockyard Hall. G.Monteith, K.Ebert, N.Baldwin and R.Hobson serviced FIT and malaise traps. Baited pitfall traps were run at 5 sites and MV lights run at 3 sites. A trapping workshop was run by G.Monteith and K.Ebert on 9 Jan for local landowners who wished to trap on their properties. These people then trapped overnight on 9/10 Jan at 27 new sites for the survey and returned their samples for a sorting session on the afternoon of 10 Jan.

Visit 5 (23 Jan 2016). K.Ebert, N.Baldwin, R.Hobson, and W.Jenkinson emptied and dismantled all flight intercept and malaise traps and the survey field work came to an end.



Fig. 5. Collecting insects from a MV light trap. Most beetles fall to the ground on to the spread-out base of the screen.)

SURVEY ZONES AND SITES

Insect collections were made at 60 sites during the survey. Four of these sites (Sites M1-M4) are ones made by community members far outside the survey zone and are not included in the survey though they are listed in Table 1. For convenience of later analysis, the overall survey region has been divided into five defined zones. The sample sites in each zone are given a code letter identifying them with that zone. All zones and sites are shown in Fig. 6 and the sites are listed with their details in Table 1. The zones are as follows:

STOCKYARD ZONE. The lower valley of Stockyard Creek and the highlands to the east of the valley up Kennedy and Egert Roads. The zone includes 13 survey sites (**S1-S13**).

DWYERS ZONE. The highlands to the east which are mostly drained by tributaries of Ma Ma Creek. The zone includes some sites on the eastern fall at Spinach Creek and along the Clifton-Gatton Road. The zone

also includes the major habitats of the Dwyers Scrub CP and the Palm Creek valley. There are 16 sample sites in this zone (**D1-D16**).

ROCKMOUNT ZONE. The upper valley of Stockyard Creek and highlands to the south. This zone includes the important rainforest locality of Sawpit Gully. The zone has 17 sample sites (**S1-S17**).

PRESTON ZONE. The highlands at the absolute head of both Stockyard Creek and Flagstone Creek. Little trapping was carried out here and the zone has only 3 sample sites (**P1-P3**).

MILLARD ZONE. Includes the upper valley of Millard Creek and adjacent escarpments. The zone has important patches of remnant brigalow and rainforest. There are 7 sample sites (**B1-B7**).

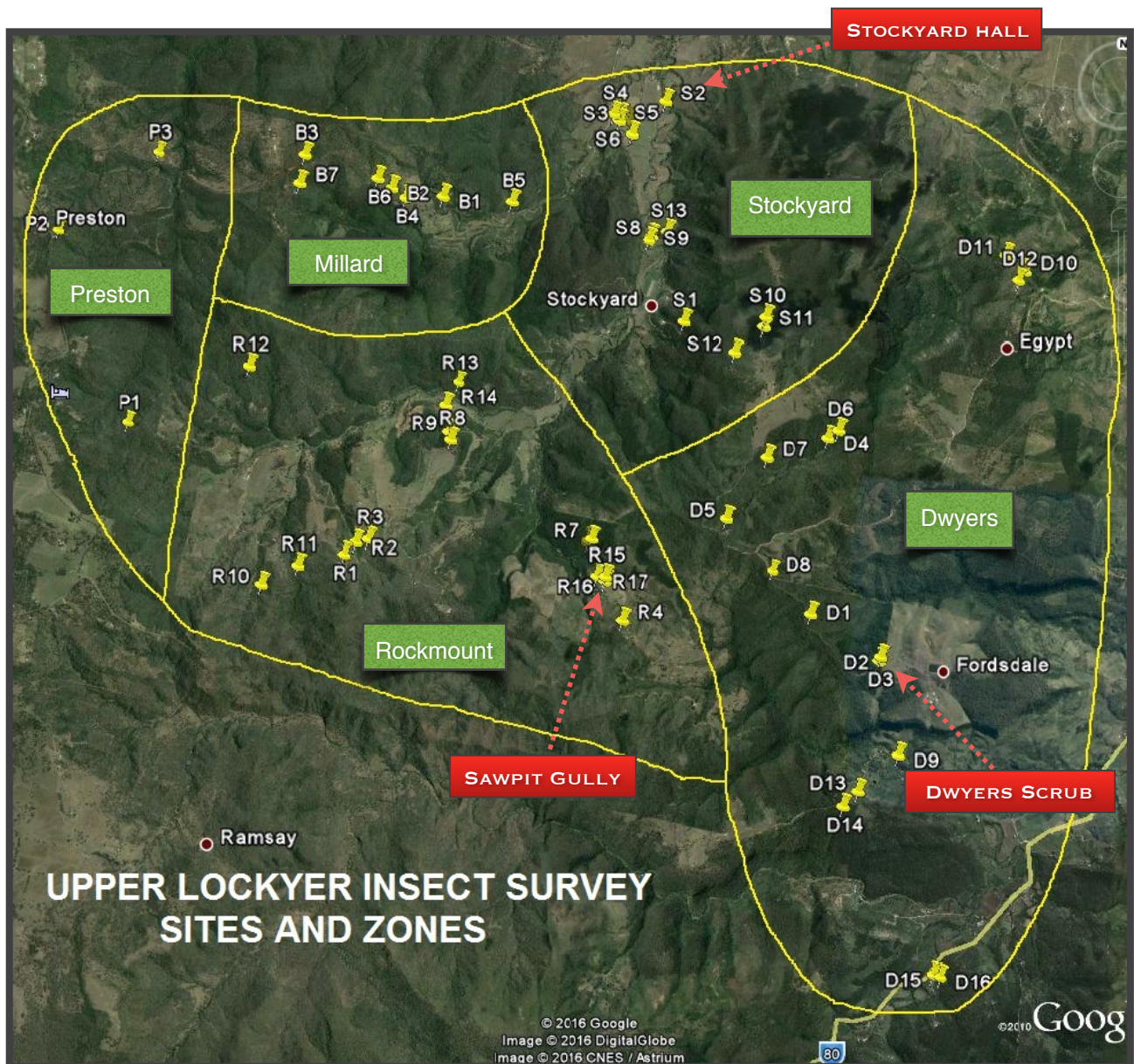


Fig. 6. Map of Survey area showing zones and collecting sites.

PROCESSING THE COLLECTIONS

The whole insect survey program yielded 203 bulk samples in jars of ethanol, many of them large and diverse trap catches. All samples were taken to Brisbane for final sorting and identification over several weeks. From all samples a total of 3912 specimens of 35 species were extracted. Final identification is a difficult business involving stereo-microscope examination of specimens which have been dried to make critical details clearly visible. After identification voucher specimens of each species from each sample need to be pinned and labelled as permanent records in the Queensland Museum. Stages in this process are as follows:

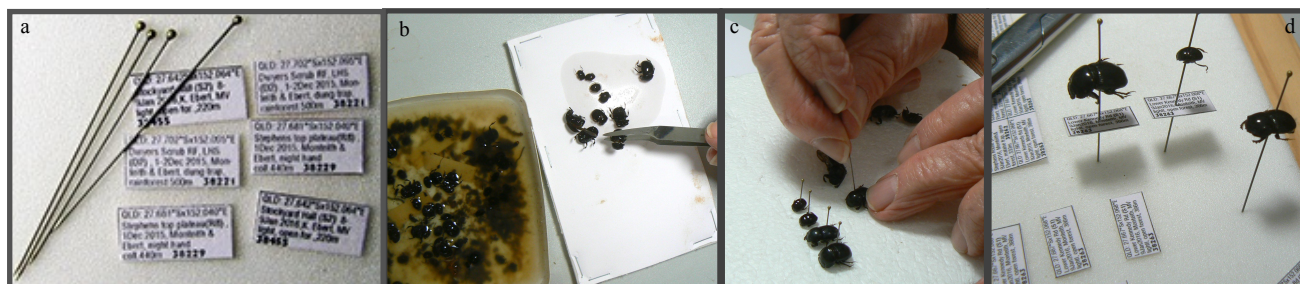


Fig 7. (a) Printed labels and pins ready for the Upper Lockyer survey dung beetles.) (b) Specimens being picked out from a bulk trap sample on to drying tray. (c) Beetles being pinned to dry. (d) Beetles with labels attached and ready to move into storage trays.

1. Multiple small labels for each sample are composed with very small font and printed on to archival grade white card with a laser printer. After printing the sheets are heat sealed to fix the ink. The tiny labels (Fig. 7) carry all the necessary data (locality, date, method, etc) as well as a bold-face Sampcode number which will eventually link the specimen to the computer database.
2. Bulk samples contain much dirt, leaves and other insects. Samples are tipped into a white tray and dung beetles are picked out with forceps by eye under good light. Specimens are spread on squares of absorbent paper where they quickly dry ready for final examination.
3. Specimens on each drying tray are roughly sorted by eye into similar groups. Final examination under the microscope verifies the identification of each specimen, sometimes using keys and illustrations in taxonomic papers or comparison with other identified specimens. Counts are made of each species in each sample and the figures are entered into the computer against that sample's Sampcode.
4. Voucher specimens of each species from each sample are impaled on special stainless steel pins and one of the small printed labels is added to each pin. The specimens are then allowed to dry thoroughly which is all the preservation that pinned insects need.
5. Finally the dried labelled specimens are pinned into single-species storage trays known as "unit trays". Each tray is labelled with the name of the species and the trays are packed into glass-topped storage drawers for permanent storage in museum cabinets where they are protected from vermin by naphthalene fumes.

The insect sampling program yielded 203 samples, many of them large and diverse trap collection samples. These were sorted in Brisbane, all dung beetles were identified, and vouchers from all samples were pinned and labelled for the Queensland Museum collection. There was a total of 3212 dung beetle specimens, which were sorted into 35 species. These included 30 native Australian species and five introduced African species. A list of all species and the zones in which they occur is given in Table 2. The Rockmount Zone was the richest with 29 of the 35 species detected there.

All data were entered into a database and, from the distribution points, maps of the occurrence of each species in the survey zone were plotted using the mapping facility of the Atlas of Living Australia website. In the following species pages, an image, map and discussion text are given for each of the Upper Lockyer species.



Fig.8. The Upper Lockyer dung beetle survey vouchers in final storage at the Queensland Museum.

DISCUSSION OF SURVEY RESULTS

The preliminary survey of Upper Lockyer dung beetles conducted on 6-8 March 2015 yielded 436 specimens of 19 different species taken at just 9 collecting sites. The much more extensive survey carried out during the summer of 2015-16 yielded another 3476 specimens and brought the total species to 35 and the number of sampled sites to 60 (Tables 1 & 2). All the data has been loaded into an Excel spreadsheet which has been lodged with the Citizens of the Lockyer Inc and is freely available from them. This spreadsheet of data has been drawn on for the following discussion of the survey results.

Overall dung beetle diversity of the Upper Lockyer (Table 2, Fig 9).

There are currently 364 named native species of dung beetles in Australia and an additional 128 known undescribed species, bringing the total known fauna to 492 species. The 30 native species taken in the Upper Lockyer thus represent 6% of the Australian fauna. This is a little lower than the diversity for other areas of similar size and diversity closer to the coast and represents the diminution in dung beetle diversity that occurs all round Australia for inland areas. The Upper Lockyer survey totals are compared with 4 other recent surveys in SE Queensland in Fig 9. The figure of 36 spp for Lamington includes only the rainforest fauna but indicates the rich fauna of its high rainfall habitats on fertile volcanic soils; several of its species are unique to the area. Beechmont, with 43 native species, is even richer because its fauna has most of the Lamington rainforest species plus a big component of open eucalypt dung beetles. The Brookfield (31 spp) and Cubberla-Witton catchments (28 spp), just west of Brisbane, have similar habitat diversity to Upper Lockyer and the diversity of the three areas is very similar. Of the five survey zones at Upper Lockyer (Table 2) Dwyers and Rockmount with 24 and 29 species respectively had around double the diversity of the other three zones and

this can be attributed partly to the rich rainforest patches which are preserved there. The low number of only 6 species in Preston is a reflection of the small amount of sampling in that zone, with no flight intercept traps operated.

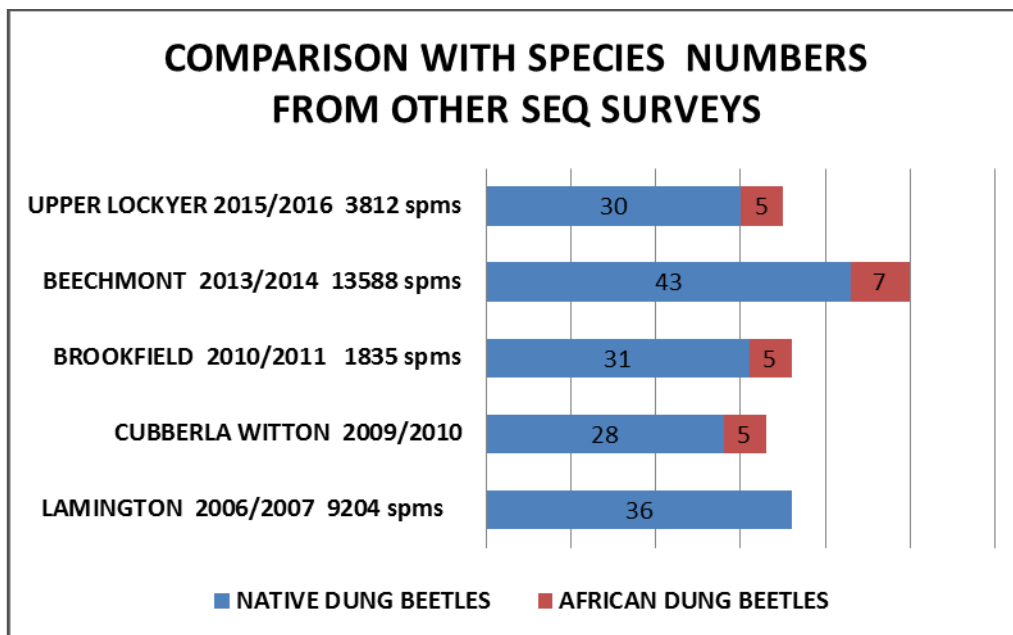


Fig 9. Comparison of numbers of species of dung beetles taken at Upper Lockyer with those from four other surveys in Southeast Queensland in recent years.

Effectiveness of sampling – did we miss some? (Figs 10, 11, 12)

The effectiveness of the five collecting methods used are shown in Figs 10 and 11. Of the 3912 specimens collected, 58% of them were taken in the flight intercept traps (Fig 10) which compares the raw numbers of specimens taken. Dung traps were also very effective in collecting 35% of all specimens while the other methods of mushroom traps, MV light and hand collecting only a small percentage. However, comparison of the numbers of separate species taken by each method (Fig 11) shows that apparently less effective methods still collect a substantial number of separate species. This is because behavioural peculiarities of some species

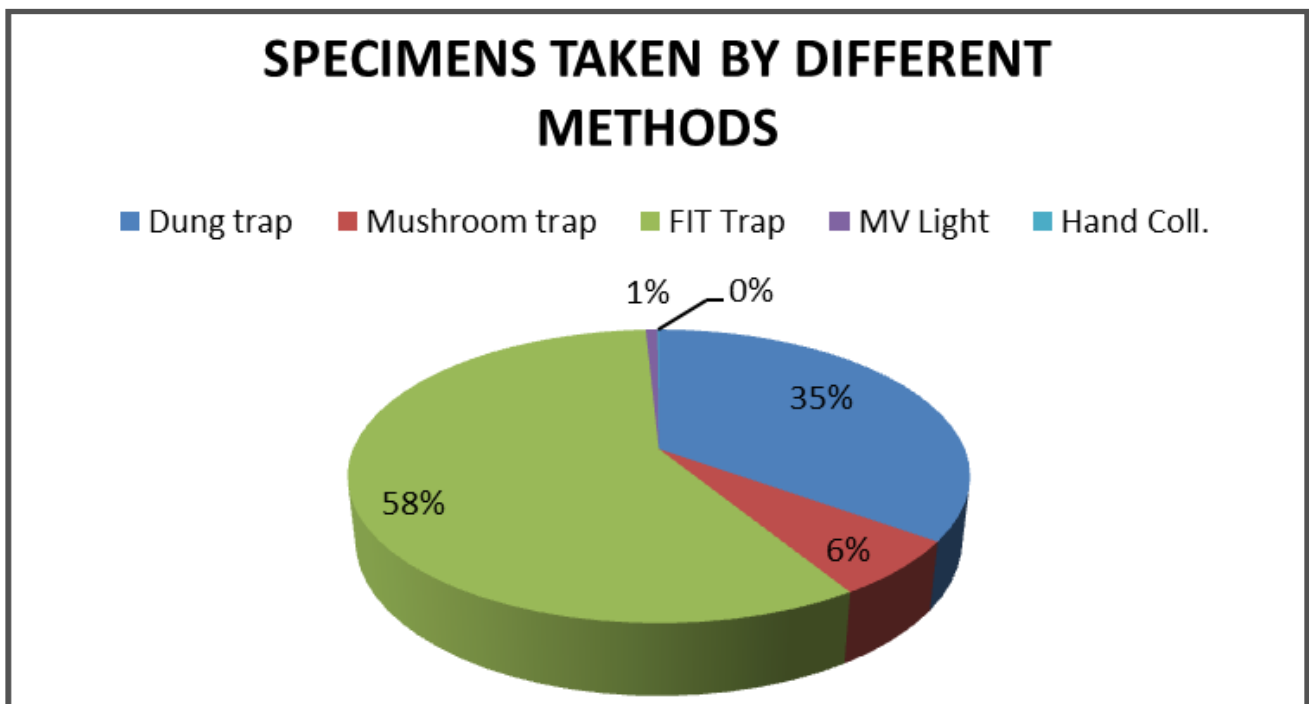


Fig 10. Proportion of the total 3813 native dung beetle specimens that were collected by the five different methods used during the survey. More than half (2212 specimens) were taken in flight intercept traps. Only three specimens were taken by hand collecting.

mean they are only taken by methods which target them. For example almost all specimens of *Onthophagus atrox*, *O. desectus* and *O. muticus* were taken at MV light and specialist mushroom feeders like *Boletoscapter furcatus* and *O. dunningi* are rarely taken other than at mushroom baited traps. To collect the full fauna we need to use many methods.

It is of interest to note that of the 2003 samples processed, the richest single trap catch was Sample 38234 which was a dung trap beside Carol Stephens' house on January 4-5 which returned 169 dung beetles in 12 different species!

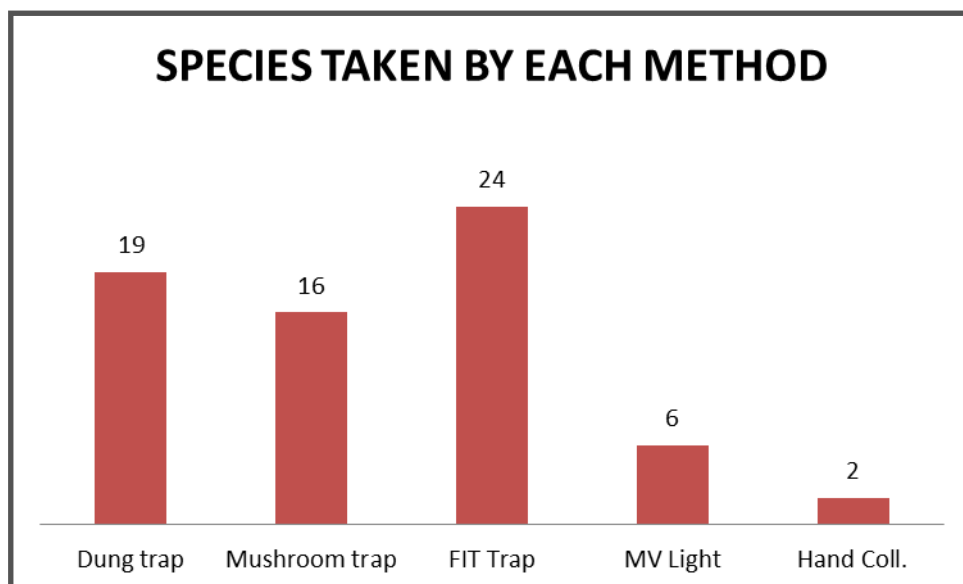


Fig 11. Number of native dung beetles species taken by each collecting method during the survey. A total of thirty native species were taken by all methods.

The relative numbers collected of each species varied dramatically, with some very common and others very rare. Of the total catch of 3912 specimens, no less than 1078 specimens, or 27.5% of all beetles, were the tiny species *Onthophagus rubicundulus*. Similarly 17.5%(687) were *O. incornutus* and 15.5%(606) were the nest parasite species, *Demarziella interrupta*. At the other end of the scale of commonness were four species for which the survey collected only a single specimen, viz. *Onthophagus bicarinaticeps*, *O. consentaneus*, *O. muticus* and *O. yourula*. There was also great disparity between species in how widespread they were within the survey region. This is shown in Fig 12., where species are arranged in order of the the number of different localities at which they were detected. This statistic does not always accord with the overall commonness of a species. For example, *Onthophagus incornutus* was much less common than *O. rubicundulus* but occurs at the maximum number of sites, 32 compared to 24. Some of the rainforest species were taken in quite high numbers, but occurred at very few sites because of their special habitat requirements, e. g. *Onthophagus sydneyensis* and *Amphistomus calcaratus* occurred only at the two Dwyers Scrub sites but both were common there. Five species were taken at only a single site out of the 60 sites sampled.

If the survey yielded only single specimens of 4 species and found 9 species at only 1 or 2 sites, then statistically there is a good chance that we missed some species altogether. Records in the Queensland Museum show the following nine dung beetle species occur at localities within about 20 km of Upper Lockyer but were not detected during the survey: *Lepanus ustulatus*, *Monoplistes leai*, *Onthophagus anchommatus*, *O. auritus*, *O.kokereka*, *O. quadripustulatus*, *O. rubrimaculatus*, *O. semimetallicus*, *O. tenebrosus*. Suitable habitats for all of them occur in the area and they almost certainly occur there.

Collections by community volunteers (Tables 3 & 4)

During the Entomological Society camp on January 9-10 we conducted a workshop on dung beetle trapping for local residents at the Stockyard Hall. Trap gear and baits were provided to them and they then ran dung and mushroom baited pitfalls on their properties for 24 hours from the afternoon of the 9th to the afternoon of the 10th. Another workshop was then run where they separated the dung beetle specimens from their catches.

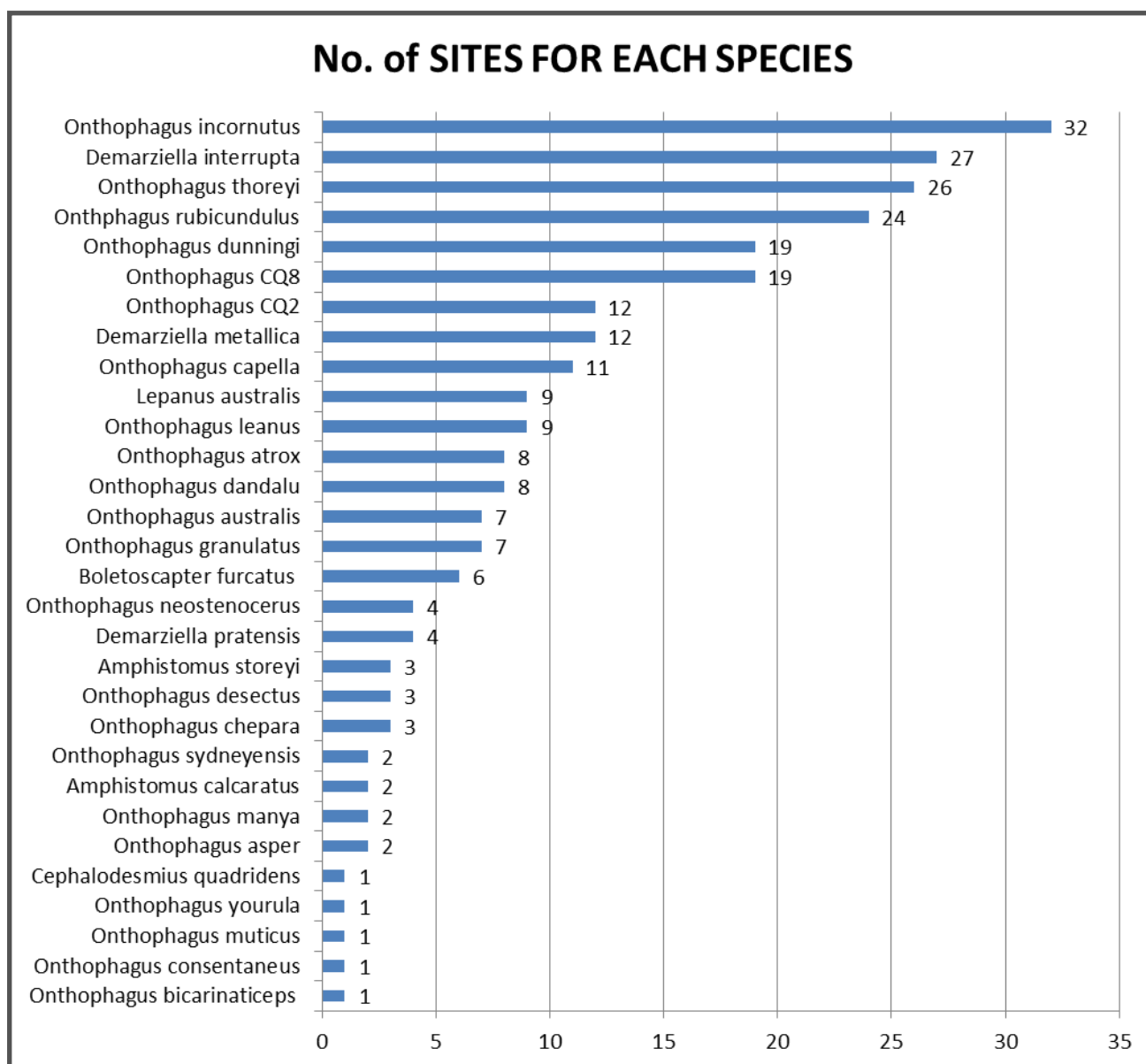


Fig. 12. Histogram showing the comparative number of localities within Upper Lockyer where each species was trapped during the survey.

The resulting samples went into the general pool for the survey. This was a valuable exercise and resulted in 93 specimens of 16 species from 25 extra sites. Interestingly, no African species were in any of the samples. The residents, and the sites they sampled, are listed in Table 3 and the full identification of their catches is given in Table 4. We are most grateful for this input into the survey.

African species in the Upper Lockyer (Table 5)

Between 1968 and 1992, CSIRO introduced 23 species of foreign dung beetles to Australia. They were native to Africa and the Mediterranean Region and were specialist feeders on the dung of large herbivores. They were introduced to bury and disperse cattle dung which was not being fully utilised by native Australian dung beetles. Of the 14 of those species which occur in SE Queensland, 96 specimens of only 5 species were collected during the survey. Details of these are listed in Table 5. Undoubtedly other African species are in the area. The poor catch is explained because no special attempt was made to target paddocks with cattle, and most trapping was done with macropod dung which the African species do not favour. Only two specimens were caught in dung traps with the remainder taken in flight intercept traps and at MV light.

Mushroom feeding species (Fig. 13)

Australian dung beetles are unusual in that a significant, but small, number of species have adopted mushroom material as the food they use for stocking their larval brood nests. Some species always use mushroom while others are more catholic and will use both dung and mushroom. Most, of course, are highly specialised to use just dung. This is why we always use adjacent pairs of traps when doing surveys, one baited with dung and the other with crushed, over-ripe mushroom. This ensures that we get all the species that are active in an area.

By comparing the dung versus mushroom collecting data for a particular species over numerous collections we can come up with a “percentage bait preference profile” for each species which then become useful in

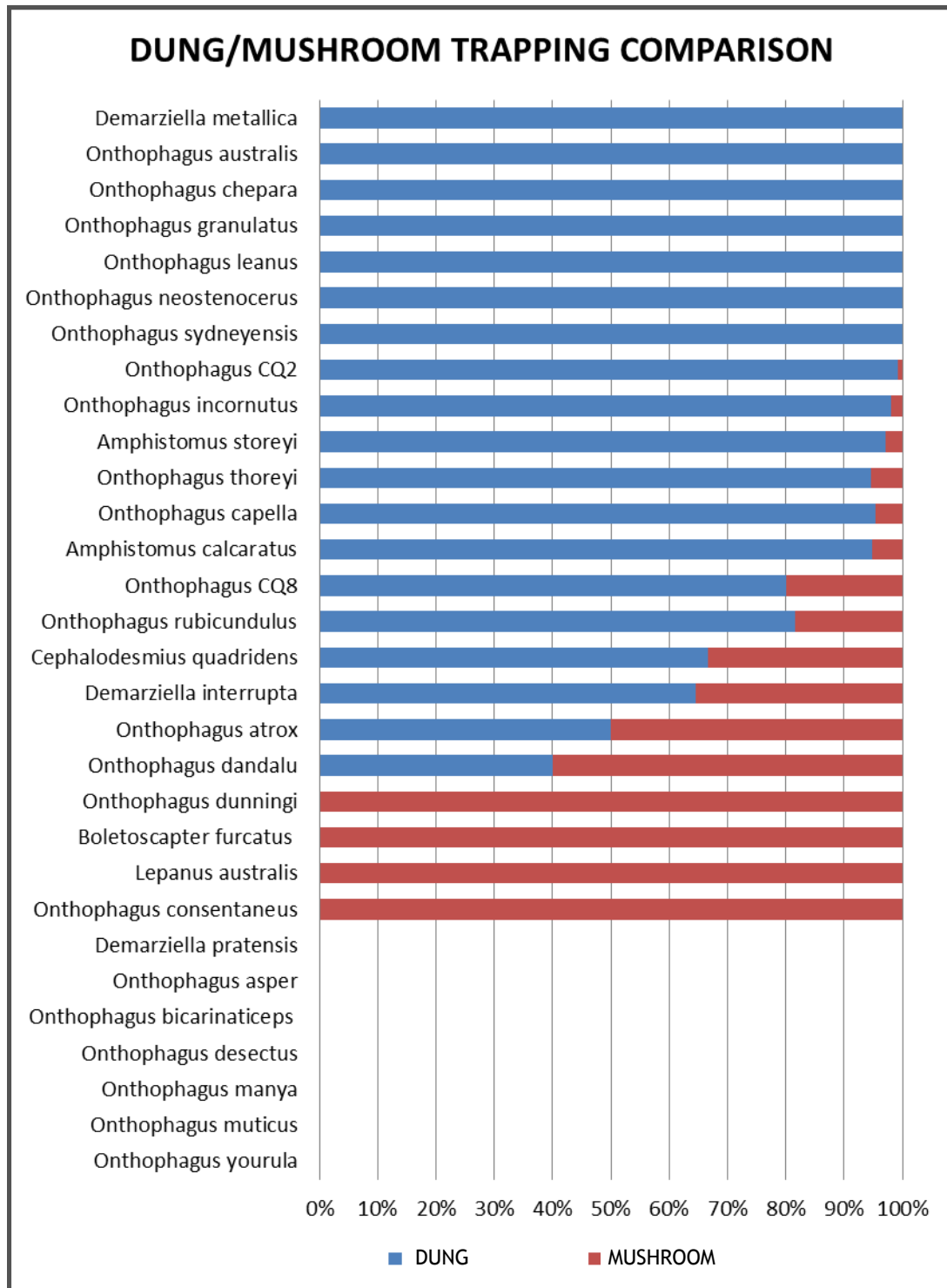


Fig. 13. Comparison of dung/mushroom bait preference of the native species. For each species the blue shows percentage of the total catch of that species taken at dung baits, and the red shows the percentage at mushroom baits. Species without a coloured bar were not taken at either dung or mushroom baits.

interpreting trapping data. Using the data from just the paired baited trap catches of the Upper Lockyer survey (1570 specimens of 23 species) and ordering the species according to the preference percent we can see how the pattern varies across the 30 native species (Fig 13). Four of the species (*Boletoscapter furcatus*, *Lepanus australis*, *Onthophagus dunningi* and *O. consentaneus*) are solely mushroom feeders and would not have been collected if mushroom baits were not used. Twelve species are optional feeders and 7 are “hard core” dung feeders. The remaining 7, at the bottom of Fig. 13, were not taken in either dung or mushroom baited pitfalls and this shows the value of using flight intercept traps which catch passively flying species regardless of their feeding preferences. By comparison with other areas, Upper Lockyer has a richer fauna of mushroom feeding species.

Rainforest species (Table 6)

In Australia there is a very important ecological divide between the dark, moist, dense habitat of rainforest and the brightly-lit, dry, sparse habitat of open eucalypt forests. Within an area, the soils in rainforest are usually different to those of open forests, often of more fertile origins. Dung beetles react to all these differences and thus each species tends to strongly favour either rainforest or open forest. The rainforest dung beetles, because of the patchy distribution of their rainforest habitat, tend to have much more limited geographic distributions, and some have lost the ability to fly because their food supply is more concentrated in a small area.

Dung beetles were trapped in five very different rainforest patches at Upper Lockyer and the 22 species obtained are listed in Table 6. Dung beetle catches in patchy Australian rainforests are usually “contaminated” by small numbers of open forest species which blunder in from adjacent eucalypt forest habitat and can be regarded as occasional “vagrants” to the system. This was the case at Upper Lockyer. The non-rainforest species are asterisked(*) in Table 6 and are not included in the site totals at the bottom of the Table. This was particularly the case in Stephen’s Vinescrub (Site R9) which lies immediately below the lip of a cleared open forest plateau. Clearly, dispersing dung beetles from the plateau are “dropping in” to the rainforest. There were 5 species in this category at Stephens, including the only survey specimen of *Onthophagus bicarinaticeps*, a species strongly oriented to open areas.

The two main rainforest sites were Dwyers Scrub and Sawpit Gully. Dwyers is a large tract of low, diverse, vine-scrub with dense understorey on deep, red, powdery loam of volcanic origin on a dry, flat tableland. Sawpit Gully is tall rainforest with sparse understorey on weathered sandstone soil in a deep, cool, well-watered valley. Their dung beetles were very different. Dwyers had 11 specialist rainforest species, and Sawpit 10. However they shared only 7 of the 14 total species and each had relict species found nowhere else in the survey. Unique to Dwyers were: the wingless *Cephalodesmus quadridens*, one of the famous species that make artificial “dung” from plant bits; the ball-rolling *Amphistomus calcaratus*, beyond its recorded range; and a thriving population of the small day-active *Onthophagus sydneyensis*. Confined to Sawpit Gully was probably the most exciting find for the survey, a population of the bizarre little, rare, flightless *Amphistomus storeyi* which is known from just a few sites, the closest being on Mt Stradbroke, near Marburg. Sawpit also has rich populations of large *Onthophagus*, including the undescribed one known as *Onthophagus CQ2*. The other rainforest patches had reduced dung beetle populations, probably due to fragmentation.

SPECIES PAGES

At the rear of this report are standardised full-page species accounts of each of the 35 species collected during the Upper Lockyer survey. Each page gives:

NAME: The full taxonomic name of the species with author and date of its original description and the tribal unit and behavioural group to which it belongs, is given.

PHOTOGRAPH: A dorsal-view, auto-montaged image of a male of each species is given. An inset silhouette of the species indicates its actual size in nature.

DESCRIPTION: A short description of key features which might help to separate the species from the other species in the survey. Maximum and minimum lengths are given in millimetres. Special features of the male are given, if distinctive. A hand lens may be needed to see some features. Fig. 14 gives images of

three contrasting species from the survey, with labels indicating some of the key features of dung beetles mentioned in the descriptions.

DISTRIBUTION: A short statement of the total known distribution of the species beyond Upper Lockyer. This draws on the databases of the Queensland Museum's extensive reference collection. If Upper Lockyer is an extension of known range then this is mentioned.

NOTES: What is known of its basic biology, activity time and diet is given.

UPPER LOCKYER SURVEY: Short notes are given on the numbers of specimens and sites for the species, and its altitude range, obtained during the survey. Other notable points about the species' status at Upper Lockyer are given.

MAP: A map of the Upper Lockyer area shows points in red for all sites where the species was collected during the survey. The maps have been made by downloading survey points to the Atlas of Living Australia's online map-making module at <http://spatial.ala.org.au/>. Details of points on the species maps can be obtained by referring to the map of all collecting sites (Fig 6) and the list of sites (Table 1).

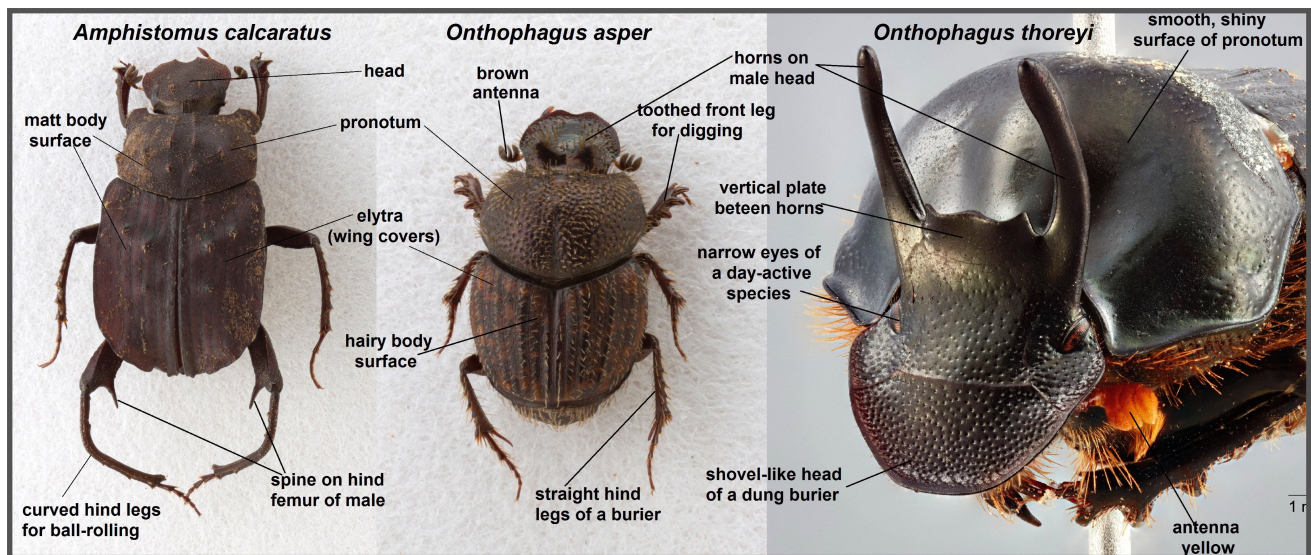


Fig. 14. Dorsal views of three contrasting species of Upper Lockyer dung beetles with characteristic features indicated.

TABLE 1. COLLECTION SITES. List of collection sites during the Upper Lockyer insect survey. Latitude and longitude are given in decimal degrees to three places. The localities are shown by their “Site No.” code on the map (Fig. 6) which indicates the boundaries of the “Zones”. Vinegar Hill and Toowoomba localities are outside the formal survey region.

SITE NO.	ZONE	SITE NAME	LAT.	LONG.	ALT. (M.)	VEG.
B1	MILLARD	Burtons, disturbed brigalow	-27.655	152.036	355	Brigalow
B2	MILLARD	Burtons, open forest past vinescrub	-27.654	152.03	410	Open forest
B3	MILLARD	Burtons, open forest, road near house	-27.652	152.019	500	Open forest
B4	MILLARD	Burtons, vine scrub on road	-27.655	152.032	390	Rainforest
B5	MILLARD	Lower Scanlans Rd, opp. shed	-27.655	152.045	287	Open forest
B6	MILLARD	Burtons, Rainforest on side track	-27.653	152.028	410	Rainforest
B7	MILLARD	Burtons house	-27.655	152.018	510	Open forest
D1	DWYERS	Dwyer's Scrub CP, road cutting	-27.698	152.086	510	Open forest/ lantana
D2	DWYERS	Dwyer's Scrub Rainforest on left	-27.702	152.095	500	Rainforest
D3	DWYERS	Dwyers Scrub, Rainforest on right	-27.703	152.095	500	Rainforest
D4	DWYERS	Lower Palm Creek, clearing	-27.678	152.086	462	Open forest
D5	DWYERS	Peter Darvall house	-27.688	152.074	560	Open forest
D6	DWYERS	Lower Palm Ck, rainforest	-27.678	152.089	461	Rainforest
D7	DWYERS	Upper Palm Ck, open forest	-27.681	152.079	520	Open forest, lantana
D8	DWYERS	Dwyers Scrub CP, boundary fence	-27.693	152.081	520	Open forest
D9	DWYERS	Spinach Creek 1	-27.713	152.100	300m	
D10	DWYERS	East Egypt 1	-27.659	152.109	570m	cleared
D11	DWYERS	East Egypt 2	-27.659	152.107	540m	Rainforest, regenerated
D12	DWYERS	East Egypt 3	-27.661	152.109	550m	cleared
D13	DWYERS	Spinach Creek 2	-27.717	152.093	450m	Open forest
D14	DWYERS	Spinach Creek 3	-27.719	152.091	490	Open forest
D15	DWYERS	Gatton-Clifton Rd 1	-27.737	152.104	280	cleared
D16	DWYERS	Gatton-Clifton Rd 2	-27.737	152.105	285	Open forest
P1	PRESTON	Upper Rockmount Road	-27.682	151.999	544	Open forest
P2	PRESTON	Preston	-27.661	151.989	637	Open forest
P3	PRESTON	Hell Hole Road	-27.652	152	420	Open forest
R1	ROCKMOUNT	Dave Darrell's house	-27.695	152.026	490	Open forest

R2	ROCKMOUNT	Dave Darvall's, house turnoff	-27.693	152.028	460	Open forest
R3	ROCKMOUNT	Dave Darvall's, Open forest at first gully	-27.693	152.03	466	Open forest
R4	ROCKMOUNT	Open forest at top of Dalton's hill	-27.700	152.062	480	Open forest
R5	ROCKMOUNT	Sawpit Gully RF 1	-27.692	152.057	390	Rainforest
R6	ROCKMOUNT	Sawpit Gully RF 2	-27.691	152.058	393	Rainforest
R7	ROCKMOUNT	Sawpit Gully RF 3	-27.691	152.058	397	Rainforest
R8	ROCKMOUNT	Stephens top plateau	-27.681	152.04	440	Open forest
R9	ROCKMOUNT	Stephens Vinescrub	-27.681	152.039	430	Rainforest
R10	ROCKMOUNT	Chris Darvall's, at fenceline	-27.699	152.016	480	Open forest
R11	ROCKMOUNT	Dave Darvall's, beside road to west	-27.696	152.021	448	Open forest
R12	ROCKMOUNT	Michael Darvall's, near top dam	-27.675	152.013	480	casuarina
R13	ROCKMOUNT	Stephens house	-27.675	152.04	333	Open forest
R14	ROCKMOUNT	Stephens horse yards	-27.678	152.038	363	Open forest
R15	ROCKMOUNT	Dawson property 1	-27.695	152.060	432	pasture
R16	ROCKMOUNT	Dawson property 2	-27.696	152.060	427	garden
R17	ROCKMOUNT	Dawson property 3	-27.696	152.059	416	grass/ lantana
S1	STOCKYARD	Lower Kennedy Road	-27.667	152.068	366	Open forest
S2	STOCKYARD	Stockyard Hall	-27.642	152.064	220	Open forest
S3	STOCKYARD	Scanlan property 1	-27.644	152.058	231	pasture
S4	STOCKYARD	Scanlan property 2	-27.644	152.057	232	pasture
S5	STOCKYARD	Scanlan property 3	-27.645	152.058	240	casuarina
S6	STOCKYARD	Scanlan property 4	-27.646	152.060	237	pasture
S7	STOCKYARD	Scanlan property 5	-27.645	152.060	230	garden
S8	STOCKYARD	Jakins property 1	-27.657	152.063	246	garden
S9	STOCKYARD	Jakins property 2	-27.658	152.063	246	pasture
S10	STOCKYARD	Kennedy 1	-27.666	152.078	520	Open forest
S11	STOCKYARD	Kennedy 2	-27.667	152.078	515	Open forest
S12	STOCKYARD	Kennedy 3	-27.670	152.074	481	Open forest
S13	STOCKYARD	Jakins property 3	-27.657	152.065	253	clearing
M1	MISC.	Vinegar Hill 1	-27.493	152.246	232	garden
M2	MISC.	Vinegar Hill 2	-27.492	152.244	232	Open forest
M3	MISC.	Vinegar Hill 3	-27.495	152.249	197	Open forest
M4	MISC.	Edward St, Toowoomba	-27.553	151.961	616	garden

TABLE 2. DUNG BEETLE SPECIES LIST. List of 35 species of dung beetles taken during the Upper Lockyer survey. Occurrence of the species in the five survey zones is shown.

SPECIES IN SURVEY	SURVEY ZONES				
NATIVE BALL ROLLERS	PRESTON	MILLARD	STOCKYARD	DWYERS	ROCKMOUNT
<i>Amphistomus calcaratus</i>				X	
<i>Amphistomus storeyi</i>					X
<i>Boletoscapter furcatus</i>	X	X	X		X
<i>Cephalodesmius quadridens</i>				X	
<i>Lepanus australis</i>		X		X	X
NATIVE NEST PARASITES					
<i>Demarziella interrupta</i>	X	X	X	X	X
<i>Demarziella metallica</i>		X	X	X	X
<i>Demarziella pratensis</i>		X			X
NATIVE BURIERS					
<i>Onthophagus asper</i>					X
<i>Onthophagus atrox</i>			X	X	X
<i>Onthophagus australis</i>				X	X
<i>Onthophagus bicarinaticeps</i>					X
<i>Onthophagus capella</i>				X	X
<i>Onthophagus chepara</i>					X
<i>Onthophagus consentaneus</i>				X	
<i>Onthophagus CQ2</i>		X	X	X	X
<i>Onthophagus CQ8</i>			X	X	X
<i>Onthophagus dandalu</i>		X			X
<i>Onthophagus desectus</i>			X	X	X
<i>Onthophagus dunningi</i>		X	X	X	X
<i>Onthophagus granulatus</i>	X			X	X
<i>Onthophagus incornutus</i>	X	X	X	X	X
<i>Onthophagus leanus</i>		X		X	X
<i>Onthophagus manya</i>					X
<i>Onthophagus muticus</i>			X		
<i>Onthophagus neostenocerus</i>				X	X
<i>Onthophagus rubicundulus</i>	X	X	X	X	X
<i>Onthophagus sydneyensis</i>				X	
<i>Onthophagus thoreyi</i>	X	X	X	X	X
<i>Onthophagus yourula</i>					X
AFRICAN SPECIES					
<i>Euoniticellus intermedius</i>				X	
<i>Liatongus militaris</i>				X	X
<i>Onitis alexis</i>				X	X
<i>Onitis viridulus</i>		X	X		X
<i>Onthophagus gazella</i>		X	X	X	X
35 SPECIES TOTAL	6	14	14	24	29

TABLE 3. COMMUNITY VOLUNTEERS. List of Upper Lockyer residents who trapped dung beetles on their properties on the weekend of Jan 9-10 2016 and the sites at which they sampled. Trapping results are given in Table 4.

COLLECTORS	LOCALITY NAME	SITE NO.	Latitude	Longitude
Gordon Claridge	Vinegar Hill 1	M1	-27.493	152.246
Gordon Claridge	Vinegar Hill 2	M2	-27.492	152.244
Gordon Claridge	Vinegar Hill 3	M3	-27.495	152.249
Bill & Helen Scanlan	Scanlan property 1	S3	-27.644	152.058
Bill & Helen Scanlan	Scanlan property 2	S4	-27.644	152.057
Bill & Helen Scanlan	Scanlan property 3	S5	-27.645	152.058
Bill & Helen Scanlan	Scanlan property 4	S6	-27.646	152.06
Liz Jakins	Jakins property 1 (290 Stockyard Ck Rd)	S8	-27.657	152.063
Liz Jakins	Jakins property 2	S9	-27.658	152.063
Liz Jakins	Jakins property 3	S13	-27.657	152.065
Ken Kennedy	Kennedy 1	S10	-27.666	152.078
Ken Kennedy	Kennedy 2	S11	-27.667	152.078
Ken Kennedy	Kennedy 3	S12	-27.670	152.074
Diane Guthrie	801 East Egypt Rd 1	D10	-27.659	152.109
Diane Guthrie	801 East Egypt Rd 2	D11	-27.659	152.107
Diane Guthrie	801 East Egypt Rd 3	D12	-27.661	152.109
Judy Whistler	Spinach Creek 1	D9	-27.713	152.1
Jim Kerr	Spinach Creek 2	D13	-27.717	152.093
Jim Kerr	Spinach Creek 3	D14	-27.719	152.091
Joanne Cork	Gatton-Clifton Rd 1	D15	-27.737	152.104
Joanne Cork	Gatton-Clifton Rd 2	D16	-27.737	152.105
Trish Dawson & Roxane Blackley	Dawson property 1	R15	-27.695	152.06
Trish Dawson & Roxane Blackley	Dawson property 2	R16	-27.696	152.06
Trish Dawson & Roxane Blackley	Dawson property 3	R17	-27.696	152.059
Glenda Walter	Toowoomba, Edward St	M4	-27.553	151.961

TABLE 4. COMMUNITY COLLECTIONS. Numbers of dung beetles trapped by community volunteers during the Entomological Society weekend on 9-10 January. Trap sites are listed at the head of columns by their Site Code Numbers. Details of sites can be obtained from Tables 1 and 2 and their locations are shown on Fig. 6 (map).

Part 1:

BEETLE SPECIES	TRAPPING SITES LISTED BY SITE No.												
	R15	R16	R17	D10	D11	D12	D15	D16	S13	S8	S9	S10	S11
<i>Demarziella interrupta</i>						1							
<i>Onthophagus atrox</i>								1					
<i>Onthophagus australis</i>	1												
<i>Onthophagus consentaneus</i>								1					
<i>Onthophagus CQ2</i>													1
<i>Onthophagus CQ8</i>			3	1		1		2				3	21
<i>Onthophagus incornutus</i>		1					4						
<i>Onthophagus rubicundulus</i>							1						
<i>Onthophagus thoreyi</i>												1	

Part 2:

BEETLE SPECIES	TRAPPING SITES LISTED BY SITE No.											
	S12	S4	S3	S5	S6	D9	D13	D14	M4	M1	M2	M3
<i>Boletoscapter furcatus</i>											1	1
<i>Demarziella metallica</i>			12					1				
<i>Demarziella pratensis</i>			1									
<i>Onthophagus atrox</i>	1											
<i>Onthophagus bicarinaticeps</i>										1		
<i>Onthophagus capella</i>												1
<i>Onthophagus CQ2</i>				1								
<i>Onthophagus CQ8</i>		2	2		1					5		
<i>Onthophagus dandalu</i>									1			
<i>Onthophagus incornutus</i>				3	5	1						
<i>Onthophagus muticus</i>										2		
<i>Onthophagus thoreyi</i>				1	2		2	2		11	5	3

TABLE 5. AFRICAN SPECIES. Localities and collection method for the 69 specimens of 5 species of introduced African dung beetles taken during the Upper Lockyer survey.

COLLECTION DETAILS			AFRICAN DUNG BEETLE SPECIES				
Site No.	Locality Name	Collection method	<i>Euoniticellus intermedius</i>	<i>Liatongus militaris</i>	<i>Onitis alexis</i>	<i>Onitis viridulus</i>	<i>Onthophagus gazella</i>
B7	Burton's house	FIT trap				1	
B4	Burton's, vine scrub on road	FIT trap		1		1	
R1	Dave Darvall house	Dung trap			1		
R1	Dave Darvall house	MV Light			1		3
R11	Dave Darvall, beside W Rd	FIT trap				1	1
D2	Dwyers Scrub RF, LHS	MV light			1		4
D2	Dwyers Scrub RF, LHS	FIT trap		1			
S1	Lower Kennedy Road	MV light					1
D4	Lower Palm Creek clearing	FIT trap		1			
R4	OF at top of Tricia's hill	FIT trap		10	1	1	2
D5	Peter Darvall house	FIT trap	1	6	3		1
R14	Stephen's horse yards	MV light			2	1	3
R8	Stephen's top plateau	MV light			2		2
R8	Stephen's top plateau	Dung trap		1			
R9	Stephen's vinescrub	FIT trap		1			
S2	Stockyard Hall	MV light				3	10
D7	Upper Palm Ck, open forest	FIT trap		1			
No OF SPECIMENS			1	22	11	8	27

TABLE 6. RAINFOREST SPECIES. Tabulation of 22 dung beetle species collected at the five different rainforest tracts during the survey. Some tracts have more than one sample site as shown by the site codes. Species considered open forest vagrants dropping into rainforest are asterisked (*) and are excluded from the bottom totals.

SPECIES	RAINFOREST TRACT				
	DWYERS (D2, D3)	BURTONS (B4, B6)	SAWPIT (R5,R6,R7)	PALM CK (D6)	STEPHENS (R9)
<i>Amphistomus calcaratus</i>	71				
<i>Amphistomus storeyi</i>			41		
<i>Cephalodesmius quadridens</i>	3				
<i>Demarziella interrupta</i>	6	5	14		53
<i>Demarziella metallica</i>	2	10	148	1	2
<i>Lepanus australis</i>	9	85	30		
<i>Onthophagus asper</i> *					1*
<i>Onthophagus australis</i>					
<i>Onthophagus bicarinaticeps</i> *					1*
<i>Onthophagus capella</i>	2		5	10	1
<i>Onthophagus CQ2</i>		66	146		28
<i>Onthophagus CQ8</i>	2		12		3
<i>Onthophagus dandalu</i>			1*		
<i>Onthophagus desectus</i> *	1*				
<i>Onthophagus dunningi</i>				4*	1*
<i>Onthophagus granulatus</i> *					2*
<i>Onthophagus incornutus</i>	41	42		4	115
<i>Onthophagus leanus</i>	50	3	16		1
<i>Onthophagus neostenocerus</i>			20	6	
<i>Onthophagus rubicundulus</i>	380	196	282		44
<i>Onthophagus sydneyensis</i>	184				
<i>Onthophagus thoreyi</i>					2*
NUMBER OF RF SPECIES	11	7	10	4	8
TOTAL SPECIMENS	750	407	718	21	247

The ball-rollers (Tribe Canthonini)



Amphistomus calcaratus (Macleay, 1871)

DESCRIPTION: A medium sized (6-8 mm) brown species with rough matt surface and long curved legs. Hind legs of male have a prominent curved spur on the femora.

DISTRIBUTION: Occurs in many isolated populations in rainforest patches from Mackay south to the Brisbane area where populations are known from Bahrs Scrub, near Beenleigh and on Mount French, near Boonah.

NOTES: A cryptic nocturnal ball-rolling species which is restricted to drier rainforests and vinescrubs.

UPPER LOCKYER SURVEY: Seventy-one specimens were taken at two closely adjacent sites in the Dwyers Scrub red soil vinescrub. This is an important newly discovered population. Altitude 500m.



The ball-rollers (Tribe Canthonini)



Actual size: 4-5mm.

Amphistomus storeyi Matthews, 1974

DESCRIPTION: Size small (4-5mm); dirty brown species, with rough, hairy tubercles on thorax and elytra; usually coated with soil for camouflage; no horns on head; hind legs long and curved, in male with a long curved spur on femur.

DISTRIBUTION: Occurs sporadically in lower elevation rainforests from near Gympie south to Brisbane with previously known southern limit at Mt Stradbroke, near Marburg.

NOTES: A nocturnal, wingless, dung-feeding species which lives in the litter of rainforests.

UPPER LOCKYER SURVEY: A total of 41 specimens were taken at 3 closely adjacent sites within the rainforest gorge at the head of Sawpit Gully. This is an important record for this rare species and is 50 km beyond its recorded range. Altitude range: 390-397 m.



Amphistomus storeyi

The ball-rollers (Tribe Canthonini)



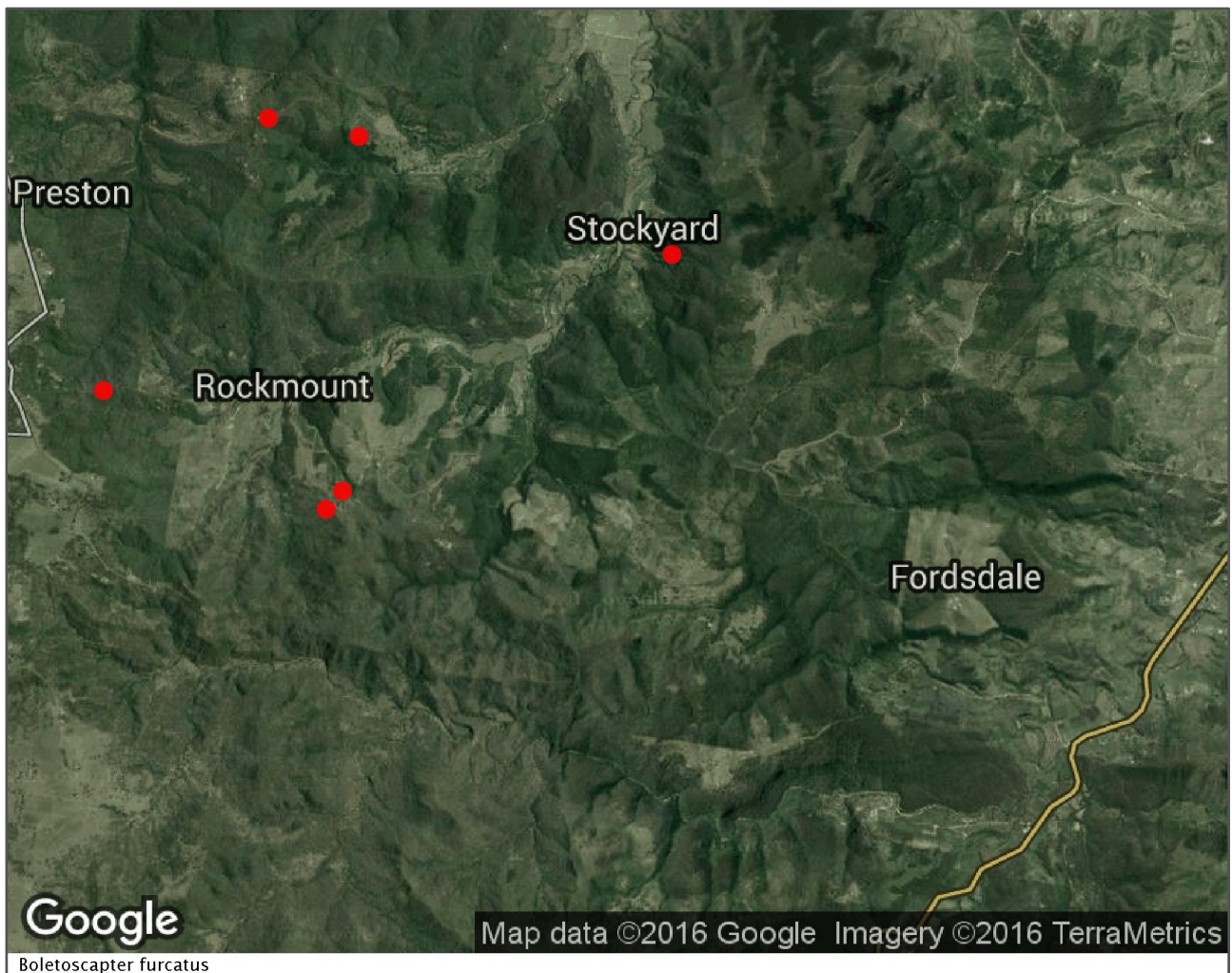
Boletoscapter furcatus Matthews, 1974

DESCRIPTION: Size medium (5-7mm); uniformly smooth, dull dirty brown; surface covered with short curved hairs which hold dirt; forked process projecting from front edge of head, short in female.

DISTRIBUTION: Occurs along the coast from the Atherton Tableland south almost to the NSW border.

NOTES: A winged, open forest, mushroom feeder. The name *Boletoscapter* literally means “mushroom digger” and all specimens were taken at mushroom baits.

UPPER LOCKYER SURVEY: The survey yielded 9 specimens at 6 different sites. The species also occurs nearby in Redwood Park below Toowoomba. These localities are its western limit and it does not cross the Great Dividing Range. Altitude range: 197-544m.



The ball-rollers (Tribe Canthonini)



Cephalodesmius quadridens Macleay, 1871

DESCRIPTION: Size medium (6-9mm); uniformly dull, dirty brown; surface covered with short curved hairs which hold soil for camouflage; no head horns, but front margin of head with four sharp points.

DISTRIBUTION: Occurs in rainforests and wetter open forests from near Gympie south to the NSW border and inland to the Bunya Mountains.

NOTES: A wingless, rainforest species which cultures macerated leaves and vegetable matter in underground burrows to make synthetic dung.

UPPER LOCKYER SURVEY: Three specimens were trapped at one site in the red soil vinescrub of Dwyers Scrub Conservation Park. Many burrows were noted in this same locality and some were excavated for study. Altitude 500m.



The ball-rollers (Tribe Canthonini)



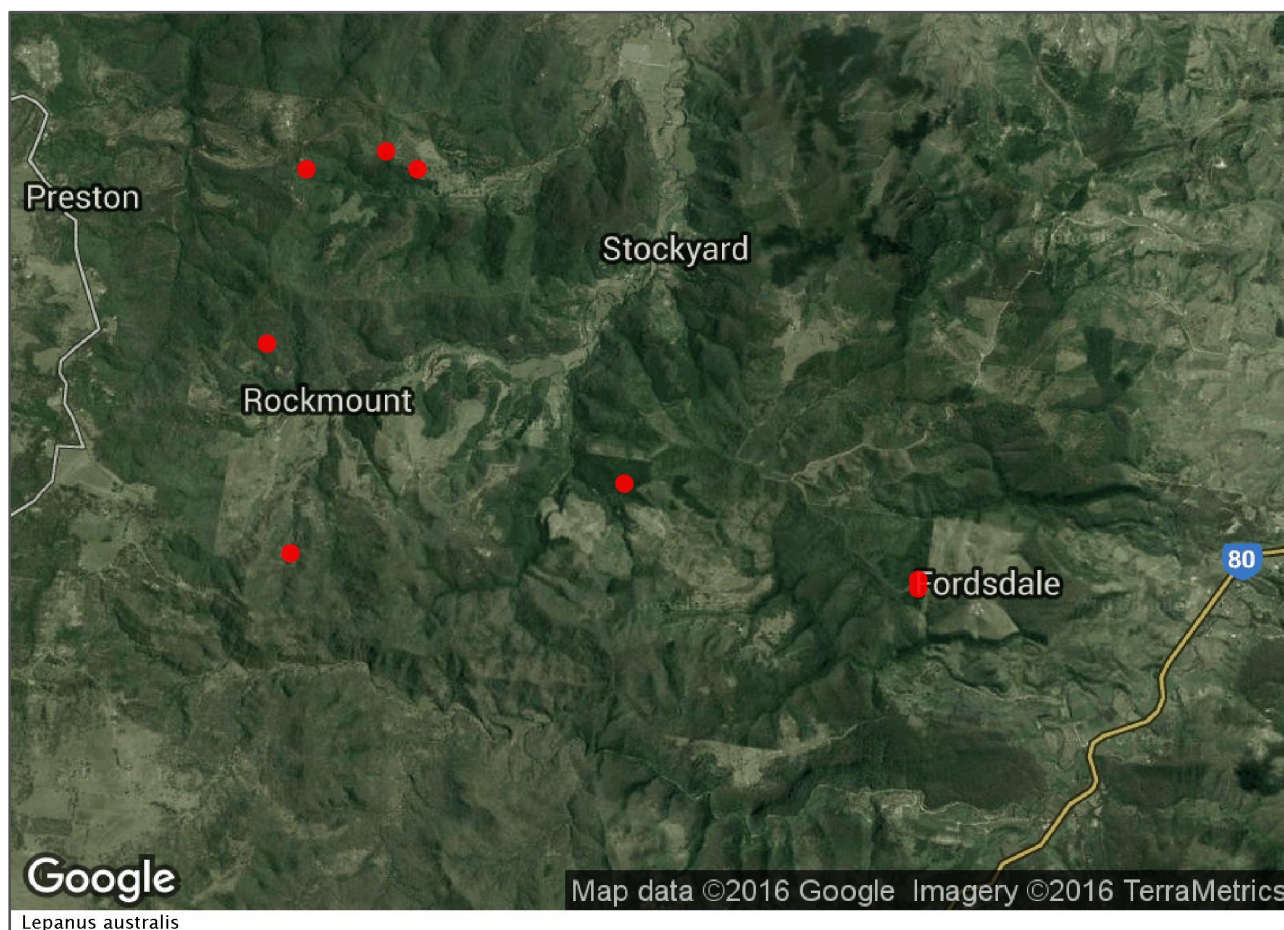
Lepanus australis Matthews, 1974

DESCRIPTION: Size very small (2-2.5mm); uniformly shiny black, hairless; no head horns; pygidium without pits or groove.

DISTRIBUTION: Occurs from St Lawrence in central coastal Queensland south to the Border Ranges

NOTES: A small winged ball roller which is widespread in both open forests and rainforest.

UPPER LOCKYER SURVEY: A total of 130 specimens were taken at 9 different sites, mostly in flight intercept traps rather than baited pitfalls. It occurred in all the main rainforest sites at Dwyers Scrub, Sawpit Gully and Burton's property, with just six specimens from open forest sites. Altitude range: 390-510m.



The nest parasites (Tribe Dichotomini)



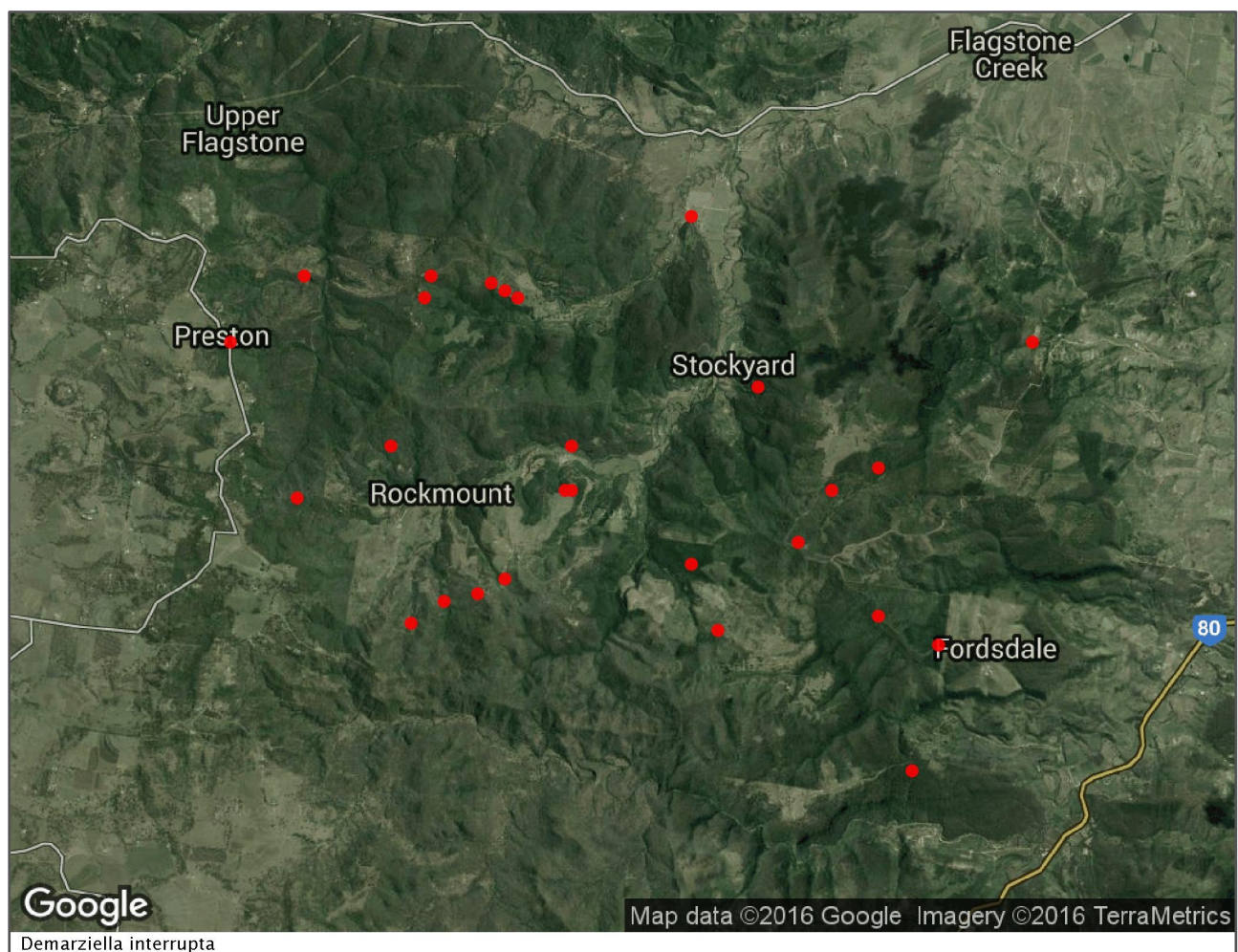
Demarziella interrupta (Carter, 1936)

DESCRIPTION: Size small (3-3.5mm); dark brown; parallel sided; no head horns; elytra with pattern of raised longitudinal ridges. seventh elytra stria chain-like.

DISTRIBUTION: Occurs from the Atherton Tableland south to Dorrigo in NSW.

NOTES: A winged species which is presumed to be a nest parasite in the nests of other dung beetles. Mostly in open forest.

UPPER LOCKYER SURVEY: The species common and widespread with 606 specimens taken from 27 different sites. Of these 515 specimens were from open forest, 78 from rainforest and 13 from pasture. Altitude range 231-637m.



The nest parasites (Tribe Dichotomini)



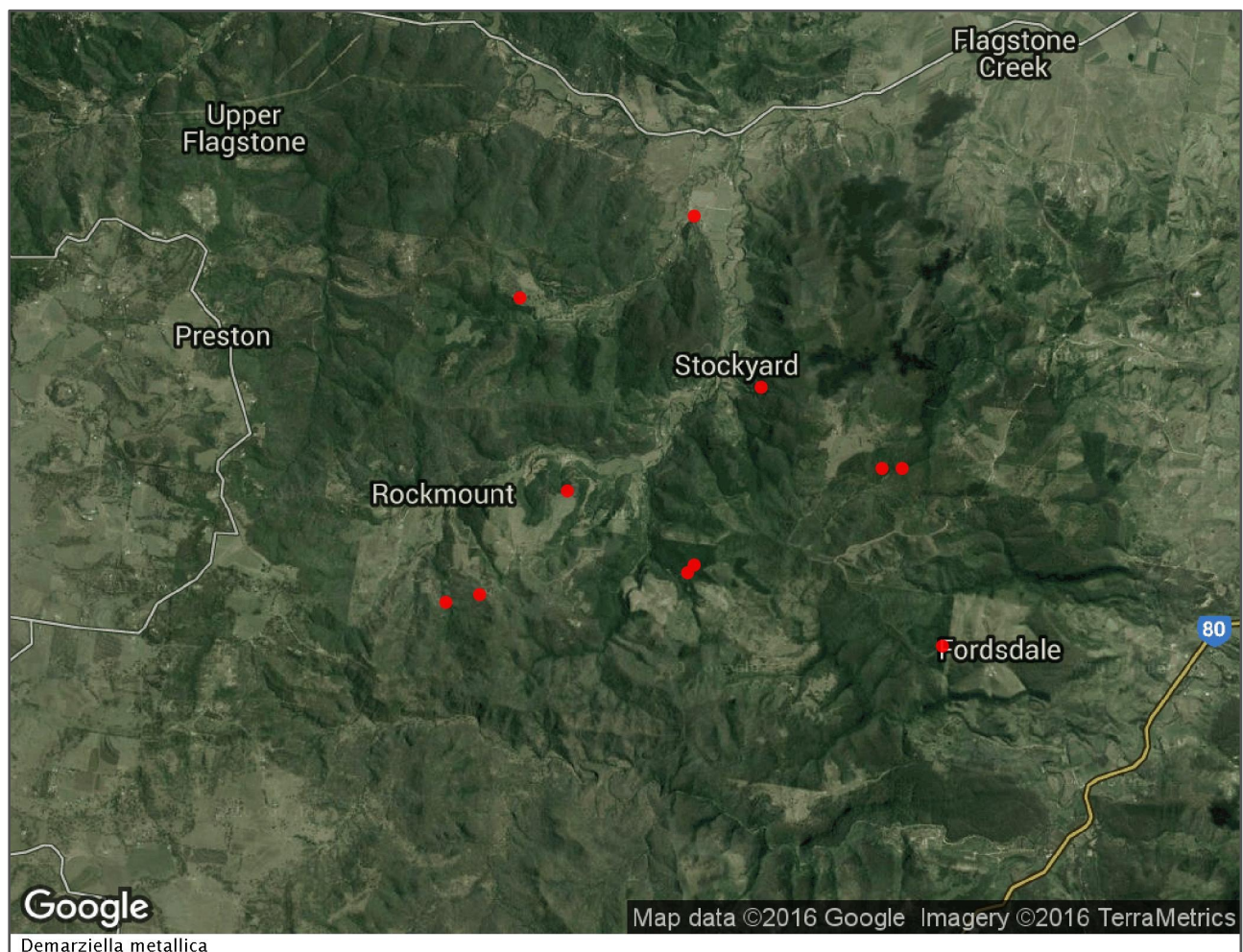
Demarziella metallica (Carter, 1936)

DESCRIPTION: Size small (3.5-4mm); shiny metallic green or copper coloured; parallel sided; no head horns; raised ridges on elytra often broken into segments. Stria of elytra linear.

DISTRIBUTION: Occurs from near Gympie south to Seal Rocks in NSW.

NOTES: A winged rainforest species which is presumed to be a nest parasite in the nests of other dung beetles.

UPPER LOCKYER SURVEY: The survey yielded 170 specimens from 12 sites with 83% of the specimens coming from the Sawpit Gully rainforest sites. Altitude range 231-500m.



The nest parasites (Tribe Dichotomini)



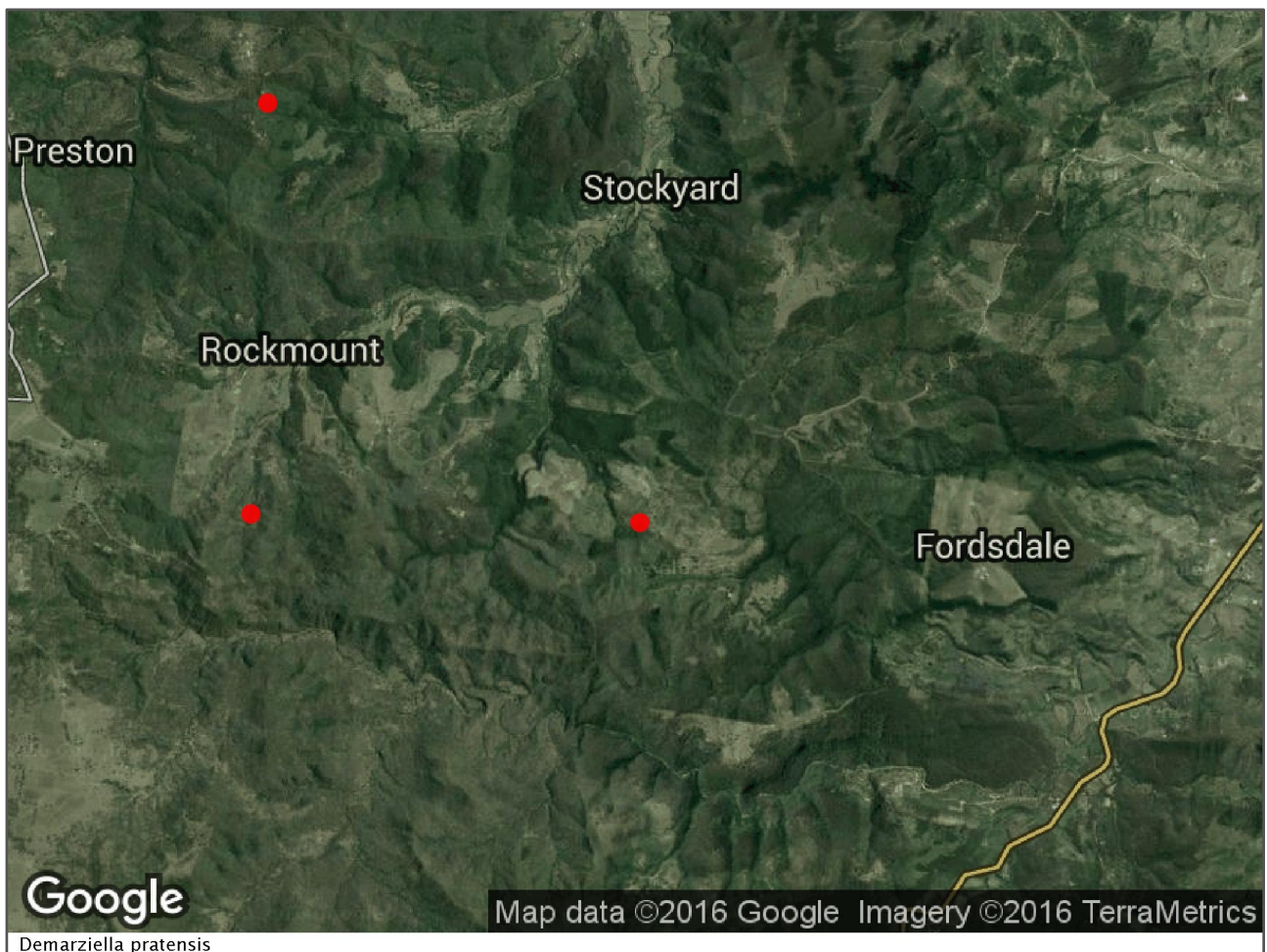
Demarziella pratensis Matthews, 1974

DESCRIPTION: Size small (2.9-3.8 mm); black, parallel-sided; no head horns; raised ridges on elytra; pronotum densely covered with circular punctures; seventh elytral stria linear.

DISTRIBUTION: Occurs around Darwin and from the Atherton Tableland south to the SEQueensland.

NOTES: An open forest species for which there is an early record from Wyreema (near Toowoomba) of being found in the nest of an *Onthophagus* species.

UPPER LOCKYER SURVEY: Uncommon, with 12 specimens recorded from 4 open forest sites during the survey. All sites are on the higher plateaus with altitude range of 480-510 m.



Demarziella pratensis

The dung-buriers (Tribe Onthophagini)



Onthophagus asper Macleay, 1864

DESCRIPTION: A small (3.5-5 mm) brown species covered with short curved bristles. The male has two short horns on the head arising between the eyes.

DISTRIBUTION: Mostly an inland species occurring in Queensland from about Cooktown south to the Darling Downs and inland to the Carnarvons.

NOTES: A day-flying species of dry open habitats. It is one of the native species which is common at cattle dung.

UPPER LOCKYER SURVEY: Two specimens were taken at two sites. One was an apparent stray in Stephen's vinescrub. This is only the second record for this inland species on the eastern side of the Great Dividing Range in SEQ. Altitude range 430-480m.



The dung-buriers (Tribe Onthophagini)



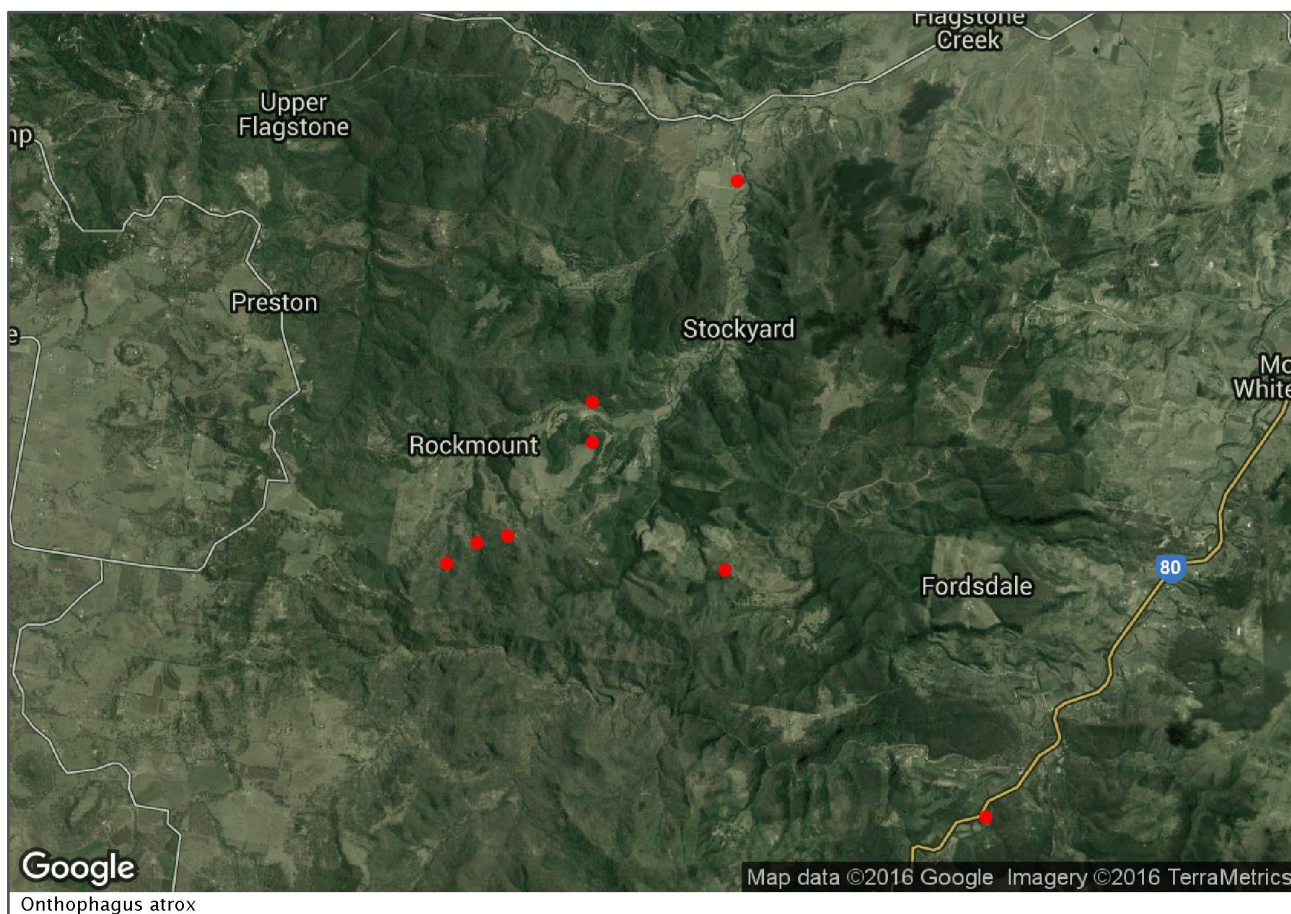
Onthophagus atrox Harold, 1867

DESCRIPTION: A very large (12-19mm) black species with pronotum bearing a large double median prominence flanked by two small tubercles. Pygidium with short setae on each side.

DISTRIBUTION: Widespread along coast and inland of eastern Australia from the tip of Cape York to Wingham in NSW.

NOTES: This is a large, nocturnal, open forest species which usually requires the presence of large macropods such as Eastern Grey Kangaroo to provide large enough dung pellets for nesting.

UPPER LOCKYER SURVEY: Twenty specimens were taken at 8 different localities, mostly at light traps. It did not occur in the Millard Creek valley. Altitude range: 285 – 520m.



The dung-buriers (Tribe Onthophagini)



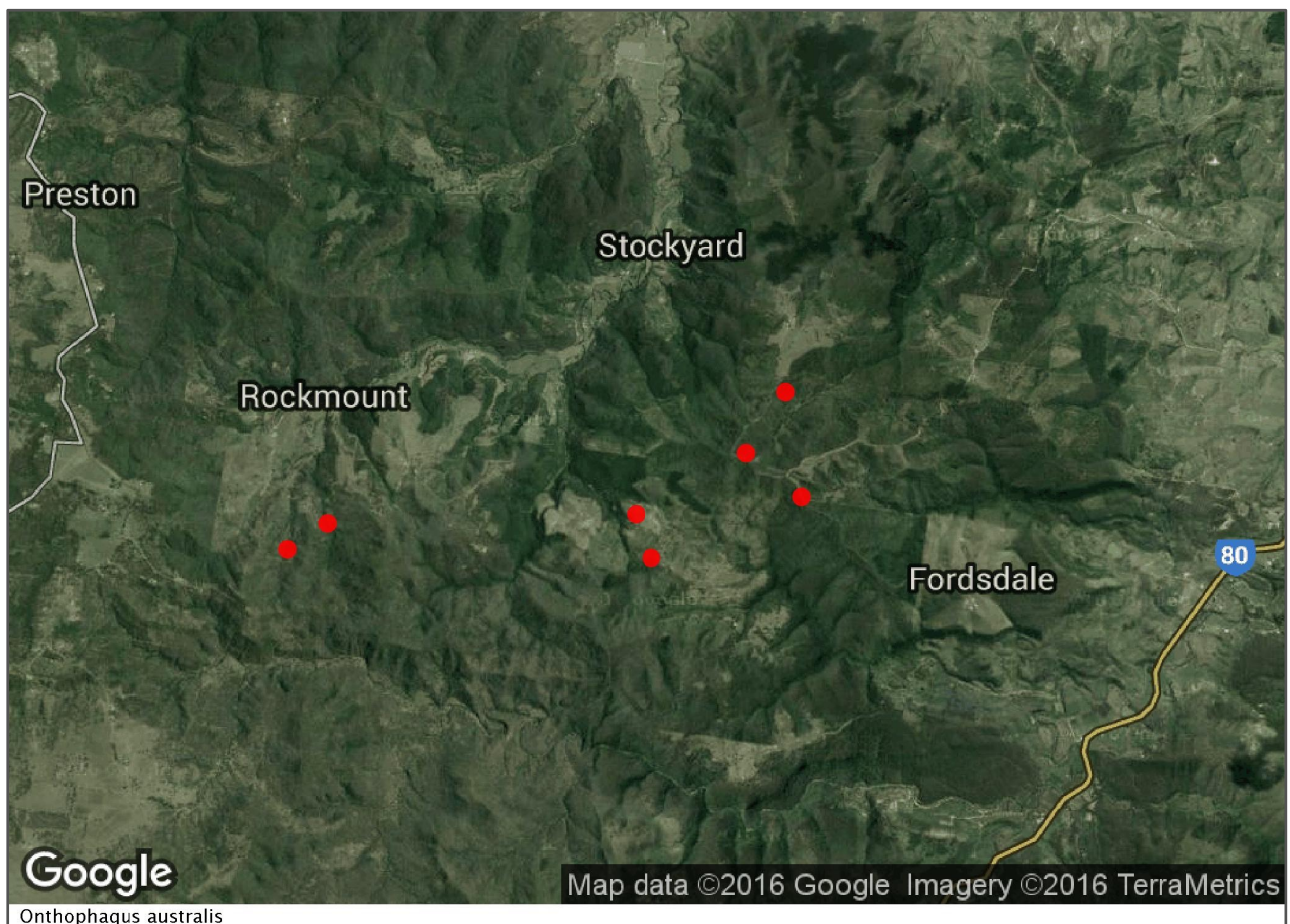
Onthophagus australis Guérin-Méneville, 1838

DESCRIPTION: Size medium-large (7-12mm); body uniformly greenish or bronzy; pygidium with sparse hairs; male with two horns separated by a flat rectangular plate along back margin of head.

DISTRIBUTION: Occurs from Carnarvon and Maryborough south to Tasmania and Adelaide.

NOTES: A winged, open forest dung burier which is active in the daytime.

UPPER LOCKYER SURVEY: Fifty-three specimens were taken at 7 different localities, mostly in the southern half of the survey region. All were from open eucalypt forests except for one in open pasture. All sites are at comparatively high altitude with range from 432-560m.



Onthophagus australis

The dung-buriers (Tribe Onthophagini)



Onthophagus bicarinaticeps Lea, 1923

DESCRIPTION: A small (2.5-4.5 mm) dark brown species covered with fine, short, erect bristles. The head has two transverse ridges on the upper part parallel with the rear margin

DISTRIBUTION: Occurs across the north of Australia from about Broome in the west down to northern NSW in the east.

NOTES: A winged, dung feeding species usually restricted to open forests. Often occurring in very arid areas.

UPPER LOCKYER SURVEY: Only a single specimen was taken during the survey. This was from Stephens vine scrub (R9) and may have been a stray from the horse dung bait collected in the nearby open paddock or a fly-in from adjacent open habitats. Altitude 430m.



The dung-buriers (Tribe Onthophagini)



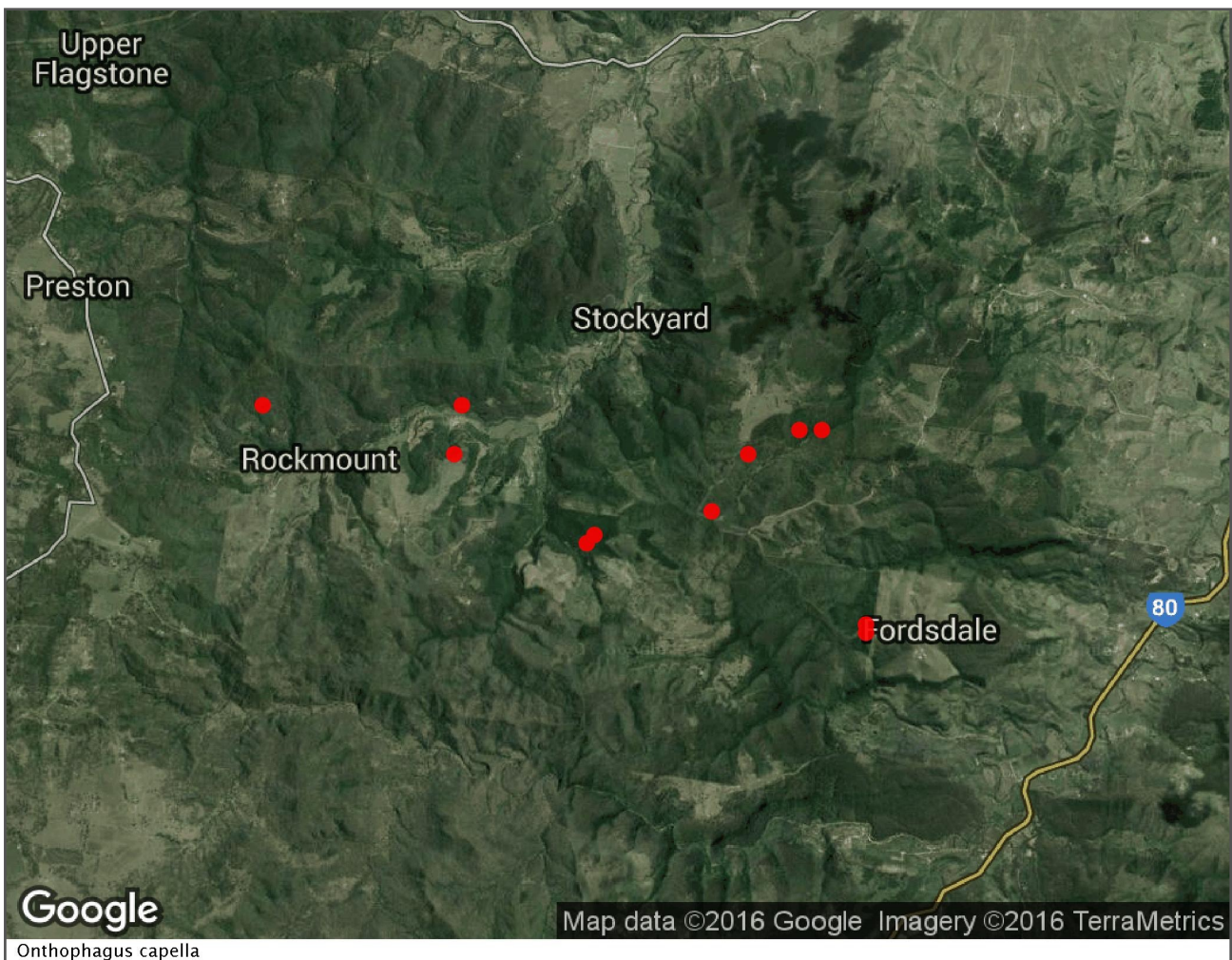
Onthophagus capella Kirby, 1818

DESCRIPTION: Size large (10-17mm); uniformly black, hairless; two bumps in middle of prothorax; male with two curved horns with a flat plate between them along the back margin of head. Two forms of male occur, one with plate between horns narrow (pictured) and other with plate wide, joining the horns.

DISTRIBUTION: Ranges from near Cooktown south to eastern Victoria.

NOTES: A large, nocturnal, winged open forest dung burier. Sometimes extends into rainforest habitats.

UPPER LOCKYER SURVEY. This large native species was common and widespread with 73 specimens taken at eleven sites. It was not taken at any site in the Millard Creek valley. Altitude range: 333-560m.



The dung-buriers (Tribe Onthophagini)



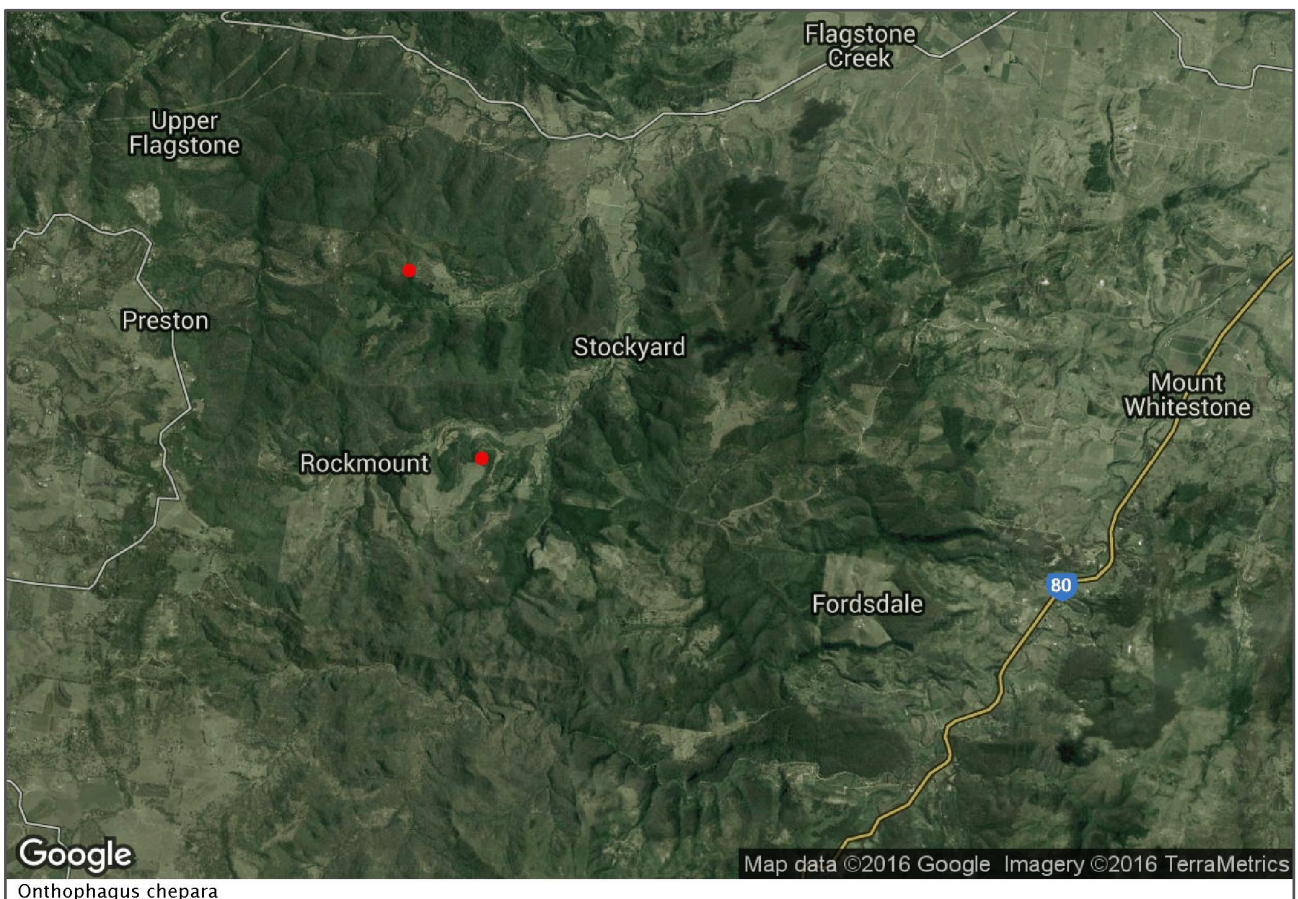
Onthophagus chepara Matthews, 1972

DESCRIPTION: A medium-sized (7-10 mm), plain black species without horns or tubercles in either sex. Tarsal claws not enlarged and recurved. Lacks any setae on dorsal surface.

DISTRIBUTION: Ranges along the eastern seaboard from about Townsville south to Sydney and inland to the Carnarvon Ranges.

NOTES: A nocturnal, dung feeding, open forest species.

UPPER LOCKYER SURVEY: Three specimens were taken at 3 localities, all in open forest. The species has been rarely recorded east of the Great Dividing Range in SEQ. Altitude range: 333-440m.



The dung-buriers (Tribe Onthophagini)



Onthophagus consentaneus Harold, 1867

DESCRIPTION: A medium-sized (6-11 mm) black hairless species with a rounded, deep body and with two ridges across the head. Antennal clubs bright yellow in life. No horns in either sex.

DISTRIBUTION: Very widespread in Australia from the southern Kimberley across the north and down to northern NSW. Extends far into inland desert areas. Also occurs in NG, Timor and New Caledonia.

NOTES: A common, day-active, open forest species which feeds on dung, carrion and decaying fungi and is often seen at dog droppings.

UPPER LOCKYER SURVEY: A single specimen was trapped on the Gatton-Clifton road at the extreme south of the survey area. Altitude: 285m.



The dung-buriers (Tribe Onthophagini)



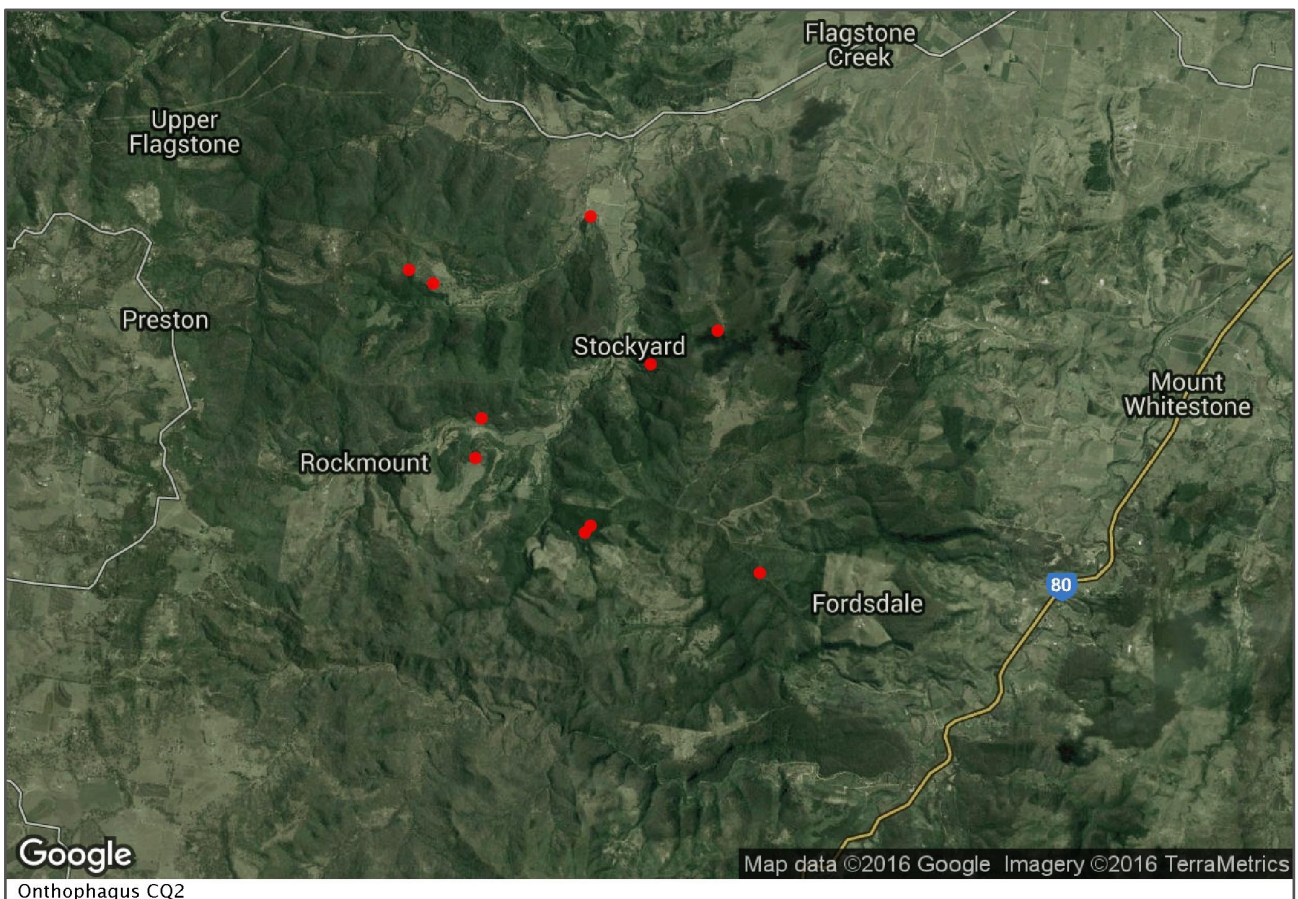
Onthophagus CQ2

DESCRIPTION: Size medium (6-10mm); colour dark greenish black; pygidium with a very few flattened hairs on either side of the midline; male with two straight, divergent horns on head, separated by a square erect plate.

DISTRIBUTION: This undescribed species occurs from near Bowen south to Bulahdelah, NSW.

NOTES: A day-active, rainforest dung burier. It is never found in good quality high-altitude rainforests, but predominates in poor rainforests in the foothills. It often extends into open forests when a lantana under-story is present.

UPPER LOCKYER SURVEY: Common and widespread in most rainforest patches and some lantana sites, but surprisingly absent from the red soil Dwyers Scrub. 254 specimens taken at 12 sites, , all but 11 specimens in rainforest. Altitude range 240-523m.



Onthophagus CQ2

The dung-buriers (Tribe Onthophagini)



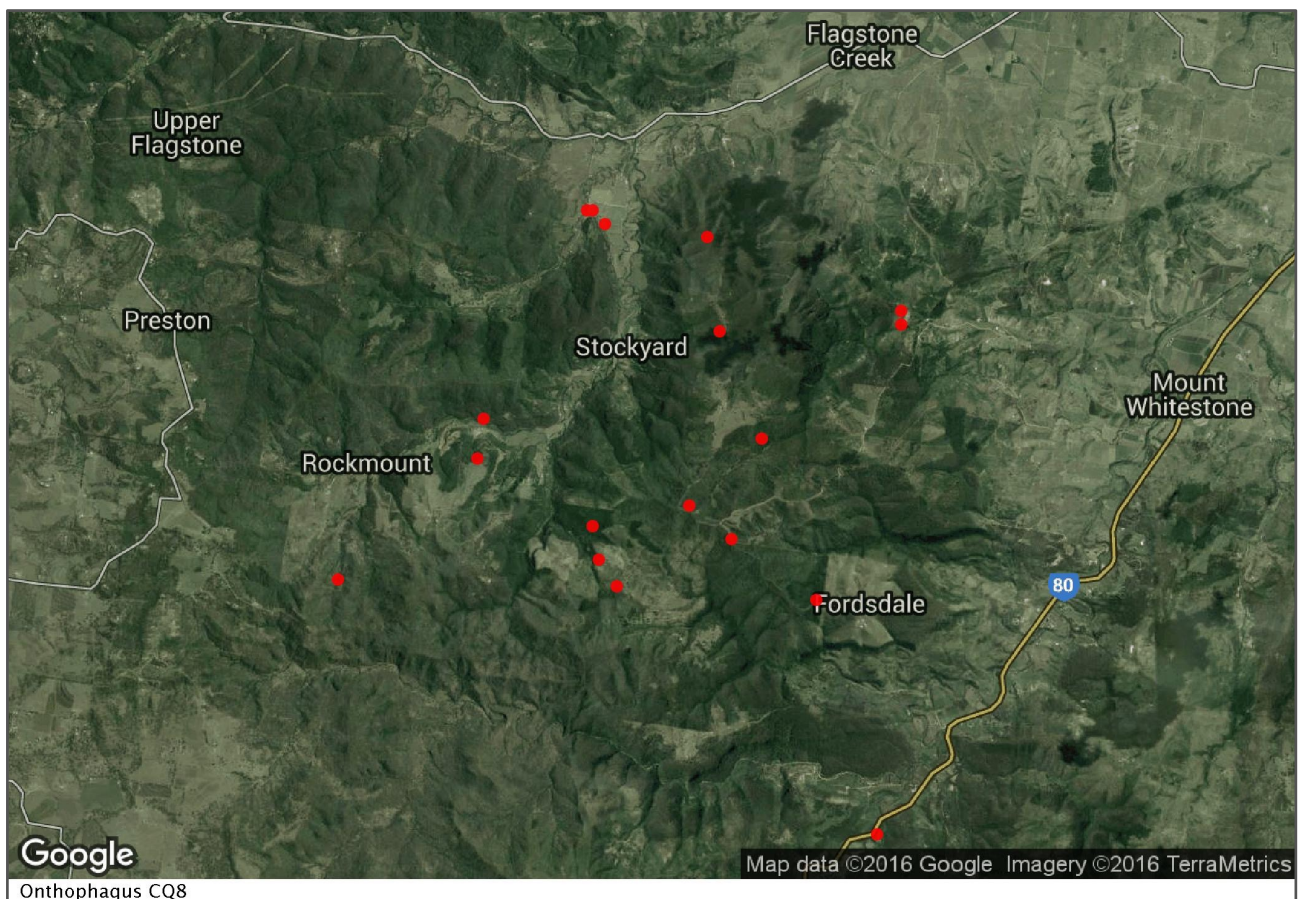
Onthophagus CQ8

DESCRIPTION: Size small (3-4mm); shiny black with thorax having a slight greenish or violet tinge; very small and sparse punctures on pronotum; no head horns but two low bumps near rear margin; male with elongated forelegs.

DISTRIBUTION: Known previously from limited lowland areas close to Brisbane and Ipswich.

NOTES: A day-active, winged, dung burier from open pasture situations, but occasionally found in dry rainforests.

UPPER LOCKYER SURVEY: This undescribed species had never been collected away from the immediate Brisbane area and this is an important range extension. It was common and widespread in the Upper Lockyer with 52 specimens taken at 19 sites. Altitude range 231-570m.



Onthophagus CQ8

The dung-buriers (Tribe Onthophagini)



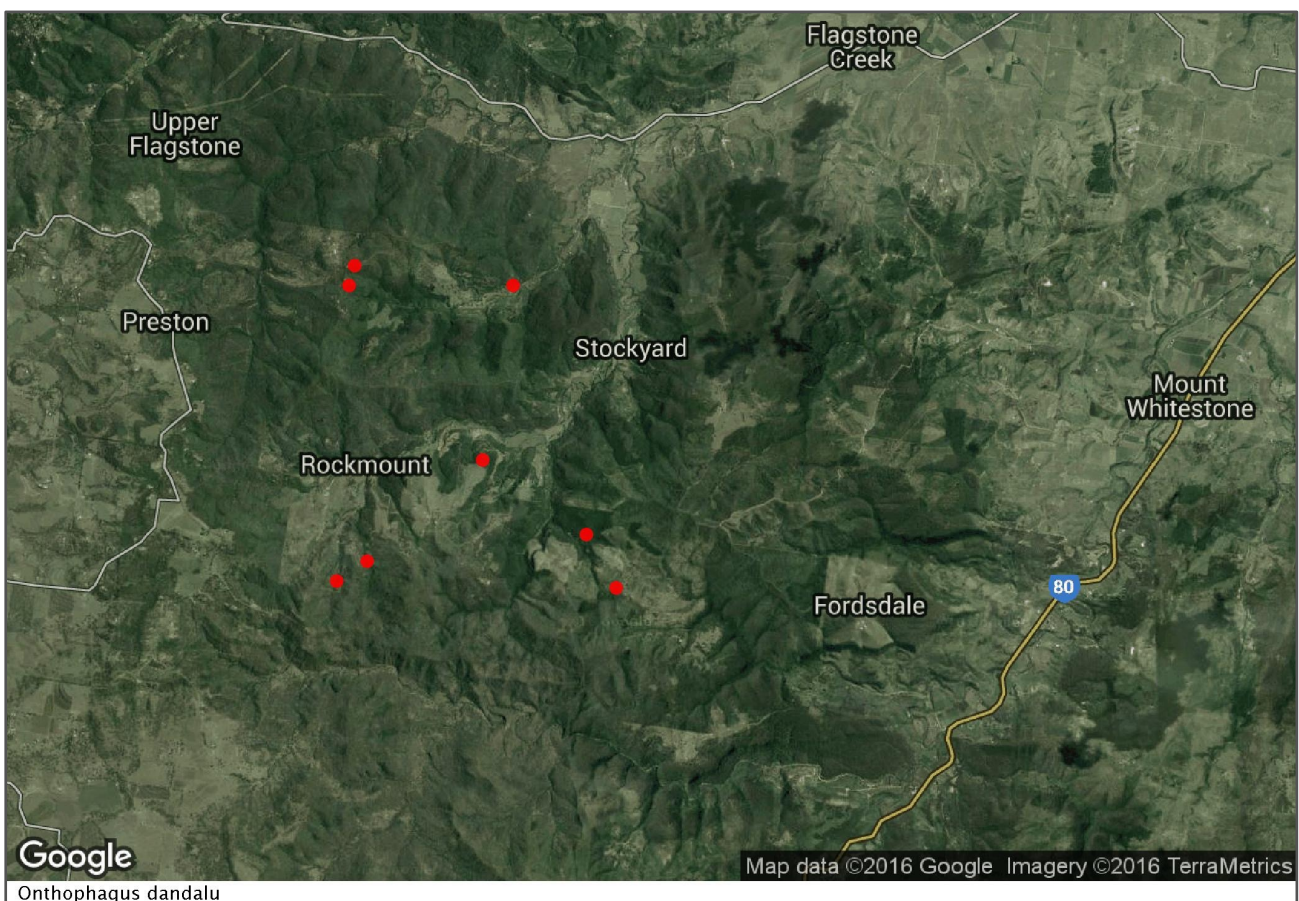
Onthophagus dandalu Matthews, 1972

DESCRIPTION: Size medium (6-9mm); wing covers black with rough surface; pronotum and head very shiny, bright copper or green in colour; single conical horn on pronotum in male, a pair of bumps in female; pygidium densely hairy.

DISTRIBUTION: Occurs from Mackay west to Carnarvon Gorge and south to western Victoria.

NOTES: An open forest, winged species that feeds on dung, carrion and mushrooms. Daytime active. Common at dog droppings in Brisbane suburbs.

UPPER LOCKYER SURVEY: This usually common species was surprisingly rare in the survey area with only 10 specimens taken at 8 localities. All were in open forest except for one stray in the Sawpit Gully rainforest. Altitude range: 287-510m.



Onthophagus dandalu

The dung-buriers (Tribe Onthophagini)



Onthophagus desectus Macleay, 1871

DESCRIPTION: A medium-large (11-15mm), all black species with a diamond-shaped flat plane on the front surface of the pronotum in males. Fine raised ridge in centre of diamond reaches front margin. Forelegs elongate in male.

DISTRIBUTION: Occurs from central Cape York Peninsula south almost to Sydney and west into the Northern Territory. Usually most abundant in inland areas.

NOTES: A nocturnal, open forest dung feeder

UPPER LOCKYER SURVEY: Only five specimens were taken at three different sites, almost all at light traps. Altitude range: 366-500m.



Onthophagus desectus

The dung-buriers (Tribe Onthophagini)



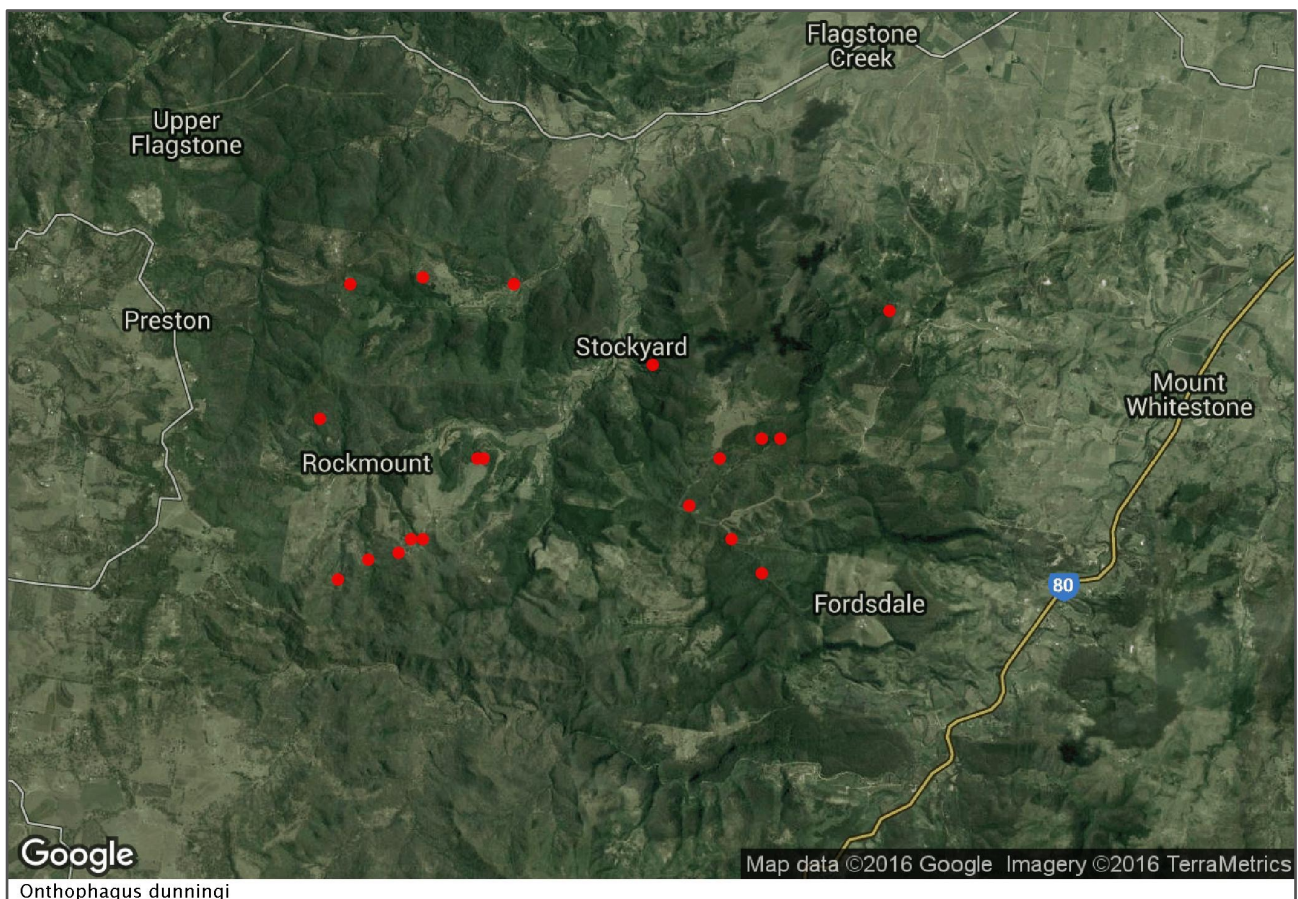
Onthophagus dunningi Harold, 1869

DESCRIPTION: Size medium (5-9mm); elytra black; thorax and head dull greenish black; not hairy; male with a single forward horn on pronotum and sometimes on front edge of head; female with a strong ridge across the pronotum.

DISTRIBUTION: Ranges from near Bowen south to eastern Victoria.

NOTES: An open forest, winged mushroom feeder. Daytime-active.

UPPER LOCKYER SURVEY: This interesting mushroom feeder was widespread in open forests with 50 specimens taken at 19 different sites. One stray was taken in Stephen's vinescrub. Altitude range: 287-560m.



Onthophagus dunningi

The dung-buriers (Tribe Onthophagini)



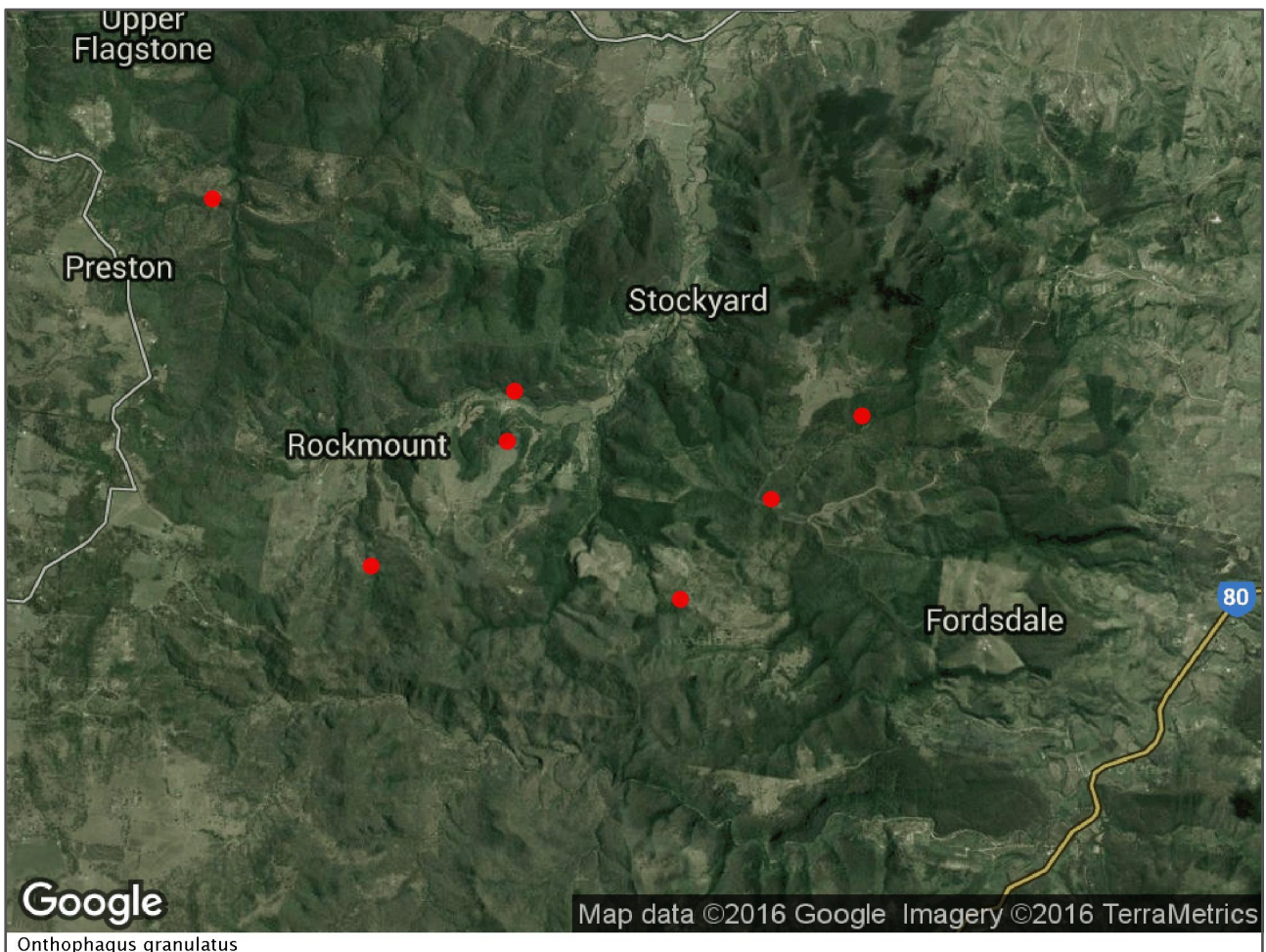
Onthophagus granulatus Boheman, 1858

DESCRIPTION: Size medium (6-7mm); surface yellowish brown with small flecks; surface hairy; many small granules on surface of pronotum at the base of each hair. No head horns, but male has elongated forelegs.

DISTRIBUTION: Ranges from near Mackay south to Victoria.

NOTES: A winged, dung burier which prefers open pastures and often comes to cattle dung. Daytime-active.

UPPER LOCKYER SURVEY: A total of 41 specimens were taken from seven sites, all in open environments, except for two strays in Stephen's vinescrub. It was hand collected at macropod dung at lower Palm Creek. Altitude range: 333-560m.



Onthophagus granulatus

The dung-buriers (Tribe Onthophagini)



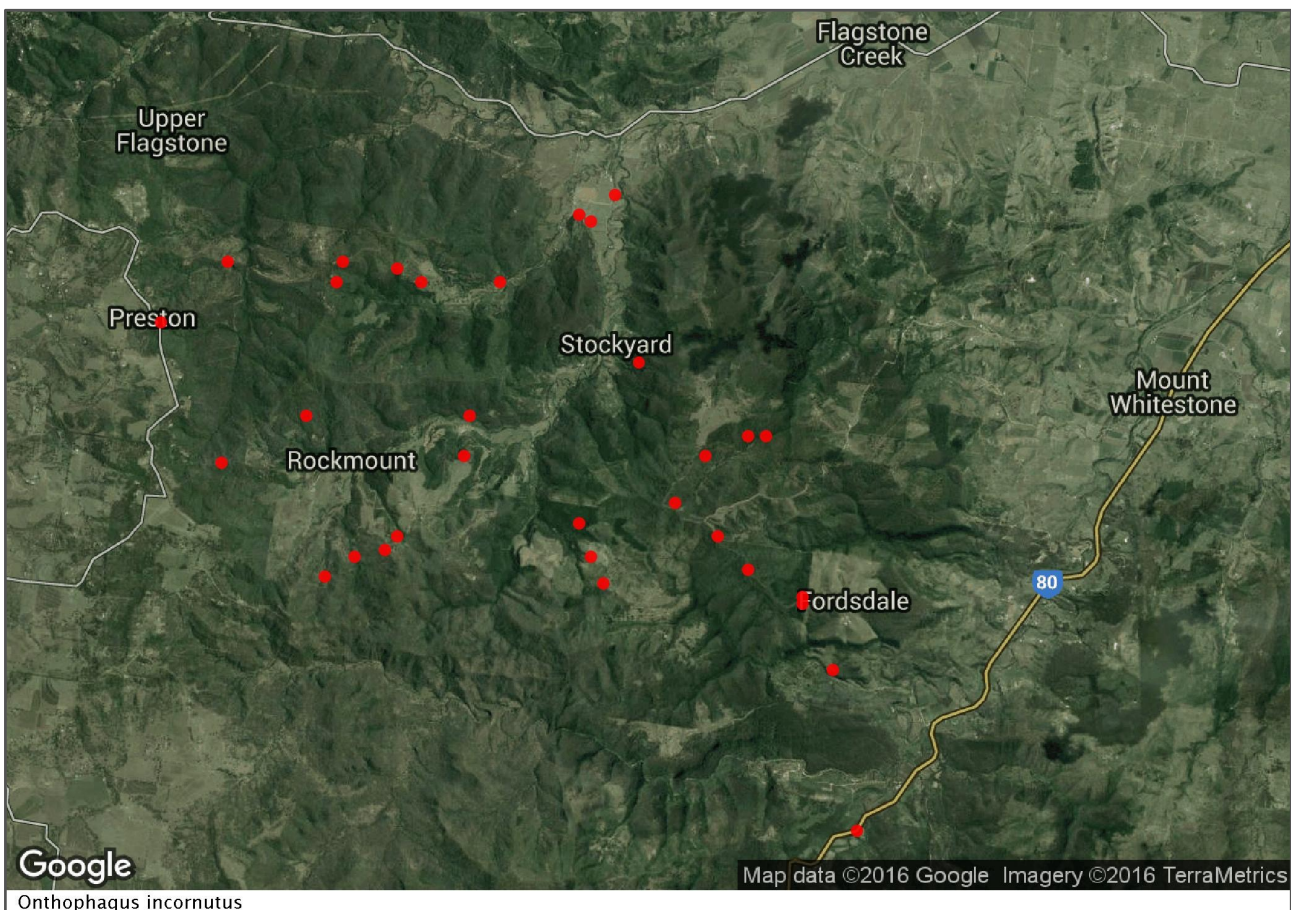
Onthophagus incornutus Macleay, 1871

DESCRIPTION: Size small (4-7mm); dark greenish black with sometimes faint yellowish markings; dense band of hairs along sides of elytra; male fore legs very long with apical brushes; two low head tubercles in male.

DISTRIBUTION: Has an isolated population on the Atherton Tableland, then ranges from Mackay south to Sydney.

NOTES: A winged dung burier. Occurs mostly in open forests close to the coast but often enters poorer rainforests in inland areas.

UPPER LOCKYER SURVEY: With 687 specimens from 32 different sites, this was the second most common species encountered and occurred at the greatest number of sites. It occurred in rainforests (221 spms), open eucalyptus forests (456) and cleared pastures (10).



The dung-buriers (Tribe Onthophagini)



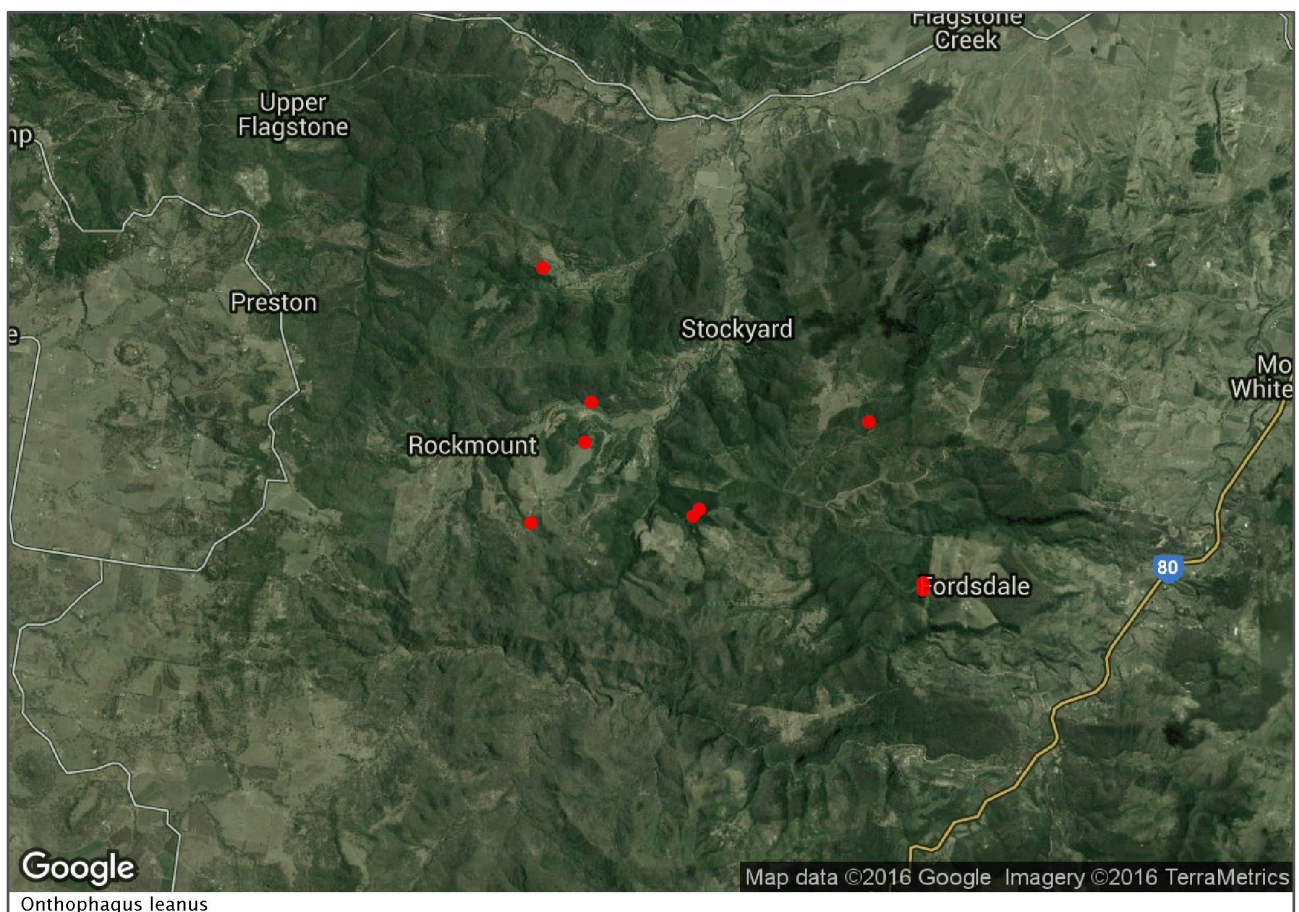
Onthophagus leanus Goidanich, 1926

DESCRIPTION: A medium-sized (10-12mm) back, hairless species with rather flattened form, broad rounded head and large eyes. Males have a blunt, triangular, forward projection from the pronotum and elongate forelegs. Pronotum has very fine punctures.

DISTRIBUTION: Ranges from near Proserpine in Queensland south to Bateman's Bay in southern NSW.

NOTES: A nocturnal, dung feeding species of open forests and poorer quality rainforests.

UPPER LOCKYER SURVEY: A total of 78 specimens were taken at 9 localities. It was the commonest large species in all the rainforest patches. Altitude range: 333-500m.



The dung-buriers (Tribe Onthophagini)



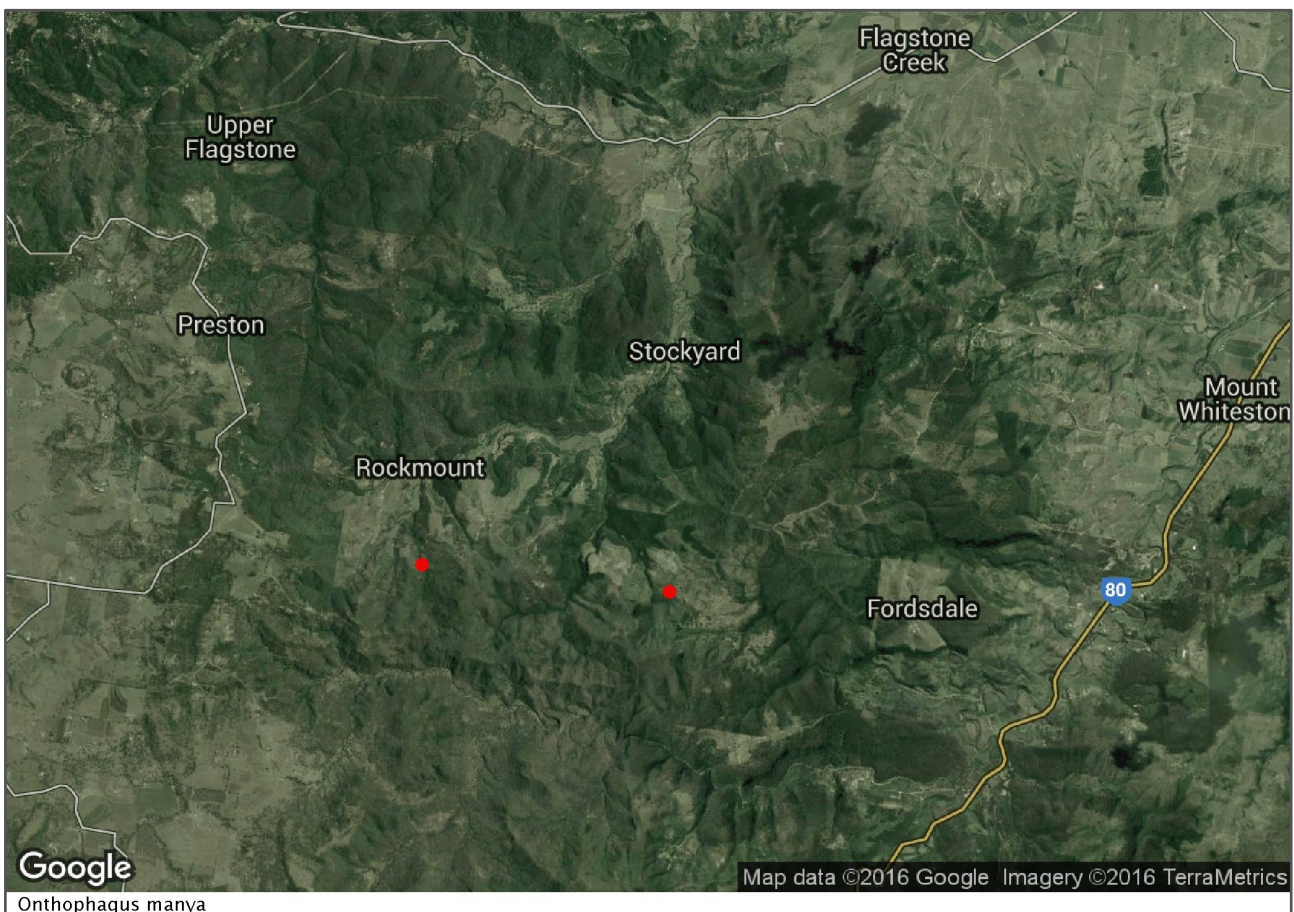
Onthophagus manya Matthews, 1972

DESCRIPTION: Small (3.5-4.2mm); body black with slight violet tinge to pronotum; male pronotum with slight depression in centre of the anterior face; female with two ridges across head, male with none.

DISTRIBUTION: Ranges from near Mareeba south to Brisbane.

NOTES: A very rare winged species of unknown habits. Mostly from open forests.

UPPER LOCKYER SURVEY: Only two specimens of this rare species were taken at two widely separated sites in open forests on the southern slopes of the Stockyard valley. Both specimens were taken in flight intercept traps. Altitude range: 448-480m.



The dung-buriers (Tribe Onthophagini)



Onthophagus muticus Macleay, 1864

DESCRIPTION: A medium-sized (6-9 mm) plain black species without horns in either sex. Lacks hairs on dorsal surfaces. The tarsal claws on ends of legs are enlarged and narrowly hooked.

DISTRIBUTION: Ranges from the Kimberley across northern Australia and down the east coast to southern NSW

NOTES: This is one of the unusual Australian species of *Onthophagus* which have specially modified claws so they can cling to the fur of mammals. They hang around the cloaca of macropods and take possession of dung pellets as they emerge.

UPPER LOCKYER SURVEY: One specimen was taken at the light trap at Stockyard Hall. Altitude 220m.



Onthophagus muticus

The dung-buriers (Tribe Onthophagini)



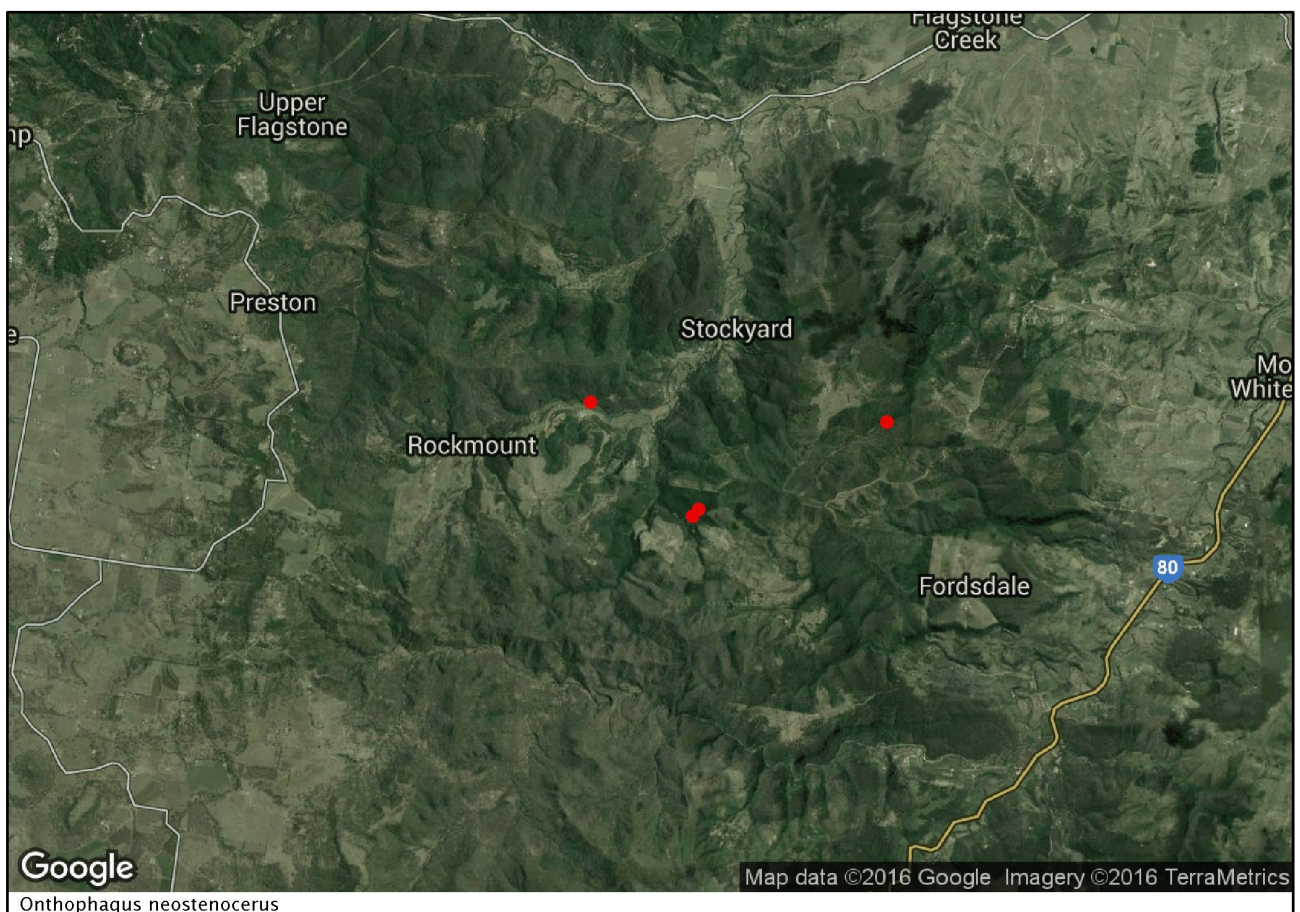
Onthophagus neostenocerus Goidanich, 1926

DESCRIPTION: Size large (9-13mm); uniformly black and hairless; eyes very large; male with two long straight parallel horns on head.

DISTRIBUTION: Ranges from Bulburin, (near Miriamvale), south to Newcastle, NSW.

NOTES: A nocturnal, winged, dung burier from rainforests and heavier open forests.

UPPER LOCKYER SURVEY: A total of 27 specimens were taken at four localities. The majority (18) were taken in the Sawpit Gully rainforest. Altitude range: 333-461m.



The dung-buriers (Tribe Onthophagini)



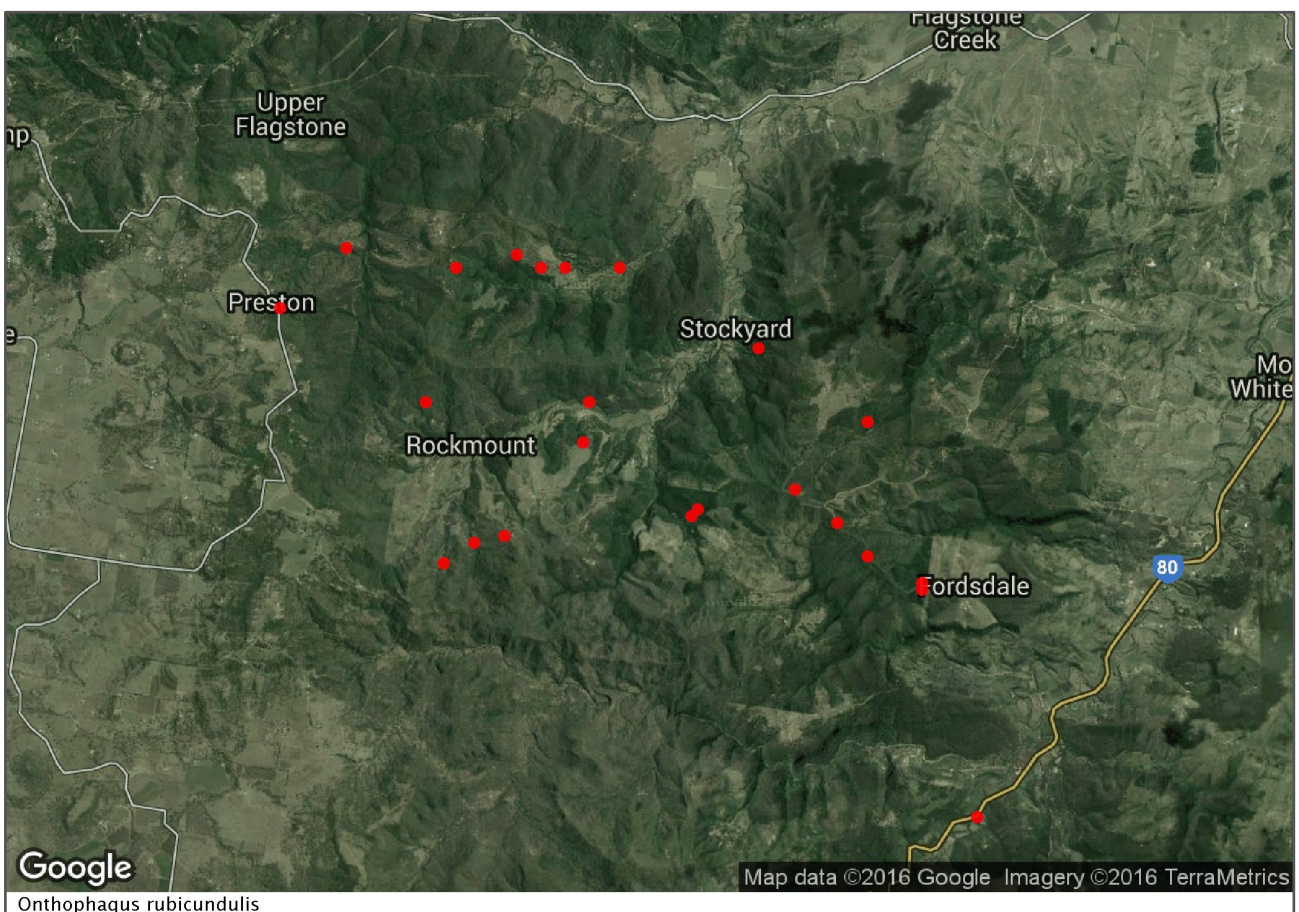
Onthophagus rubicundulus Macleay, 1871

DESCRIPTION: Size small (3-4mm); dull, matte brown with small pale patches; covered with short flattened hairs which hold a camouflaging soil deposit; male with two large, flattened horns curving outwards from the rear margin of the head.

DISTRIBUTION: Has an isolated population on the Atherton Tableland then ranges from Rockhampton south almost to Sydney.

NOTES: A small winged, dung burier from rainforests and shaded situations.

UPPER LOCKYER SURVEY: This was the commonest species collected and the 1078 specimens taken comprised 27.5% of the total catch. It occurred at 24 different sites including all the rainforest sites. Altitude range: 280-637m.



The dung-buriers (Tribe Onthophagini)



Onthophagus sydneyensis Blackburn, 1903

DESCRIPTION: A small (2.75-3.25mm), shiny black species with two erect horns on the head of the male; sometimes with orange patches on the shoulders and/or apex of the elytra.

DISTRIBUTION: It occurs from Kroombit Tops (SW of Gladstone) in Queensland south to Melbourne.

NOTES: A daytime active, winged species of rainforests and damper tall open forests.

UPPER LOCKYER SURVEY: This species was absolutely restricted, within the survey area, to the Dwyers Scrub vineforest. It was very common there with 184 specimens trapped. Altitude 500m.



The dung-buriers (Tribe Onthophagini)



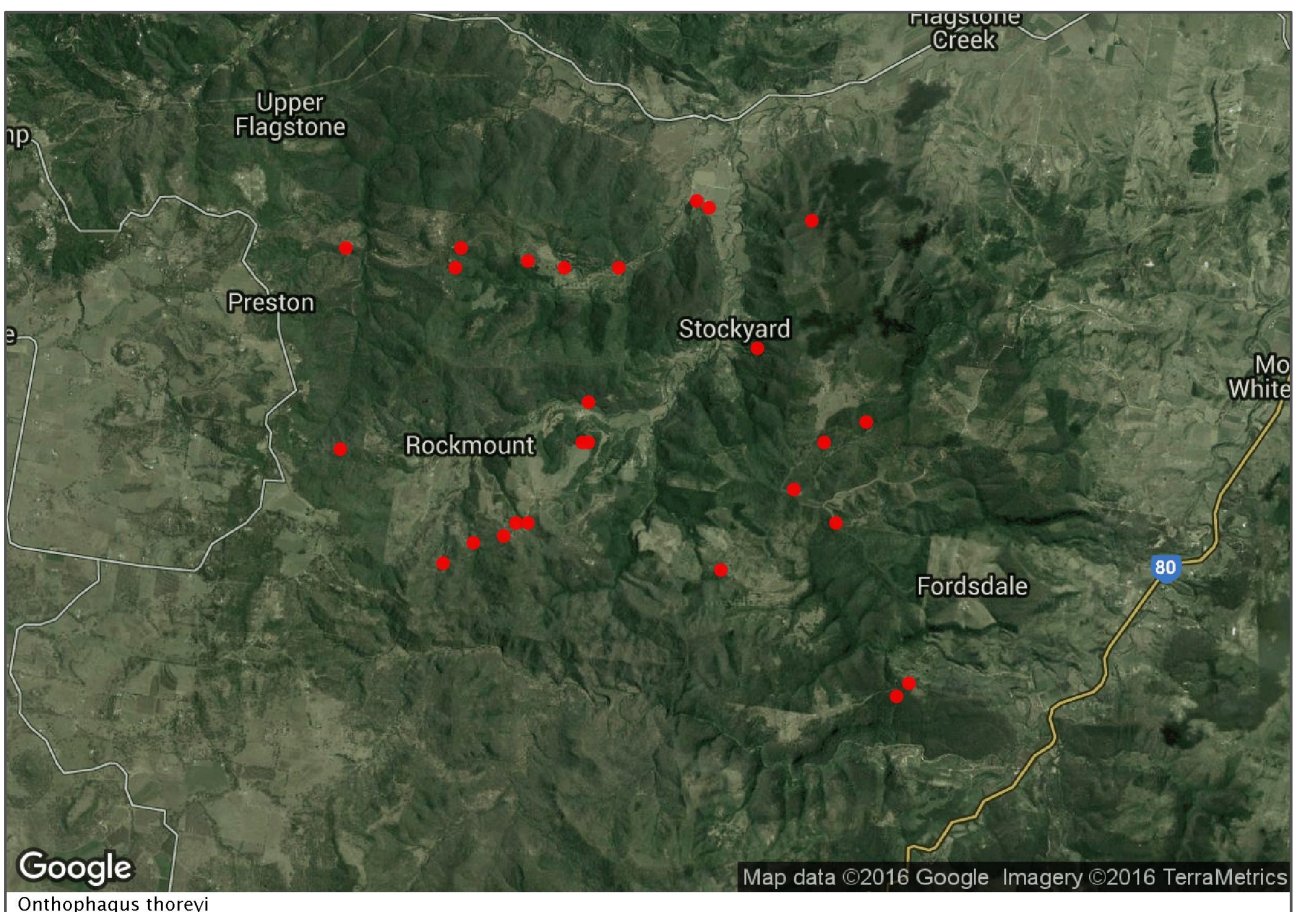
Onthophagus thoreyi Harold, 1868

DESCRIPTION: Size medium (8-11mm); body black with faint greenish tinge; male with two long erect horns on head which curve inwards at their apices. The rectangular flat plate between the horns has a sinuate upper margin.

DISTRIBUTION: Ranges from near Cairns south to the NSW border

NOTES: A winged, daytime-active dung buriar from open forests.

UPPER LOCKYER SURVEY: Widespread in open forests with 172 specimens taken at 26 sites. It is very closely related to the undescribed species *Onthophagus CQ2* and the two species show perfectly complementary distributions in the area with *O. thoreyi* in open forests and *O. CQ2* in the rainforests and some lantana areas. Altitude range 237-560m.



The dung-buriers (Tribe Onthophagini)



Onthophagus yourula Storey & Weir 1990

DESCRIPTION: A medium-sized (7-9mm) species, uniformly bronze in colour and with a very finely matt surface. Males have a swollen pronotum and two low curved horns without a median plate on the rear of the head.

DISTRIBUTION: A rare species which occurs from the Blackbutt Range in Queensland south almost to Sydney in NSW.

NOTES: A winged, daytime active rainforest species which often comes to mushroom baits as well as dung.

UPPER LOCKYER SURVEY: A single specimen of this rare species was taken in an open forest flight intercept trap on David Darvall's property. Altitude 448m.



African Species (introduced)



Euoniticellus intermedius (Reiche, 1849)

DESCRIPTION: A medium-sized (7-9 mm) sandy brown species with a diamond shaped pattern on thorax. Body elongate and parallel sided. Males have a short blunt horn on middle of head.

DISTRIBUTION: Widespread in NSW, QLD, NT and WA. Occurs mostly in cattle grazing areas.

NOTES: A winged, daytime active species which makes nest burrows beneath cattle dung. It is a native African species from south of the Sahara and was introduced to Australia.

UPPER LOCKYER SURVEY: Only a single specimen was taken in open forest at 560m during the survey.



African Species (introduced)



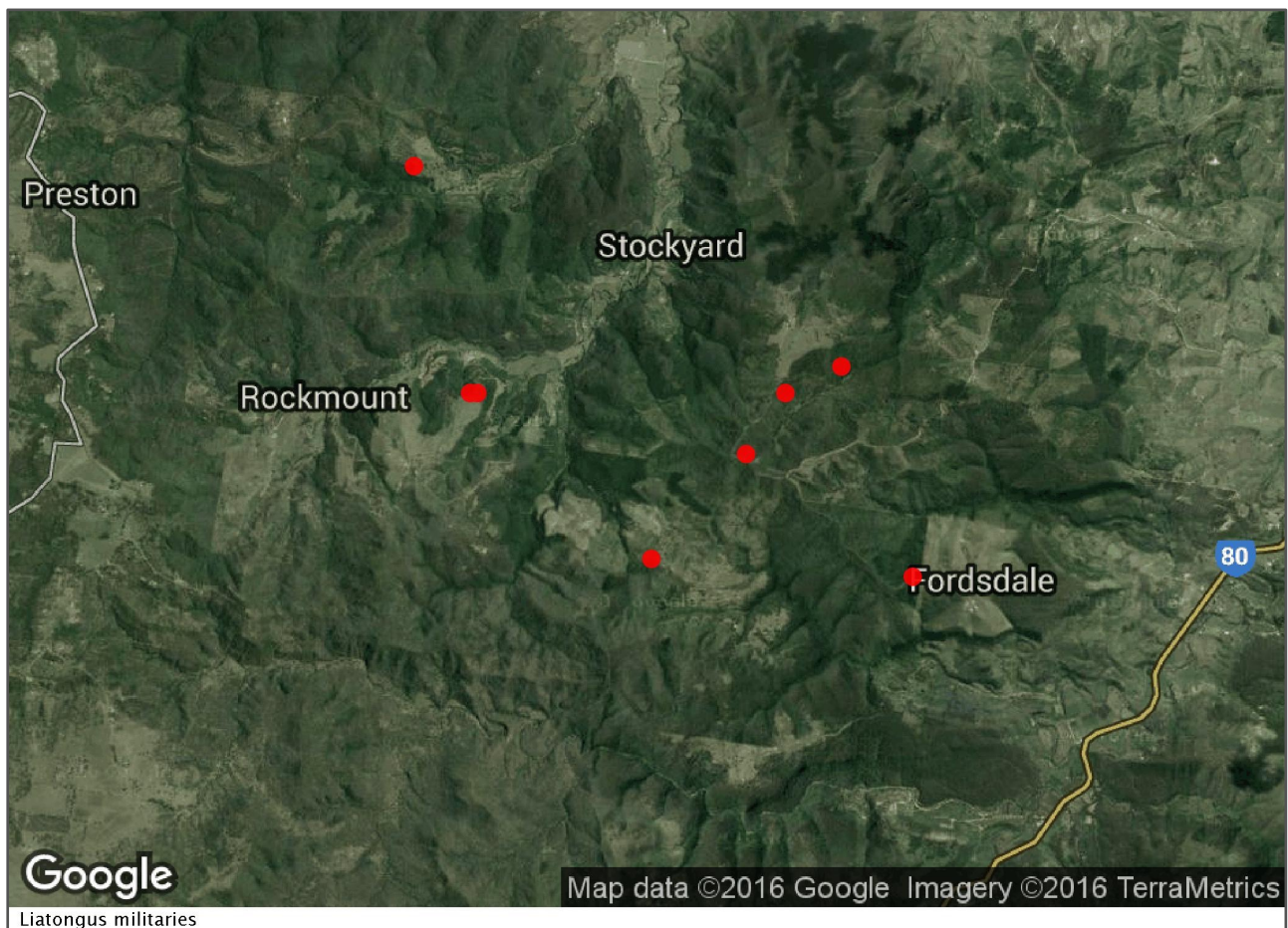
Liatongus militaris (Castelnau, 1840)

DESCRIPTION: A medium-sized (9-10 mm), dark brown species with pale margins to the prothorax and broken black lines on the elytra. No horns in the male.

DISTRIBUTION: Occurs near Darwin in NT and along the east coast from Cape York south to northern NSW.

NOTES: A species native to southern and eastern Africa which was introduced to Australia to control cattle dung.

UPPER LOCKYER SURVEY: Twenty-two specimens were taken at 8 widespread localities, mostly in open environments. Altitude range: 430-560 m.



African Species (introduced)



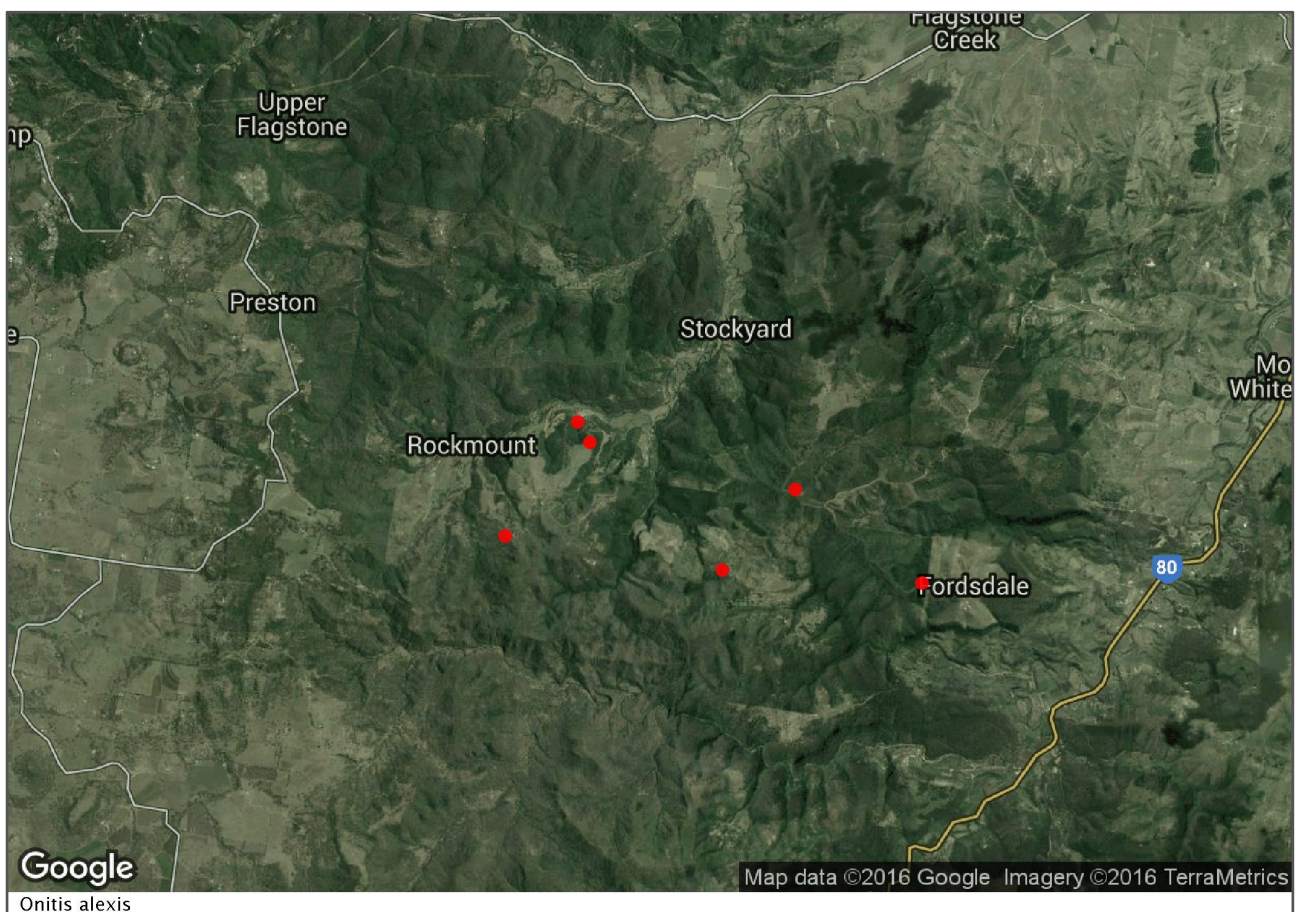
Onitis alexis Klug, 1835

DESCRIPTION: A large (13-20 mm) species with bright green prothorax and khaki-coloured elytra. Males have a curved spur on the outer part of their hind femora.

DISTRIBUTION: Occurs throughout Australia except in the drier desert regions and Tasmania..

NOTES: Native to southern Africa and southern Europe and was introduced to Australia to control cattle dung. It flies strongly at dawn and dusk and often comes to house lights early in the evening.

UPPER LOCKYER SURVEY: Eleven specimens were taken at 8 localities in the southern half of the survey region. All were in open forest except for one stray in Dwyer's Scrub. Altitude range: 363-560 m.



African Species (introduced)



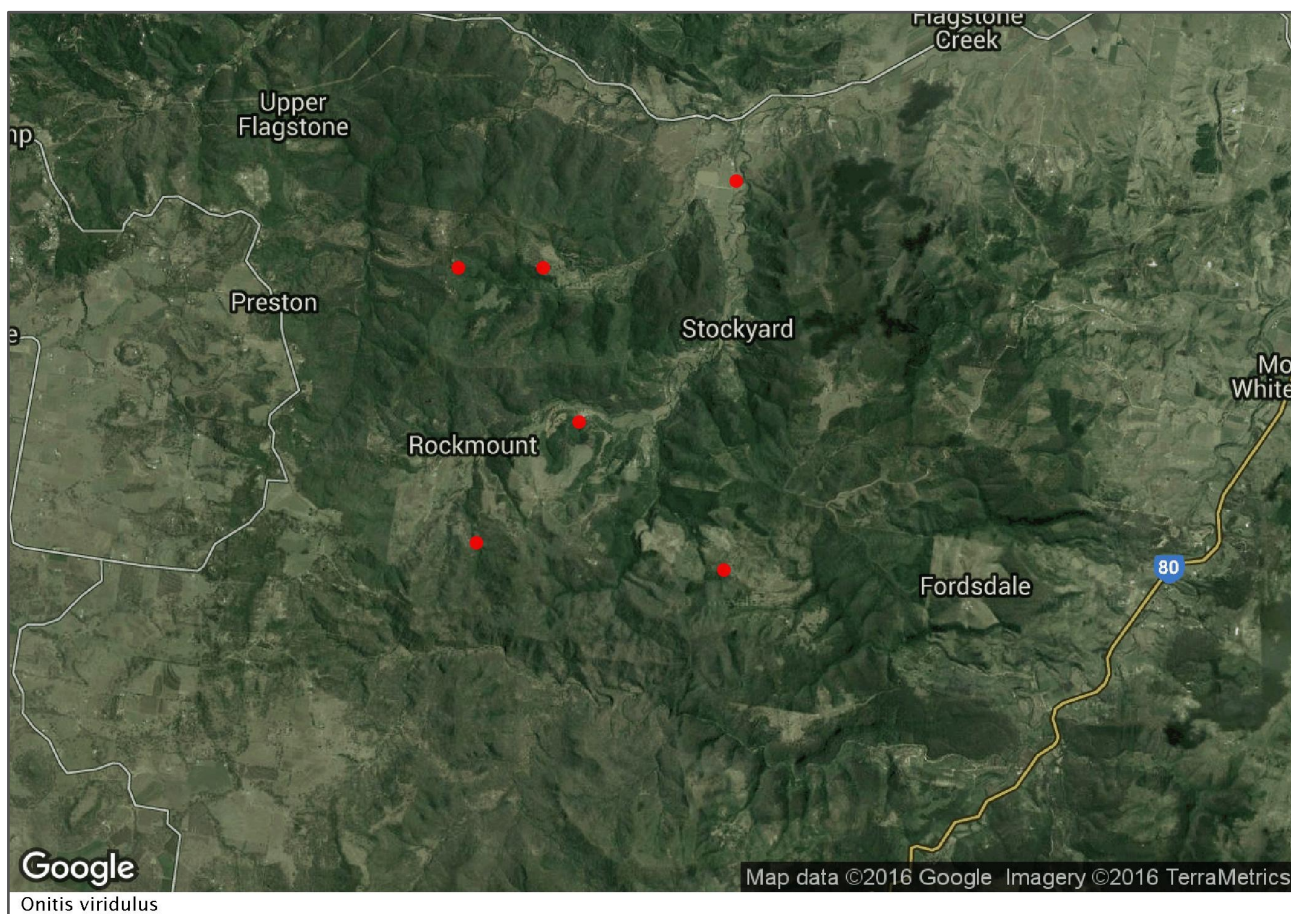
Onitis viridulus Boheman, 1857

DESCRIPTION: A large (18-23 mm), black or dark green/bronze species. Males have an uneven double spur on the hind leg.

DISTRIBUTION: Occurs around Kununurra in WA, the northern NT and down the eastern part of Queensland from Cape York Peninsula to the NSW border.

NOTES: Flies strongly at dawn and dusk and comes to house lights. Originally from central Africa, the species was introduced to Australia to control cattle dung.

UPPER LOCKYER SURVEY: Widespread in the region with 8 specimens taken from 6 different sites in open situations. One stray was taken in rainforest on Burton's property. Altitude range: 220-510m.



African Species (introduced)



Onthophagus gazella (Fabricius, 1787)

DESCRIPTION: A medium-sized (10-13 mm) species with dark pronotum and pale wing covers. On underside it has characteristic dark spots on base of legs. Male has two short, widely spaced head horns.

DISTRIBUTION: Widespread across northern Australia and down south to the Victorian border.

NOTES: Originally from southern Africa this species has been introduced to many warmer parts of the world to control cattle dung. It flies strongly at dusk and dawn and often comes to house lights in early evening.

UPPER LOCKYER SURVEY: The species was relatively uncommon, but widespread. Only 27 specimens were trapped at 8 sites. Altitude range: 220-560m.

