IDENTIFICATION GUIDE TO THE SCARABAEINAE DUNG BEETLES OF CUSUCO NATIONAL PARK, HONDURAS

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with
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Operation Wallacea

Conservation research through academic partnerships

Guide production

This guide was created by Thomas J. Creedy, with the expert assistance of Darren J. Mann in identification and matters of taxonomy and systematics. Imaging and compilation of the guide was kindly funded by Operation Wallacea.

All images are of specimens held in the Hope Entomological Collections, Oxford University Museum of Natural History, of which D.J. Mann is assistant curator. The specimens were collected as part of Jose Nunez-Mino's DPhil, whose advice is also appreciated. Thanks to the Operation Wallacea staff and volunteers in Cusuco National Park who supported and worked on the dung beetle study. Many thanks to the volunteers at the OUMNH who tested the guide out and provided useful notes.

To report inaccuracies or provide constructive criticism, please contact thomas@tjcreedy.co.uk.

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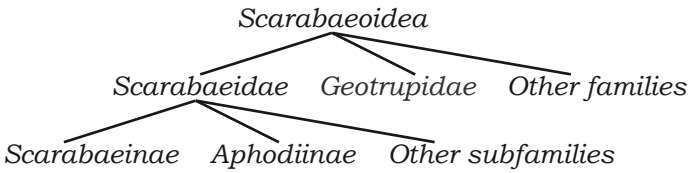
Contents

Introduction

This is a guide to identification of the *Scarabaeinae* dung beetles of Cusuco National Park (CNP), Honduras. In five years of collection, 39 separate species in 12 genera have been identified within the core and buffer zones of the park. As this guide will show, some of these species are fairly easy to identify in the field, while some can be very difficult! However, with practice and with correct use of the keys and images in this guide, identification of the difficult species should become quicker and easier, if not second nature.

Dung beetle taxonomy

The classification 'dung beetle' is not useful for taxonomy as it can refer to a wide range of beetle species from several different families, often with quite different ecologies. Indeed, the term often doesn't even accurately describe species' feeding habits: a substantial proportion of 'dung beetles' feed on a wide variety of resources, and in many cases never feed on dung. All dung beetles belong to the superfamily *Scarabaeoidea*, within which most belong to the *Scarabaeidae*, with representatives in many other families, such as the *Geotrupidae*. The majority of dung beetles are found in two *Scarabaeidae* subfamilies, the *Aphodiinae* and the *Scarabaeinae*, the latter of which is commonly known as the true dung beetles because a substantial portion of its members feed exclusively on dung.



The phylogeny of 'dung beetle' taxa

Of all dung beetles, the *Scarabaeinae* is usually the easiest to study in a tropical region, for two reasons: they are usually the most species rich, and their dung-collecting behaviour makes them easier to catch. Scarabaeinae dung beetle species usually roll dung balls away from (teleocoprid) or burrow beneath (paracoprid) dung patches, rather than living within the resource (endocoprid). This means that the *Scarabaeinae* are generally more active around dung, making them easier to catch in pitfalls than, for example, the *Aphodiinae*, who are mostly endocoprids. The range of life histories within the *Scarabaeinae* contributes to their species richness, and also to the importance of this family of dung beetles within an ecosystem. It is for these three reasons - ease, richness and ecosystem impact - that the dung beetle work in CNP focuses on only the *Scarabaeinae* dung beetles.

Other *Scarabaeoidea* will occasionally be found in dung baited pitfall traps, and the generic key thus starts by differentiating between *Scarabaeinae* and other similar families and subfamilies. *Aphodiinae* are the most common other dung beetle species found, and they should be recorded as "*Aphodius spp. agg.*" in the database. They are not identified to species because they are found inconsistently and are very difficult to identify in the field.

Dung beetle identification

The identification of a range of unknown dung beetle specimens to species is usually time consuming and requires considerable experience or the supervision of someone sufficiently experienced. Species identification involves searching the relevant literature and using keys (where available) to estimate an identification, then reading species' original descriptions or redescriptions to ensure that the morphological characters with the specimen. This is not simple even for nearctic or palearctic samples and can be very complicated for the relatively understudied neotropical *Scarabaeinae*. Species descriptions can be difficult to acquire, keys can be misleading, reviews incomplete and, most confusingly, the same species described more than once, or a single species split into multiple species based on morphological variation. Differentiating between species, as you will come to realise, can sometimes be very difficult, and it requires some experience to decide if variation in a morphological character in a species is within the expected range for one species, or if it is in fact another species.

In the production of this guide several previously unsure or incorrect identifications have been finalised and a few groups of specimens thought to be single species were split, creating several new species records. We are confident that the majority of identifications are correct, but several remain questionable, usually because the CNP specimens fit closely to a species description, but certain characters do not seem to fit. This is denoted by the inclusion of "*aff.*" before the unsure name. Three CNP species are probably new to science, and are denoted "*sp.nov*" until their descriptions are published. One species does not fit to any published description for its genus, but this was a very recent species split and not enough literature search has been done to suggest it is also new - it is denoted "*sp.DJM*"

This guide, and specifically the keys, are based only on the species known to CNP. Any unknown species will either key to a known species or not fit to any of the presented sets of characters. This is unavoidable, as to include every species that might theoretically occur in CNP would require far more space and user expertise. After five years of collecting, finding new species is unlikely if habitats remain constant, but disturbance and climate change may cause shifts in community composition.

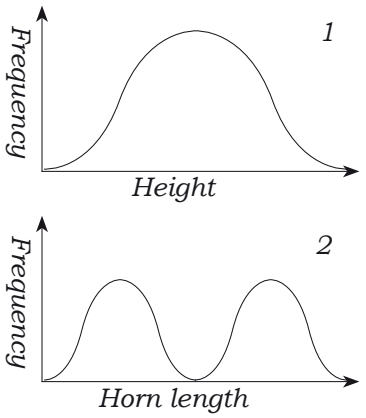
Dung beetle morphology

As the images in this guide will illustrate, *Scarabaeinae* dung beetles can be very variable in body shape and in the shape and variety of different bodily structures. Annoyingly for the taxonomist, some morphological variation can be greater between different groups within a species than between similar groups in different species. Structural differences between males and females, known as sexual dimorphism, is well known throughout the animal kingdom; however, the existance of several distinct morphological forms within a single gender is somewhat rarer. This is known as intrasexual polymorphism, at least in this guide, with the different groups referred to as morphs (see below for more detail). In many of the Cusuco National Park Scarabaeinae, males can be grouped into two morphs, known as major and minor males. The two morphs will usually have clear differences, with intermediates very rare or absent. These differences will be described in the descriptions and included in the keys. Whenever there is substantial differences between sexes or morphs, the sex symbols are shown next to each image to show whether it is female (♀) or male (♂); or if that species is intrasexually dimorphic, major male (♂♂) or minor male (♂). If no symbols are present, the image is equally representative of both sexes, and any slight gender differences will be indicated by the relevant gender symbol adjacent to an arrow. It is important to remember morphological variation when attempting to identify a specimen, especially at first, as it is easy to mistakenly identify different morphs as different species.

Most CNP *Scarabaeinae* are quite clearly sexually dimorphic, and where this is the case it is discussed in the associated infobox. The males and females of some species are very similar, but the sex of any *Scarabaeinae* can be determined by examining the ventral surface of the penultimate segment of the abdomen. In males, this is medially compressed, while in females it stays the same width.

Intrasexual polymorphism is more complicated than discussed above, but that explanation will suffice for identification. The following explanation is provided **for interest only**, and understanding it is not necessary for the rest of this guide.

Intrasexual polymorphism describes variation within a sex that is separate from gradually-varying traits, such as height the human male population. This follows a so-called normal distribution, where there are very few men of the very shortest or tallest heights, but many of the mean height (1). Instead, variation between morphs follows a more distinctive pattern, which may see a structure like horn length follow a so-called bimodal distribution, where few males have very short or long horns, but very few also have horns of an intermediate length. Instead, the distribution is split in two, forming two separate means (2). The diagrams to the left are stylised, and in practice the distributions are scattered and often skewed. A character showing a bimodal distribution, as it is called, is compared with a normally-distributed character in order to define the morphs within a species. A bimodal distribution does not necessarily imply that there are only two morphs - in fact, it is thought that the differentiation between morphs is actually more subtle than originally expoused and that bimodality may in fact lead to four different morphs. However, for the purposes of this guide we shall stick to major and minor morphs.



Explaining intrasexual polymorphism (also for interest only)

Intrasexual polymorphism is not genetically predetermined. In fact, it is determined during larval development, as a response to the conditions a male larva finds itself in. The characters involved are secondary sexual characteristics, that have evolved because females find them sexually attractive. A major male with a long horn and a developed pronotum is more attractive. However, a long horn and a developed pronotum requires more resources, and can be a handicap when digging in dung. Therefore a male will only become major if the environment it grows up in is favourable enough to be able to support it. On the other hand, a minor male is less attractive, but is more likely to survive when the environment is harsh, and may get more matings simply because he was around longer. These are referred to as reproductive strategies, and can be found throughout the animal kingdom.

How to use this guide

To start with, the best way to identify a specimen with this guide is to first check that it is a Scarabaeinae and then identify it to genus using the key on page 8. Then use the key, descriptions and images in the section for that species to narrow your identification down. With practice, the guide and common genera and species will become familiar, and you can skip to the relevant pages as needed.

Introduction to keys

The keys are the best way to identify a specimen, and should always be referred to if unsure. They consist of a list of numbered 'dichotomies': pairs of mutually exclusive morphological characters for a specimen to be compared against. The keys are based solely on the morphological characteristics of a specimen, and technical morphological terms are used in order to be unequivocal and concise. A full glossary of these terms can be found on page 49.

Body size and colouration are only included on these keys as secondary characteristics or when no other character is available, and other characters should always take precedence. While body size and colouration may be the easiest characters to use to decide on identification, they are also the most variable within species. The majority of species have a dark red-brown hue when teneral (after moulting), and colour can look different depending on whether a species is dry, wet or dirty. Body length is difficult to accurately measure, especially in the field, as the three body sections can flex relative to one another and partially overlap. Without experience, body size and colouration are often the first and only characters looked at and can lead to misidentification .

Morphological characters have been chosen for the keys with ease of field identification in mind. However, in some species the use of small and difficult-to-distinguish characters has been unavoidable, especially in the smaller genera. A microscope or hand lens will probably be needed in order to see many of these characters, and for some it is simply unavoidable. However, it is often not clear from keys whether or not a character needs magnification to be seen, so this symbol ♀ will denote if a character definitely requires a microscope or hand lens.

How to use the keys

Starting with number 1, decide whether the specimen fits statement 'a' or 'b', and then proceed to the number indicated. If a specimen falls in between 'a' and 'b', choose the statement that has the most characters that fit. Characters are in order of importance in each statement. Every character mentioned in a key can be located on the images in the guide, often aided with the addition of red arrows.

The species description boxes

Species descriptions in identification guides are usually overlooked in favour of keys and pictures in identification guides, so in this guide descriptions are kept short and focused on showing key features and discriminating between similar species. An example box is shown right. The size and colouration given is an average that most specimens should fall within. The identification notes aim to provide more general features that can be used for quicker identification, in addition to the definitive characters used in the keys, although the keys should always take precedence. Where it is possible to differentiate between sexes and morphs, the easiest characters are described. A small amount of ecological information, when known, is given for interest. A reference to the original describing paper or more recent redescription used for this guide is given, if available.

Onthophagus breviconus

Size 7.0-11.0mm **Colouration** Black

Identification notes

Onthophagus breviconus is the largest CNP *Onthophagus* and is fairly easy to identify from the distinctive pronotal horn in males and the flat circular area on the pronotum of females. It may be confused with *O. cyanellus*, but *O. breviconus* lacks a blue-cyan hue and has a head horn in males and prominent clypeal teeth in females. *O. breviconus* also has distinct elytral striae.

Sex differences

Major males of *O. breviconus* have a single central pronotal horn which splits into two at its end, whereas females have a convex pronotum with a flattened circular region. In males, a head horn arises from the anterior clypeal margin, while in females the margin forms two acute teeth. In minor males, the pronotum and head horns are less developed.

Ecology

Onthophagus breviconus is a nocturnal paracoprid. It has been found in dung and fruit traps, throughout the park.

See Howden & Gill 1987

The images

While it is much easier to look at a picture than read a complicated key, the keys should always take precedence. The images in this guide are all photographs, and so only represent at best three or four members of a species, although the subjects were chosen to be as representative as possible. A slight variation in the photographed specimen from the average for a species may be seized upon, and an incorrect identification made. These photographs have all been taken under a microscope with a digital camera, with very even and diffuse lighting, and of very clean, dry specimens. This should be remembered when comparing a dirty, wet specimen seen with the naked eye to the photographs. Colouration, especially of the small glossy species, can vary considerably with lighting, dryness and magnification.

It is also important to remember that the images are often not to scale with one another, so a small and a large species may appear to be the same size. This is done in order to make characters as clear as possible, so be sure to check the scale bars and the size of the species. Approximately life-size silhouettes of each species are shown compared with others of their genus for reference.

Sample Sorting

Scarabaeoidea are not the only invertebrates that are found in Cusuco National Park; any samples will contain as many or more individuals of other species as it will dung beetles. While identifying all of these species is not necessary, it is important that this bycatch is preserved for use by other researchers in the future. If possible, the bycatch should be sorted into broad taxonomic groups at the same time as identifying dung beetles, in order to aid this future study. As well as saving time in the long run, this can be interesting, and can ensure that all of the focal specimens in the sample have been located.

There is a specific set of taxonomic groupings into which bycatch should be sorted. These groups are not taxonomically equal; instead, they reflect research interests and the abundance of different taxa. Properly identifying these groups is beyond the scope of this guide, but the list below contains some very brief guidelines. See the references list for suggestions of general insect identification literature

Formicidae Ants. Constricted waist, usually wingless.

Hymenoptera except formicidae Bees and wasps (and sawflies). Constricted waist, two pairs of wings that are often joined, making smaller species difficult to separate from diptera. (Sawflies are uncommon in CNP, and lack the constricted waist)

Diptera Flies. Only have one pair of wings, the second instead replaced with halteres. Usually obvious, but smaller species difficult to distinguish from hymenoptera.

Aphodiinae See 'dung beetle taxonomy' section above. Small, parallel-sided dung beetles, included on generic key. Should be recorded in data as Aphodius sp.agg.

Scarabaeinae The focal taxon of this guide. See generic key for identification.

Silphidae Carrion beetles. Two species in CNP, one with broad body and yellow-edged pronotum, the other with orange markings on elytra.

Staphylinidae Rove beetles. Beetles with long, often upward-curved, abdomen and small elytra.

Other Coleoptera Beetles that do not belong to any of the other groups mentioned here.

Hemiptera Bugs. Triangular area usually very evident between bases of wings when closed, have elongated mouthparts (rostrum) that often extends between forelegs at rest. Includes cicadas

Orthoptera Crickets and grasshoppers. Long hind legs, soft abdomen. (Crickets have antennae longer than their body, grasshoppers shorter than their body)

Blattaria Cockroaches. Flattened body, usually with long antennae and leathery wings that overlap when folded over abdomen

Lepidoptera Butterflies and moths. Large wings. (Butterflies have 'ball' at end of antennae, moths don't). Usually destroyed by liquid, so should be discarded.

Arachnida Spiders, scorpions, harvestmen and relatives. Always have eight legs, body divided into only two segments.

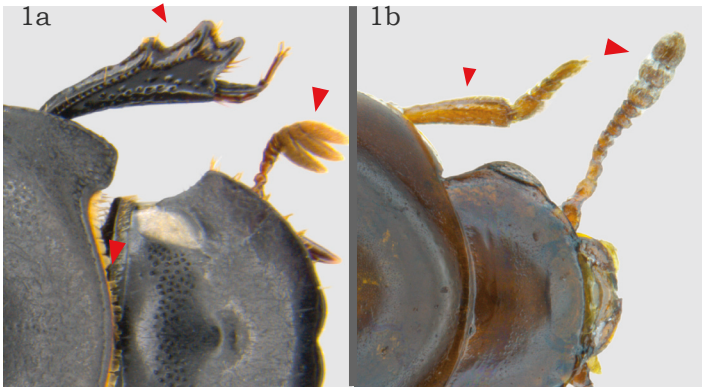
Other invertebrates Invertebrate that does not belong to any of the other groups on this list.

Key to genera

1.

a. Antennal club 3-7 segmented and lamellate, segments able to fit together closely. Pronotum not covering head. Foretibia flattened with one or more teeth on outer edge. Tarsi with 5 distinct segments. Abdomen with 6 ventral sclerites. Elytra not widely separated at apex.....2

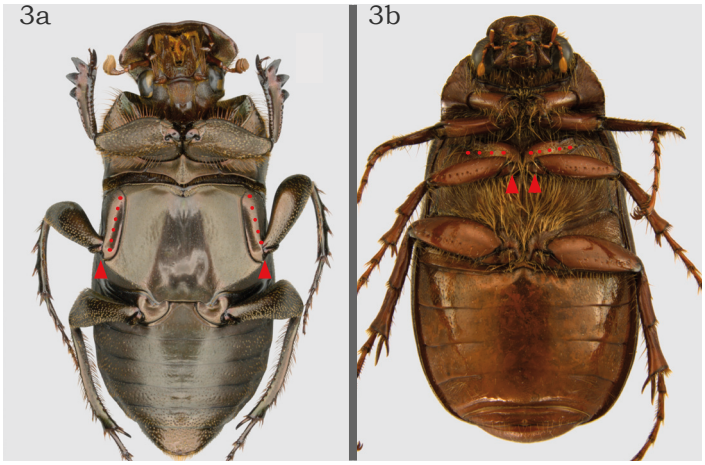
b. Not as above..... *Not a dung beetle*



2.

a. Midcoxae extending along the anterior-posterior axis, with trochanters widely separated 3

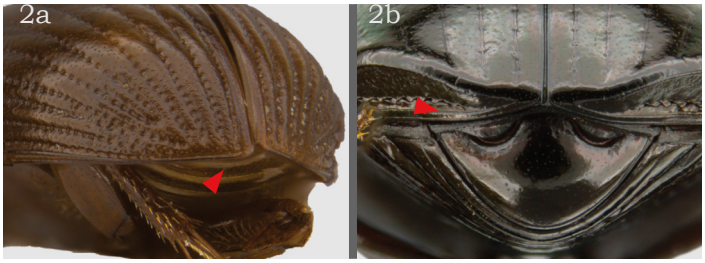
b. Midcoxae extending inwards, lying laterally, with trochanters close..... *Not a dung beetle*



3.

a. Pygidium completely or almost completely covered by apex of elytra. Generally less than 6mm. Body generally parallel sided ..... *Aphodiinae* (see note on page 5)

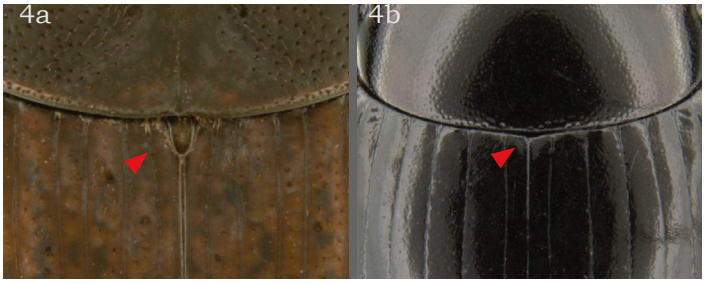
b. Pygidium usually completely exposed. Rounded body shape 4



4.

a. Scutellum clearly visible between bases of elytra..... *Eurysternus (page 35)*

b. Scutellum not clearly visible between bases of elytra without magnification.....5



5.

a. Middle and hind tibia slender, often curved, not substantially enlarged apically.....*6*

b. Middle and hind tibia enlarged apically or broad and flattened along entire length.....*8*

6.

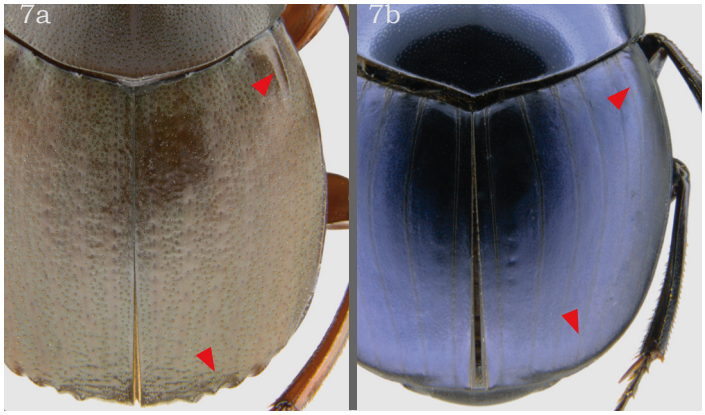
a. Smaller than 5mm in length, dorsally hirsute .....*Cryptocanthon (page 32)*

b. Greater than 5mm in length, ♀ not dorsally hirsute *7*

7.

a. Strong carina at or near to the humeral umbone. Multiple brief carinae near to elytral apex..... *Deltochilum (page 28)*

b. Elytra lacking carinae..... *Canthon (page 33)*



8.

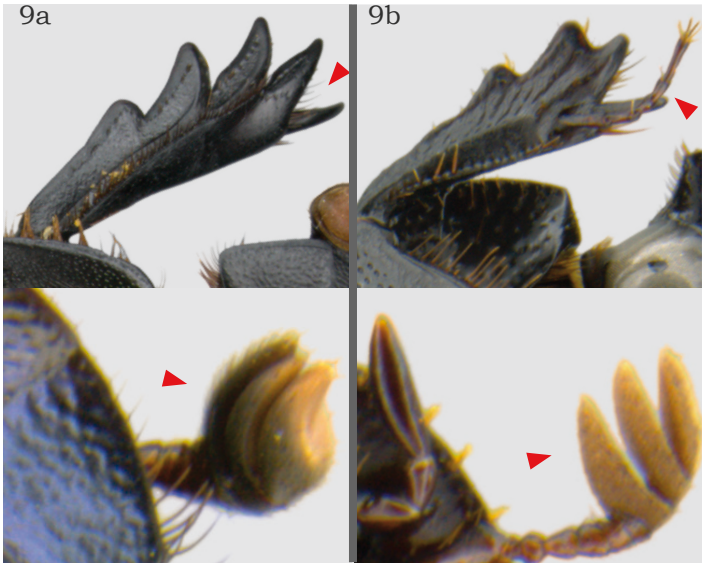
a. Foretibia slender and elongated, with four teeth on outer margin. Basal hind tarsal segment not enlarged apically, elongated, as long as tibial spur....*Onthophagus (page 38)*

b. Foretibia broad and apically widened, with three or four teeth on outer margin. If four teeth, basal hind tarsal segment enlarged apically, not slender.....*9*

9.

a. Anterior tarsi absent, basal segment of antennal club hollowed, darker than other segments *10*

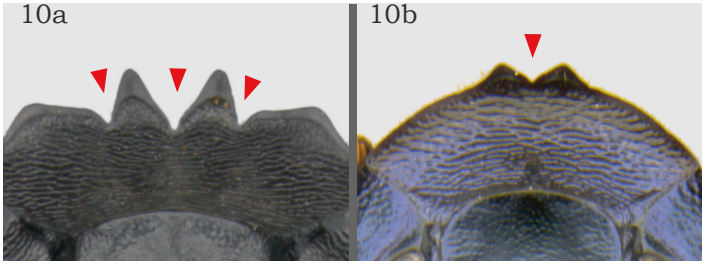
b. Anterior tarsi present, basal segment of antennal club not clearly hollowed, same colour as other segments *11*



10.

a. Anterior clypeal margin with three indentations delimiting two acute teeth ..... *Coprophanaeus (page 26)*

b. Anterior clypeal margin with a single median indentation, two acute or rounded teeth..... *Phanaeus (page 34)*



11.

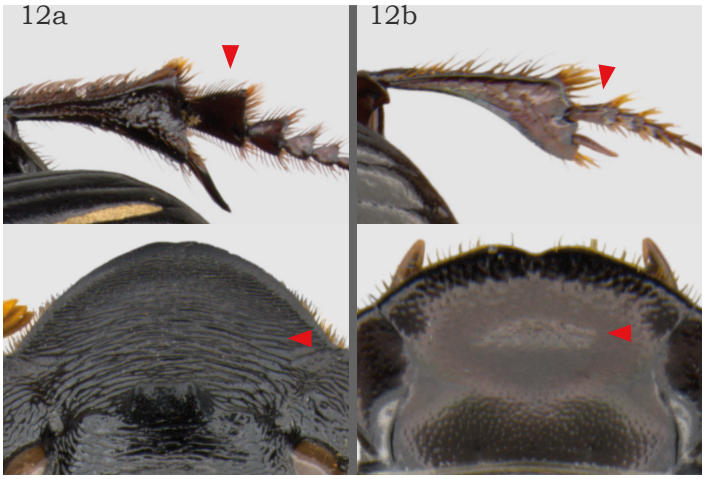
a. Hind tibia with strong lateral transverse carina. Median longitudinal pronotal groove usually developed ..... *Copris (page 21)*

b. Hind tibia without strong lateral transverse carina. Median longitudinal pronotal groove not developed *12*

12.

a. Basal hind tarsal segment triangular. Clypeus rugose ..... *Dichotomius (page 30)*

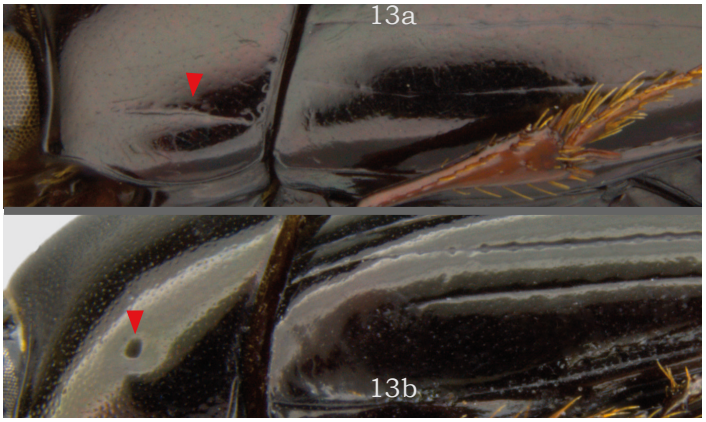
b. Basal hind tarsal segment slender or broadly rectangular. Clypeus not distinctly rugose *13*



13.

a. Lateral pronotal fovea oval or oblong, with a clear longitudinal groove in line with fovea ..... *Uroxys (page 46)*

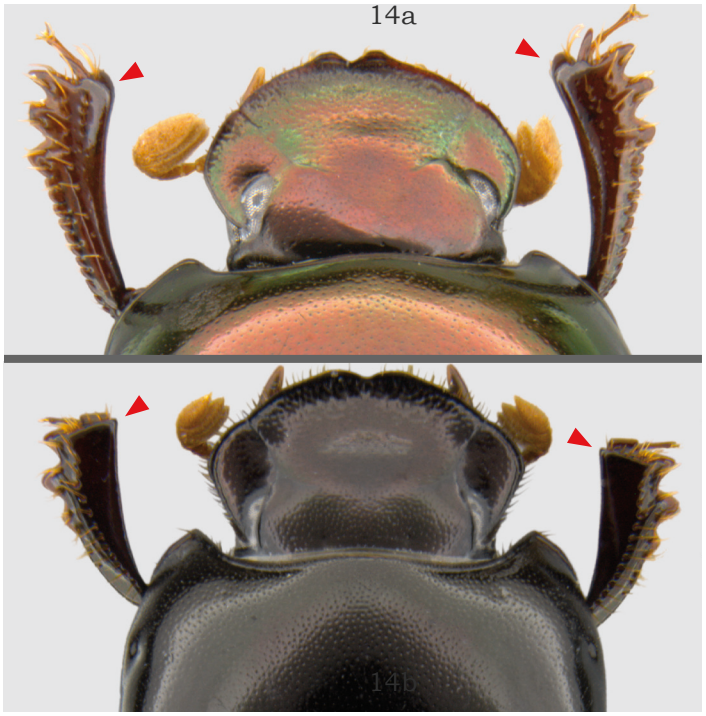
b. Lateral pronotal fovea round, without longitudinal groove in line with fovea *14*



14.

a. Inner apical angle of fore tibia rounded and slightly protruding. Metasternum usually convex. Very feeble longitudinal clypeal ridge. Body usually dark with green or red metallic reflections..... *Canthidium (page 14)*

b. Inner apical angle of fore tibia approximately right-angled, with no protruberance. Metasternum usually flat. No longitudinal clypeal ridge. Body glossy black, never with any metallic reflections .. *Ateuchus (page 12)*



Ateuchus

The *Ateuchus* genus usually consists of small black beetles, and has two species in CNP. Superficially, the *Ateuchus* genus can be very similar to *Canthidium*, *Uroxys* and even *Onthophagus* and *Canthon* species. The generic key provides good characters for the latter three genera, but differentiating between *Canthidium* and *Ateuchus* can be tricky. *Ateuchus* species are larger than most *Canthidium* (except *C. centrale*), are usually less rounded and never have metallic reflections.

1.

a. Pygidium large and convex. Anterior margin of the pronotum incomplete, pronotal surface moderately punctuate. Body size 5.2-6.7mm.....*Ateuchus guatemalensis*

b. Pygidium broad and flat. Anterior margin of the pronotum complete, pronotal surface smooth, punctuation not evident. Body size 7.0-8.5mm ..... *Ateuchus chrysopype*

Ateuchus chrysopyge  *Ateuchus guatemalensis*

Ateuchus chrysopyge

Size 7.0-8.5mm **Colouration** Glossy black

Identification notes

Ateuchus chrysopyge is the larger of the two *Ateuchus* species in CNP and can be most easily distinguishedby its relatively flat pygidium. Viewed laterally, the posterior end of the abdomen slopes evenly downwards and inwards from the apex of the elytra. This character takes practice to recognise by eye, but is very evident under a microscope. The pronotal characters are also quite distinctive, but almost certainly require a microscope.

Sex differences

The V-shaped median indentation of the clypeal margin is broader in males than females.

Ecology

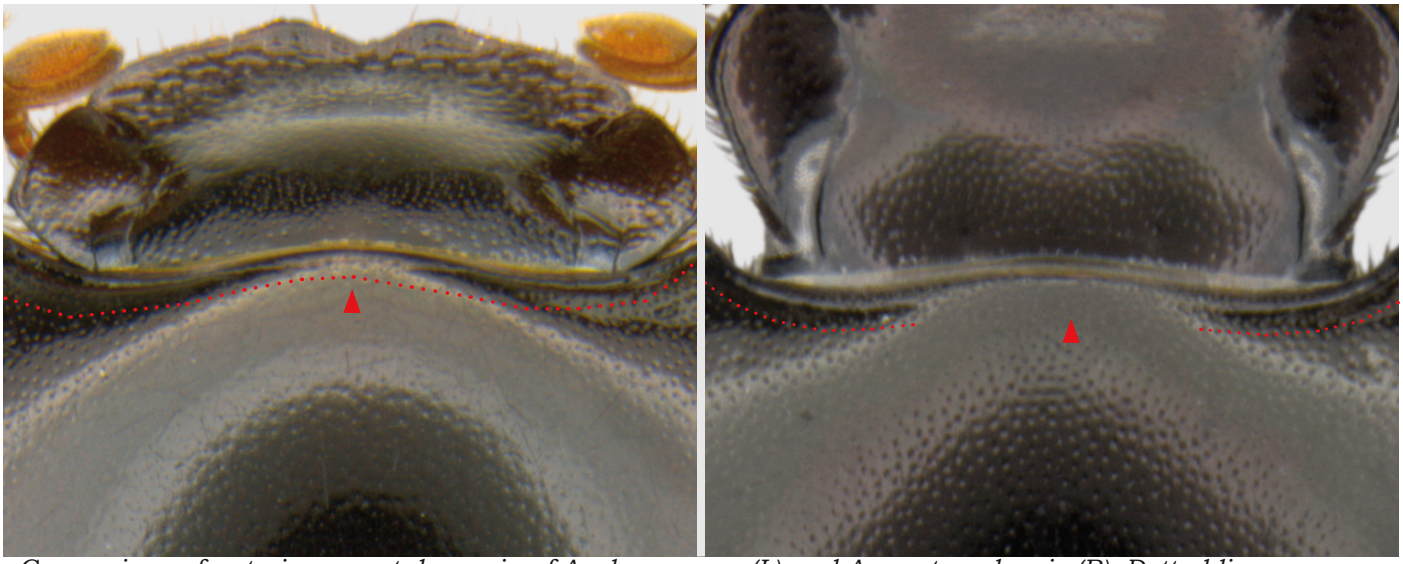
Ateuchus chrysopyge is a nocturnal paracoprid and has been trapped with dung, carrion and fruit in CNP. It is usually found quite freqently at middle elevations in the park, and occasionally in lower sample sites.

See Kohlmann 2000

Dorsal: arrow indicates broad clypeal indentation indicative of females

Lateral: arrow indicates convex pronotum indicative of A. chrysopyge

Images to scale with counterparts on facing page



Comparison of anterior pronotal margin of A. chrysopyge (L) and A. guatemalensis (R). Dotted line highlights margin, arrow indicates where incomplete in A. guatemalensis.

Ateuchus guatemalensis

Size 5.2-6.7mm **Colouration** Glossy black

Identification notes

Ateuchus guatemalensis is the smaller of the two *Ateuchus* species in CNP and can be most easily recognised by its strongly convex pygidium. Viewed laterally, the posterior end of the abdomen bulges outwards below the apex of the elytra. This character takes practice to recognise by eye, but is very evident under a microscope. The pronotal characters are also quite distinctive, but almost certainly require a microscope.

Sex differences

The V-shaped median indentation of the anterior clypeal margin is broader in males than females.

Ecology

Ateuchus guatemalensis is a nocturnal paracoprid and has only been trapped with dung in CNP. It is usually found at low to middle elevations in the park.

See Kohlmann 2000

Dorsal: arrow indicates acute clypeal indentation indicative of females

Lateral: arrow indicates convex pronotum indicative of A. guatemalensis

Images to scale with counterparts on facing page

Canthidium

The *Canthidium* genus consists of small to medium-sized shiny beetles, and has six species in CNP. Two of these species, *C. hespenheidei* and *C. aff. pseudoperceptible*, are recent additions to the species list that were previously identified as C. ardens or unidentified respectively, a testament to the difficulty of identifing these species. Without practice, it can be difficult to identify a specimen as belonging to the *Canthidium* genus, as superficially they can be very similar to *Ateuchus*, *Uroxys* and even *Onthophagus* and *Canthon* species. The generic key provides good characters for the latter three genera, but differentiating between *Canthidium* and *Ateuchus* can be tricky. *Canthidium* species are smaller than most *Ateuchus* (except *C. centrale*), are usually more rounded and usually have metallic reflections.

1.

a. Extreme posterior margin of pronotum with transverse row of punctures, not necessarily complete. Body length 8.5-10.0mm ..... *Canthidium centrale*

b. Extreme posterior margin of pronotum without transverse row of punctures. Body length less than 8.5mm..... *2*

2.

a. Frontal clypeal region with three elevated rounded swellings..... *Canthidium ardens*

b. Frontal clypeal region with no elevated rounded swellings..... *3*

3.

a. Dorsally, canthus strongly curved with posterior edge intruding over eye. Posterior of eye appears constricted *4*

b. Dorsally, canthus not strongly curved, posterior edge not substantially intruding over eye..... *5*

4.

a. Body size less than 4mm ..... *Canthidium hespenheidei*

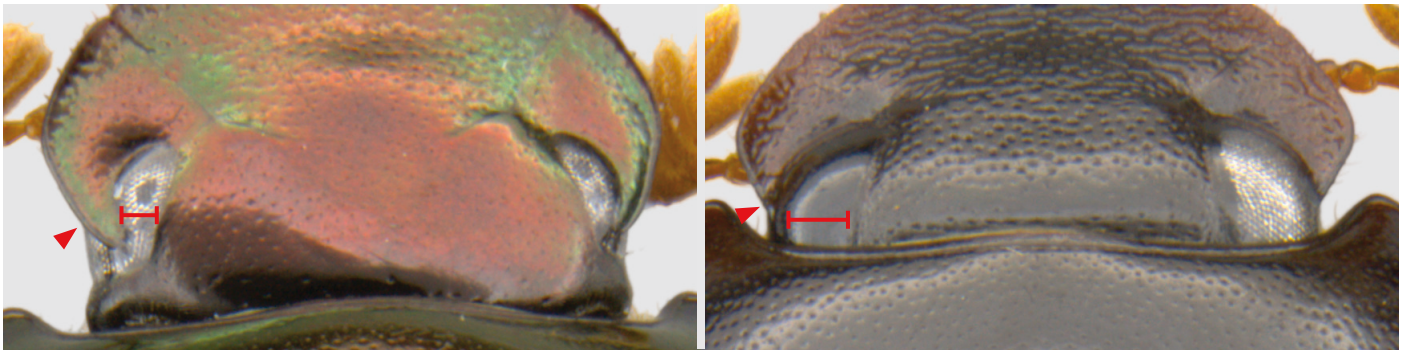
b. Body size greater than 4mm ..... *Canthidium aff. pseudoperceptible*

5.

a. Body with metallic green or reddish reflections. Elytral surface lightly punctuate. Interocular distance around three times dorsal eye width. Body size less than 5.3mm ..... *Canthidium aff. vespertinum*

b. Body without metallic reflections, matte. Elytral surface strongly punctuate. Interocular distance around 2.5 times dorsal eye width. Body size greater than 5.3mm .....*Canthidium aff. macroculare*

L-R: C. hespenheidei, C. ardens, C. aff. pseudoperceptible, C. aff. vespertinum, C. aff macroculare, C. centrale



Comparison of the shape of the ocular canthus in two Canthidum species: strongly curved with small dorsal eye area (L) and not strongly curved with larger dorsal eye area (R)

Canthidium ardens

Size 3.5-5.6mm **Colouration** Black with red or green reflections

Identification notes

Canthidium ardens is best recognised in CNP by the forward-pointing triangle of bumps on its head and the lack of punctuation on the elytral striae. Specimens can vary considerably in body length, leading it to be frequently confused with *C. hespenheidei*. *C. ardens* usually also overlaps with *C. macroculare* and *C. vespertinum* in body size range, but finding *C. ardens* specimens that large in CNP is uncommon.

Sex differences

In males, the apex of the foretibial spur is more bluntly rounded than in females, and they have a an apical projection of the foretibia about half the length of the spur.

Ecology

Canthidium ardens is a diurnal paracoprid and has only been trapped with dung in CNP, but has also been collected from rotting fruit and carrion outside the park. It is usually found from low to middle elevations in the park.

See Howden & Young 1981

Right and Below: Arrows indicate three swellings on head

Canthidium hespenheidei

Size 2.6-4.1mm **Colouration** Black with green reflections

Identification notes

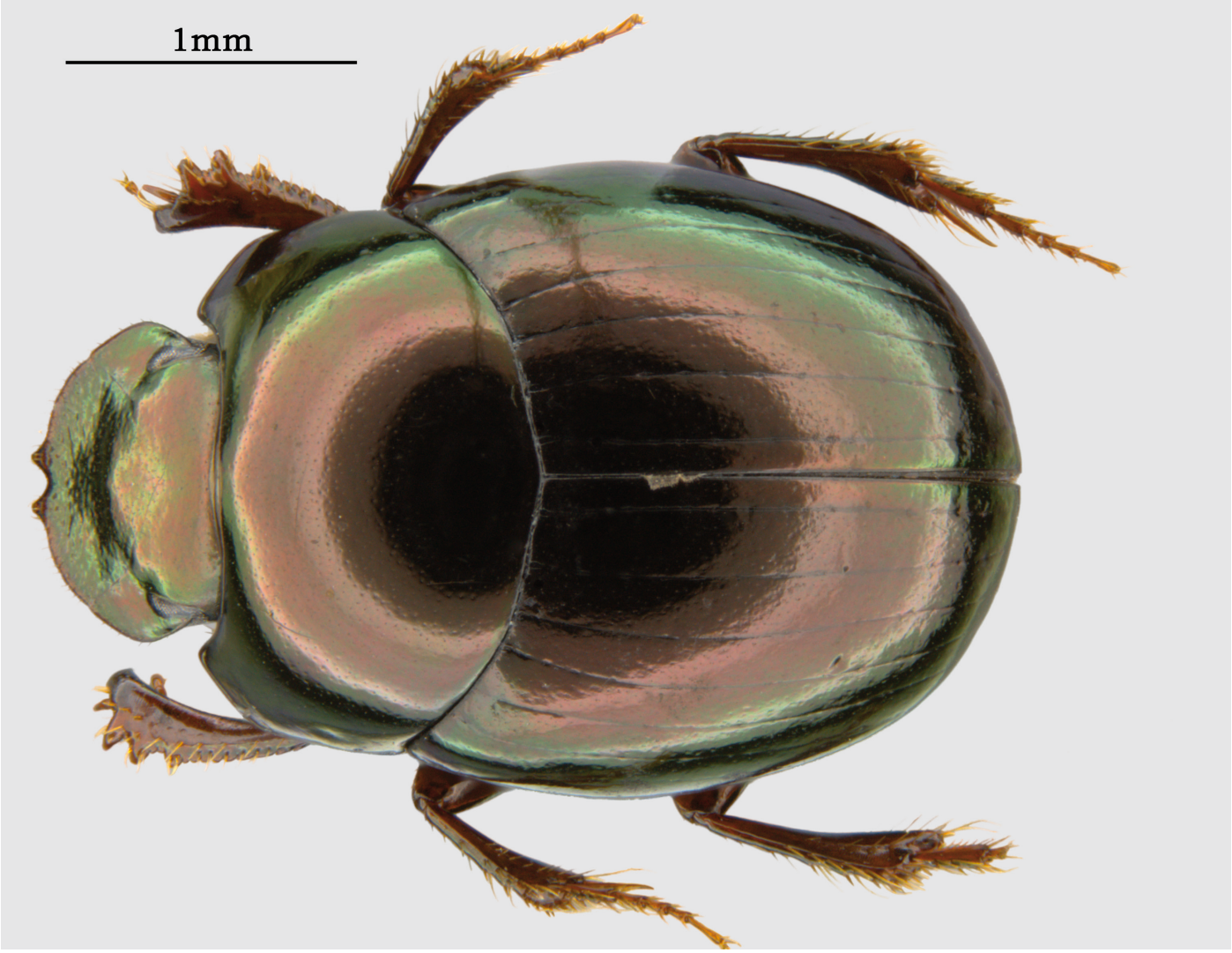
Canthidium hespenheidei is the smallest of the CNP *Canthidium* species, although specimens collected in CNP tend to be larger than the known average, occasionally leading to confusion with *C. ardens*. It can be easily distinguished from *C. ardens* by the lack of any swellings on the head. In CNP it is almost always smaller than 4.0mm, separating it from *C. aff. pseudoperceptible*

Ecology

Canthidium hespenheidei is a diurnal paracoprid and has been collected from dung and carrion baited traps in CNP. It is usually found from low to middle elevations in the park.

See Howden & Young 1981

Images not to scale with counterparts on facing page



Canthidium aff. pseudoperceptible

Size 3.9-4.1mm **Colouration** Black with red or green reflections

Identification notes

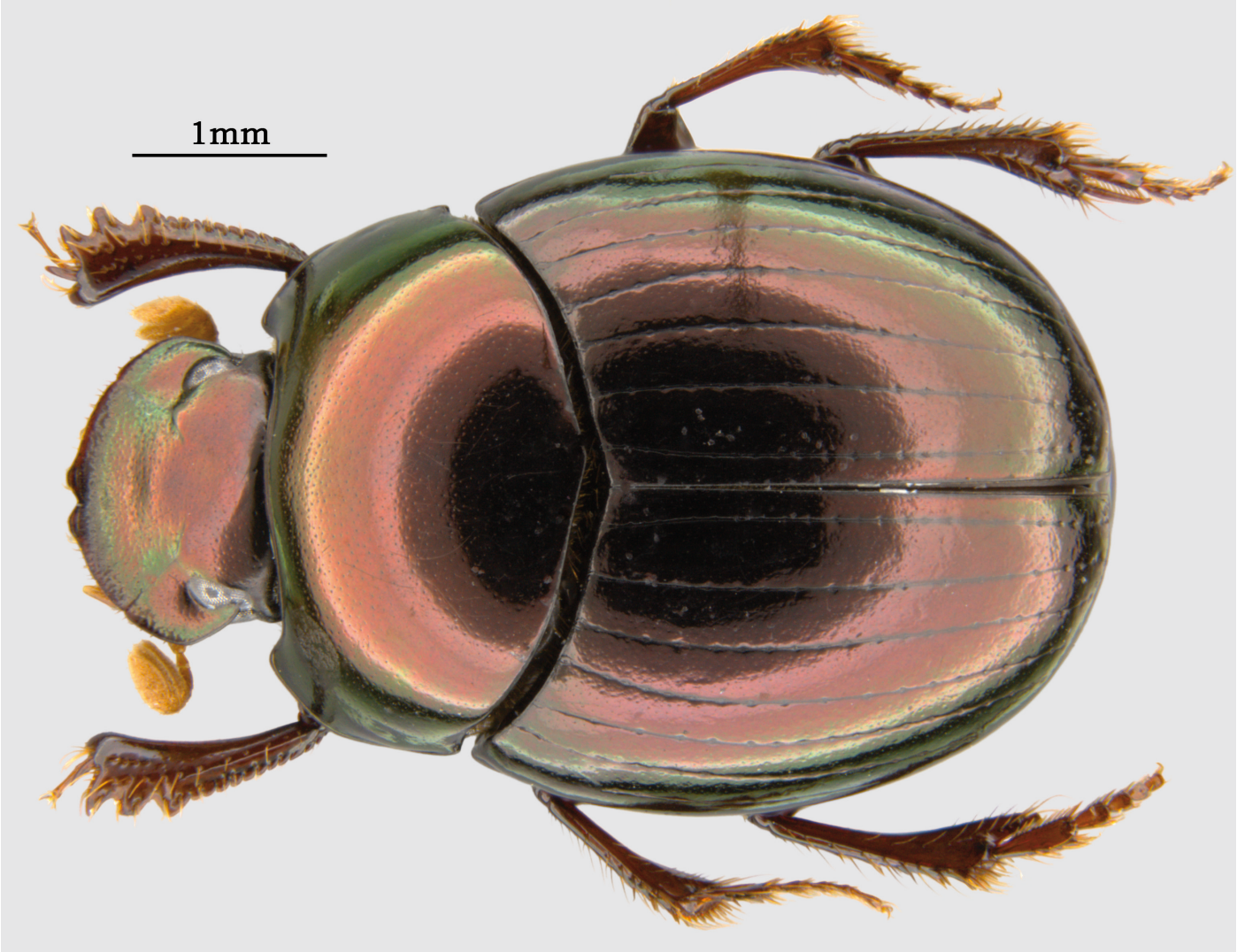
Canthidium aff. pseudoperceptible is similar in size to several other CNP *Canthidium* species, but can be distinguished by its small eyes (viewed dorsally), the lack of any swellings on the head and its relatively strong elytral striae. In CNP it is almost always larger than 4.0mm, separating it from *C. hespenheidei*.

Ecology

Canthidium aff. pseudoperceptible is a diurnal paracoprid and has been collected from dung and carrion baited traps in CNP. This species is only know from Santo Tomas (the lowest elevations in the park) so far, but this is probably due to under identification.

See Kohlmann & Solis 2006

Images not to scale with counterparts on facing page



Canthidium aff. vespertinum

Size 4.6-5.0mm **Colouration** Black with red or green reflections

Identification notes

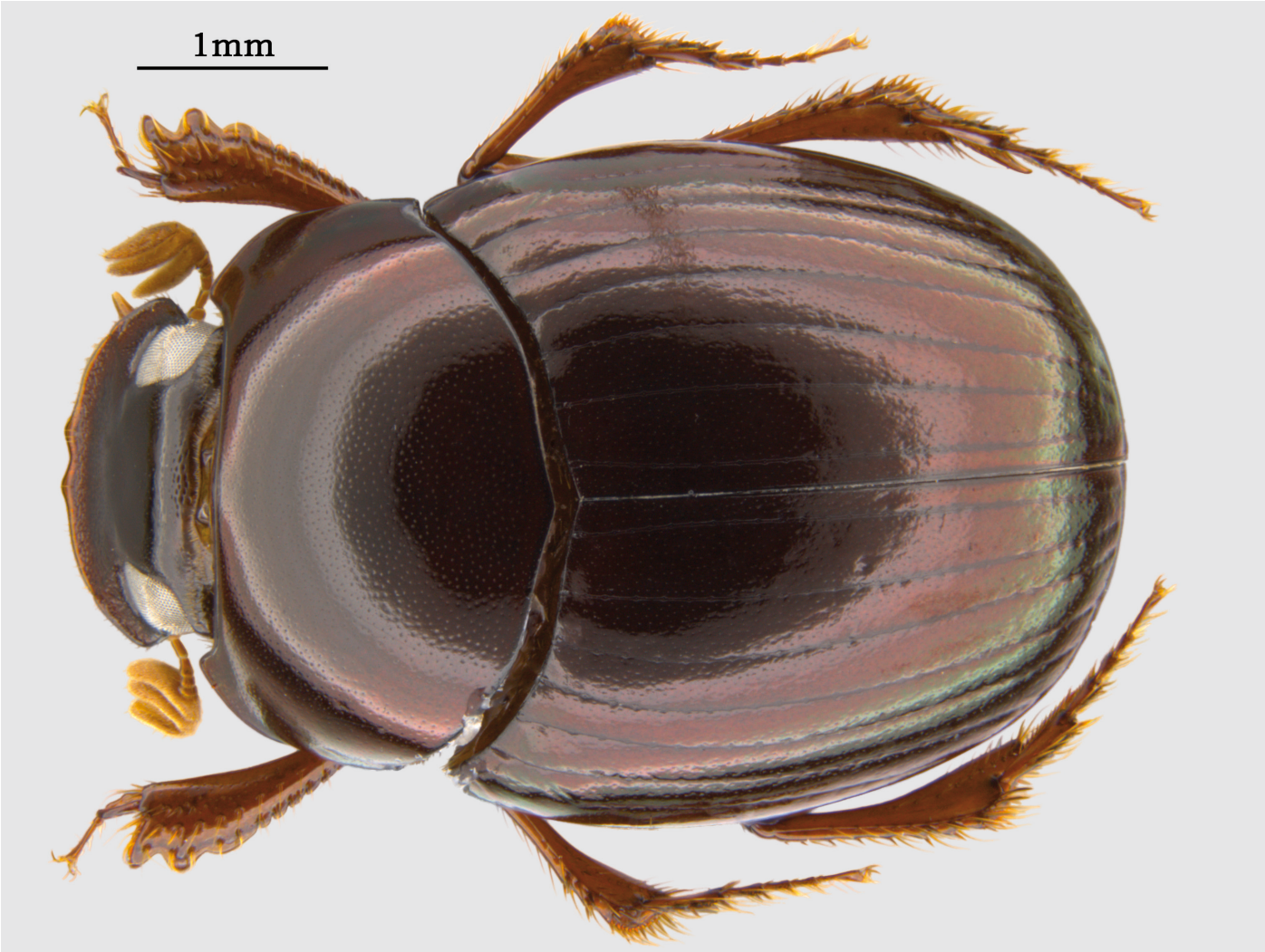
Canthidium aff. vespertinum shares many similar characters with *C. aff. macroculare*, and the morphologies of the species found in CNP do not precisely match the original descriptions, so these identifications are unconfirmed. *C. aff. vespertinum* is best recognised by its large eyes (viewed dorsally) and relatively shiny black body colouration, with green or reddish reflections. It is usually slightly smaller than *C. aff. macroculare*, less than 5.0mm.

Ecology

Canthidium aff. vespertinum is a nocturnal paracoprid and has only been collected from dung baited traps in CNP. It is usually found throughout the park, except at the lowest elevations.

See Howden & Young1981

Images to scale with counterparts on facing page



Canthidium aff. macroculare

Size 5.1-7.2mm **Colouration** Matt black with no reflections

Identification notes

Canthidium aff. macroculare shares many similar characters with *C. aff. vespertinum*, and the morphologies of the species found in CNP do not precisely match the original descriptions, so these identifications are unconfirmed. *C. aff. macroculare* is best recognised by its large eyes (viewed dorsally) and relatively matte black body colouration, with no green or reddish reflections. It is usually slightly larger than *C. aff vespertinum*, greater than 5.0mm.

Ecology

Canthidium aff. macroculare is a nocturnal paracoprid and has been collected from dung, carrion and fruit baited traps in CNP. It is usually found from middle to high elevations in the park.

See Howden & Gill 1987

Images to scale with counterparts on facing page

Canthidium centrale

Size 8.5-10mm **Colouration** Black with copper reflections

Identification notes

Canthidium centrale is best recognised in CNP by its relatively large size; all other *Canthidium* species are smaller than 8.0mm. The line of punctures along the posterior margin of the pronotum definitively distinguishes this species from the rest of its genus. *C. centrale* may be confused with some of the larger *Onthophagus* species: however, *Onthophagus* species always have four teeth on the foretibia, while *Canthidium* species have three.

Sex differences

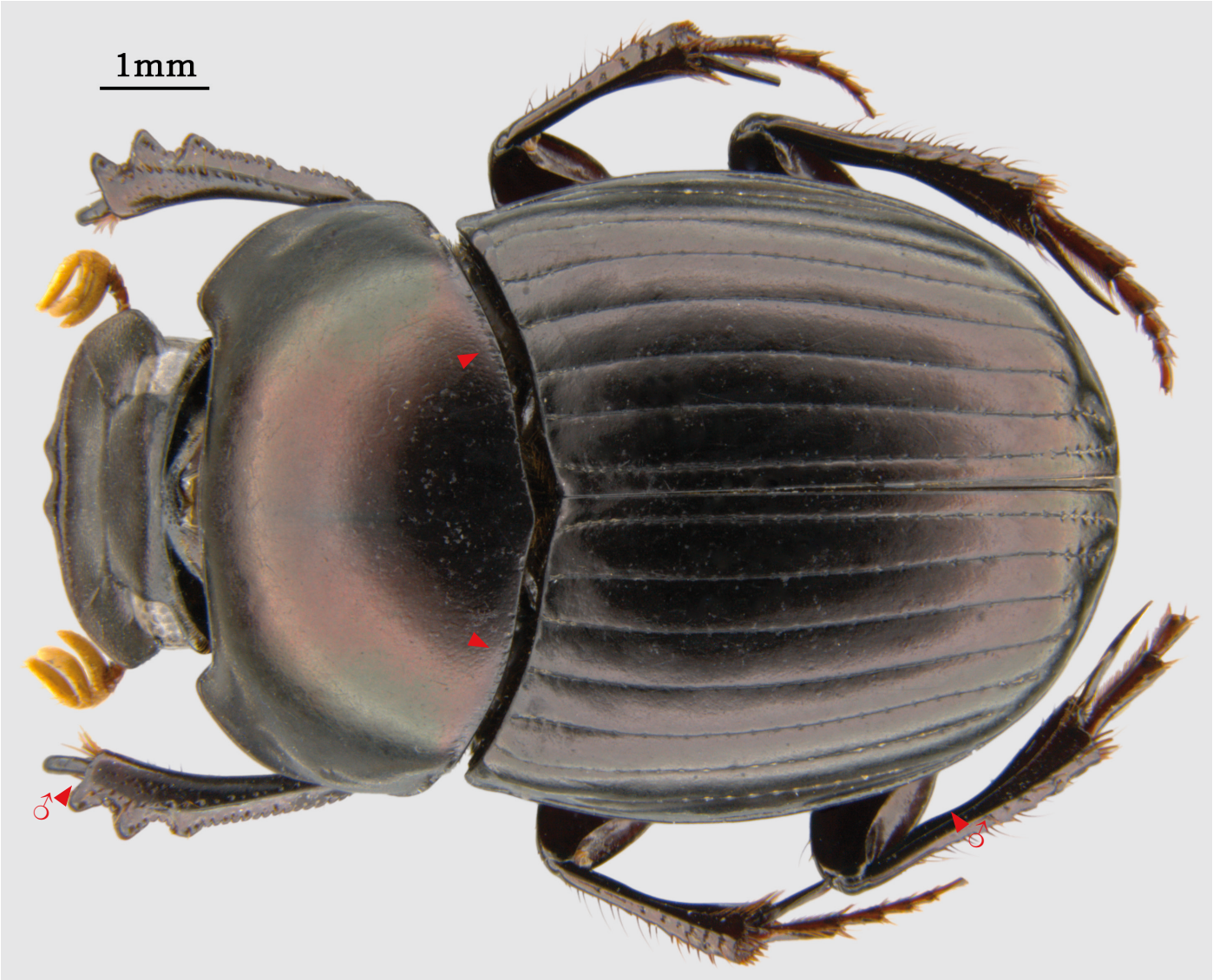
In males, the foretibial spur is slightly shorter and broader, with a basal tuft of setae. In males, the basal half of the inner edge of the hind tibia is sinuate; in females this is feeble or absent.

Ecology

Canthidium centrale is a nocturnal paracoprid and has only been trapped with dung in CNP, but has also been collected at light, in forest floor leaf litter and from carrion elsewhere. It is usually found at the lowest elevations in the park.

See Howden & Young 1981

Arrows indicate punctuation along posterior pronotal margin



Copris

The *Copris* genus consists of medium-sized beetles that often have strongly developed pronotal and head armanentation in males. The key provides the definitive way of recognising *Copris* species, but in practive the usually look fairly distinctive. *Copris* and *Dichotomius* species may sometimes be confused, but members of the *Dichotomius* genus are usually larger and broader. Three of the four species of *Copris* found in CNP show intrasexual dimorphism. This means that differences in morphology within a gender fall into two distinct categories. This is most obvious in males, and can lead to difficulties in identification. The key therefore first aims to ascertain the morph of a specimen before identifying it to species.

1.

a. Extended cephalic horn, curved to a greater or lesser degree. Two clear median pronotal prominences either side of medial longitudinal groove, extending towards anterior pronotal margin ..... *major male: 2*

b. If present, cephalic horn small, not curved. Dorsally, pronotum smoothly declivous towards anterior margin or with two swellings either side of medial longitudinal pronotal groove..... *4*
NB: Apex of horn acute: minor male; apex of horn transversely trucated: female

2.

a. Median pronotal prominences transversely truncated. Horn-like tubercle posterior to cephalic horn ..... *Copris lugubris*

b. Median pronotal prominences rounded or acute. No tubercle posterior to cephalic horn *3*

3.

a. Clear lateral pronotal carina present, extending anteriorly. Lateral pronotal margin sinuate, sometimes with small indentation anteriorly *4*

b. No clear lateral pronotal carina extending anteriorly. Lateral pronotal margin evenly curved..... *5*

4.

a. Median pronotal prominenes increase in separation anteriorly. Anterior clypeal margin with single median indentation forming two acute teeth. Foretibial teeth, and indentations between, strongly acute. Eighth elytral stria complete..... *Copris sp. nov.*

b. Median pronotal prominences parallel. Anterior clypeal margin without clear median indentation, two reduced obtuse teeth. Indentations between foretibial teeth somewhat rounded. Eighth elytral stria incomplete, replaced by occasional punctuation towards posterior..... *Copris nubilosus*

5.

a. ♀ Ventral surface of mid and hind femur and trochanter with sparse setae. Body length greater than 13mm..... *Copris lugubris*

b. ♀ Ventral surface of mid and hind femur and trochanter without setae. Body length less than 13mm..... *Copris laeviceps*

L-R: C. laeviceps, C. nov.sp., C. nubilosus, C. lugubris

Right: Close up of the head of a female Copris. Arrow highlights the characteristic truncated head horn

Top row: comparison of the lateral pronotal carina in the four Copris species

Bottom row: comparison of the shape of the lateral pronotal margin in the four Copris species

Left to right: C. laeviceps, C. lugubris, C. nubilosus, C. sp.nov Not to scale

Copris laeviceps

Size 11-13mm **Colouration** Black

Identification notes

Copris laeviceps is the only species of *Copris* in CNP that is not intrasexually polymorphic, i.e. there is only one male morphological form. It is the smallest *Copris* species in CNP, usually less than 13mm, and lacks head arnaments apart from a small conical process on the clypeus. It can easily be confused at first glance with a minor male or small female of *C. nubilosus* or *C. sp.nov*: in general the horn of *C. laeviceps* is more acute than that of a female of the two other species and shorter than that of any male of *C. nubilosus* or *C.sp.nov*

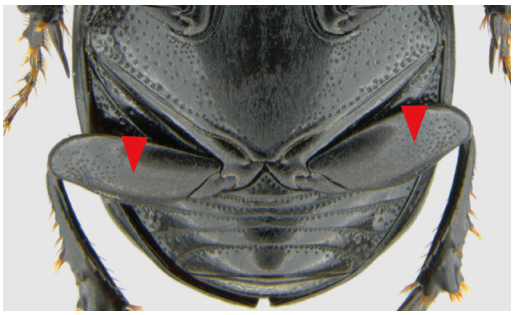
Sex differences

Female *C. laeviceps* have a parallel sided or tapering spur on the foretibia, as opposed to distally expanded in males.

Ecology

Copris laeviceps is a nocturnal paracoprid and has only been trapped with dung in CNP, though it has also been found on carrion elsewhere. It is found infrequently in the park, at low middle elevations.

See Matthews 1961



Right: arrows show areas lacking fibial setae

Below dorsal view of C. laeviceps to scale with that of C. lugubris on the facing page

Copris lugubris

Size 13.5-19mm **Colouration** Black

Identification notes

Copris lugubris is the largest *Copris* species in CNP, although smaller specimens overlap with *C. nubilosus* and *C. sp.nov* The males are usually easily distinguished from other *Copris* species by the relatively straight horn, lateral pronotal processes and truncated pronotal development. Smaller females may be confused with large females of *C. nubilosus* or *C. sp.nov* and can be differentiated by the lateral pronotal carina (see key).

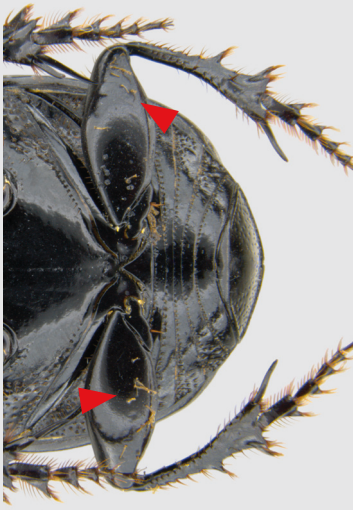
Sex differences

Female *C. lugubris* often lack any head arnaments, instead having only a short transverse carina. In the minority of strongly developed females, a cephalic horn is present, but shorter than in males and transversely truncated. Similarly, the majority of females lack any of the pronotal developments of males; the pronotum in the minority of developed females bears low rounded tumosities.

Ecology

Copris lugubris is a nocturnal paracoprid and has only been trapped with dung in CNP, though it has also been found on carrion and rotting fruit elsewhere. It has only been found at the lowest elevations in the park, at Santo Tomas.

See Matthews 1961



Far left: dorsal view of C. lugubris to scale with that of C. laeviceps on the facing page

Left: arrows show areas with sparse fibial setae

Copris nubilosus

Size 13.8-16.9mm **Colouration** Black

Identification notes

Copris nubilosus is one of the most widespread species in CNP, and overlaps in body size with most of the other *Copris* species. It is easily confused with *C. sp.nov*, but the two species can be distinguished with practice by the characters mentioned in the above key: the eighth elytral stria is incomplete, the foretibial and anterior clypeal teeth are not strongly acute, and the two horns of the pronotal process on major males are parallel. *C. nubilosus* is usually slightly larger than *C. sp.nov* Minor males and females of *C. nubilosus* can be distinguished from *C. lugubris* and *C. laeviceps* by the presence of a lateral pronotal carina and major males by the curved cephalic horn.

Sex differences

Females of *Copris nubilosus* lack the extended head horn and pronotal processes. Instead, the head horn is short and transversely truncated, and the pronotum is smooth or with some development in the largest females.

Ecology

Copris nubilosus is a nocturnal paracoprid and has been trapped with rotting fruit, carrion and dung in CNP. It is found frequently throughout the park.

See Kohlman, Cano & Delgado 2003

Above: arrows show incomplete area of eighth elytral stria

Below: lines emphasise angle of pronotum horns in major male. All images to scale with counterparts on facing page

Above: arrows show complete area of eighth elytral stria

Below: lines emphasise angle of pronotum horns in major male. All images to scale with counterparts on facing page

Copris sp.nov

Size ~14mm **Colouration** Black

Identification notes

Copris sp.nov has so far not been identified and is thought to be a new species known only from CNP. It is slightly smaller on average than *C. nubilosus*, but otherwise is very similar at first glance. The two species can be distinguished with practice by the characters described in the above key: the eighth elytral stria is complete, the foretibial and anterior clypeal teeth are acute, and the two horns of the pronotal process on major males form a V-shape. As in *C. nubilosus*, major males of *C. sp.nov* species are easily distinguished from *C. lugubris* and laeviceps by the curvered head horn, and minor males and females can be distinguished by the presence of a lateral pronotal carina.

Sex differences

Females of *C. sp.nov* lack the extended head horn and pronotal processes. Instead, the head horn is short and transversely truncated, and the pronotum is smooth or with some development in the largest females.

Ecology

Copris sp.nov is probably a nocturnal paracoprid. It has been trapped with carrion and dung in CNP, usually at low elevations.

See N/A

Coprophanaeus

The two CNP *Coprophanaeus* species are relatively large and fairly distinctive due to their very acute cephalic and foretibial teeth. This genus is most closely related to *Phanaeus*, but in CNP these genera are morphologically fairly different. The *Coprophanaeus* species have four teeth on their foretibia, but the teeth are sharper, the tibiae are less elongated and the body size is much larger than in any CNP *Onthophagus*. Superficially, *Coprophanaeus* species look somewhat like members of the *Dichotomious* genus, but the latter have much reduced clypeal teeth.

a. Clypeus tetrahedral with distinct anteriolateral clypeal angles and straight lateral margins. In males, tapering cephalic horn inclined posteriorly and bi-arcuate thoracic carina. In females, pronotal declivity with rounded carina. Body length 24-28mm..... *Coprophanaeus corythus*

b. Clypeus roughly semicircular with rounded anteriolateral clypeal angles and curved lateral margins. In males, rounded thoracic carina with single slight medial indentation. In females, pronotal declivity with extended truncated carina. Body length 16-20mm..... *Coprophanaeus gilli*

Coprophanaeus corythus

Size 24-28mm **Colouration** Black with slight sheen (see notes)

Identification notes

Coprophanaeus corythus is the larger of the two *Coprophanaeus* species in CNP, greater than 22mm in body length. *C. corythus* has a slightly metallic green sheen to the lateral margins of the pronotum, whereas *C. gilli* has a purple-blue hue to the elytra. If in doubt, the morphology of the head described in the above key is most definitive.

Sex differences

The males of *C. corythus* usually have a strongly developed pronotum, and often have a broad-based tapering horn to the rear of the head. Females have a more smooth pronotum, but with a transverse ridge just behind the join with the head.

Ecology

Coprophanaeus corythus is a relatively new addition to the CNP fauna, and has only been collected twice, both from carrion traps in Santo Tomas. It is a crepuscular paracoprid.

See Edmonds & Zidek 2010

1mm

Arrows indicate transverse pronotal carina

L-R: Coprophanaeus corythus, C. gilli

Coprophanaeus gilli

Size 16-20mm **Colouration** Black with slight sheen (see notes)

Identification notes

Coprophanaeus gilli is the smaller of the two *Coprophanaeus* species in CNP, less than 22mm in body length. *C. gilli* has a purple-blue hue to the elytra, whereas *C. corythus* has a slightly metallic green sheen to the lateral margins of the pronotum. If in doubt, the morphology of the head described in the above key is most definitive.

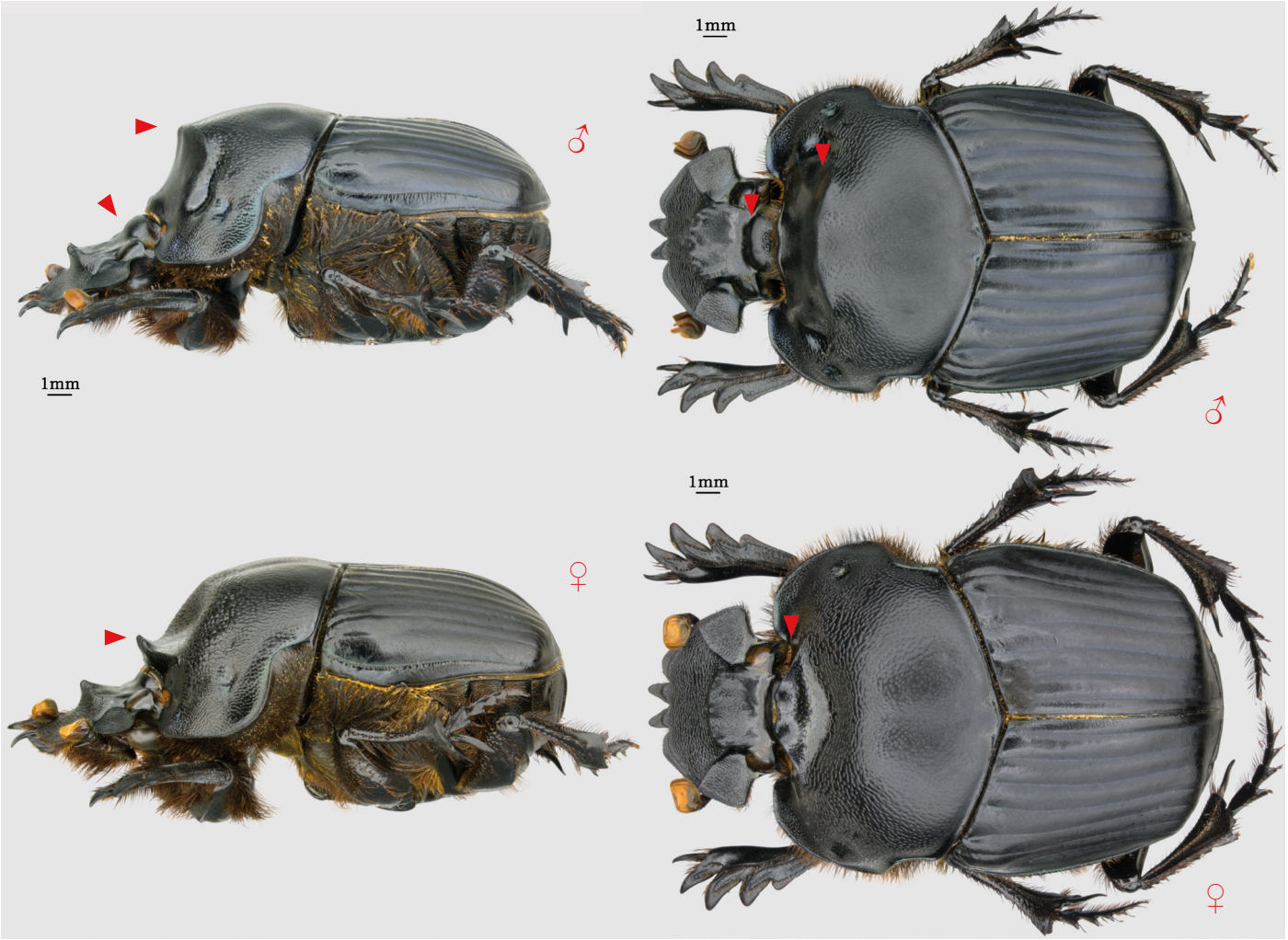
Sex differences

The males of *C. gilli* usually have a strongly developed pronotum, and often have a broad carina at the rear of the head. Females have a more smooth pronotum, but with a transverse ridge just behind the join with the head.

Ecology

Coprophanaeus gilli has been trapped with both dung and carrion in CNP, but probably favours the latter. It is a crepuscular paracoprid and is usually only found at the lowest elevations in the park.

See Edmonds & Zidek 2010



Arrows indicate transverse pronotal carina, and in males the broad carina at the rear of the head

Deltochilum

The three CNP *Dichotomius* species are easy to identify by their globular bodies and long, curved hind limbs. Although these characteristics are shared by the *Canthon* and *Cryptocanthon* genera, *Deltochilum* species are always greater than 15mm. The three species are generally very easy to tell apart, by colouration and by size.

1.

a. Clypeal teeth only somewhat separated (by no more than three times their length). Pygidium somewhat convex. Dorsal surface with brownish reflections. Body length 17mm or less .....*Deltochilum pseudoparile*

b. Clypeal teeth widely separated (by greater than three times their length). Pygidium almost flat. Dorsal surface not brownish. Body length 18mm or greater *2*

2.

a. Anterior half of lateral pronotal margin straight or with slight curve. Dorsal surface black with slight copper reflections. Body length 26-28mm..... *Deltochilum gibbosum ssp. panamensis*

b. Anterior half of lateral pronotal margin sharply sinuate, creating slight notch. Dorsal surface with purple-blue reflections. Body length 19-22mm.....*Deltochilum mexicanum*

L-R: Deltochilium pseudoparile, D. mexicanum, D. gibbosum ssp. panamensis

Deltochilum pseudoparile

Size 11-13mm **Colouration** Dark brown-black

Identification notes

Deltochilum pseudoparile is the smallest of the *Deltochilum* species in CNP, less than 16mm: this and its slightly brownish colouration usually easily distinguish from the others in its genus. If in doubt, the positioning of the clypeal teeth in the above key is a definitive character. While it is of similar size to many *Copris* and other species, it can easily be distinguished by its characteristic hindlimbs and faint elytral striae.

Ecology

Deltochilum pseudoparile is a nocturnal teleocoprid. It has been trapped with both carrion and dung, and is usually found at low elevations in CNP.

See Howden & Young 1981

Images not to scale

Deltochilum gibbosum ssp. *panamensis*

Size 26-28mm **Colouration** Black with slight copper reflections

Identification notes

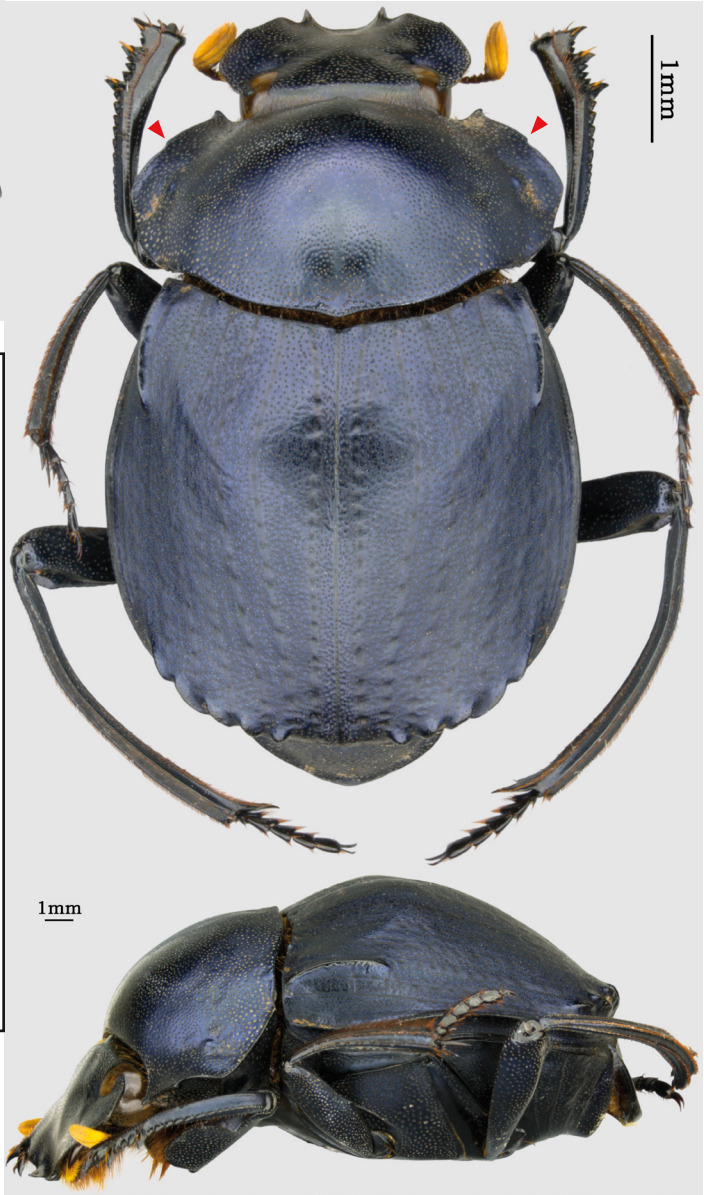
Deltochilum gibbosum is the largest of the *Deltochilum* species in CNP, greater than 26mm and his is usually the easiest way to recognise this species. If in doubt, the characters and colours in the above key clearly separate the species. It is fairly difficult to confuse *D. gibbosum* with members of other genera, as the other species of its size do not have the distinctive hind limb shape, rounded body and faint elytral striations.

Ecology

Deltochilum gibbosum is a teleocoprid, as can be inferred from its long hind limbs, and has been trapped with both dung and carrion in CNP. It is usually found at low elevations in the park.

See Howden & Young 1981

Left: Deltochilum gibbosum. Arrows indicate straight or slightly curved area of lateral pronotal margin. Not to scale.



Deltochilum mexicanum

Size 19-22mm **Colouration** Black with blue-purple sheen

Identification notes

Deltochilum mexicanum is most easily distinguished by its slight blue-purple sheen, although the sharp sinuation of the lateral pronotal margin is definitive. It is smaller than *D. gibbosum* but larger than *D. panamensis*. It is larger than most species from other genera, and can also be distinguished by its characteristic hind limbs, rounded body shape and faint elytral striations.

Ecology

Deltochilum gibbosum is a teleocoprid, as can be inferred from its long hind limbs, and has been trapped with dung and carrion in CNP. It is has been found throughout the park, but most frequently at middle elevations.

See Howden & Young 1981

Right: Deltochilum mexicanum. Arrows indicate sharp sinuation in lateral pronotal margin. Not to scale

Dichotomius

The two members of the *Dicotomius* genus are fairly distinctive, being of relatively large size. The smaller members can often be confused for *Copris*, but the shape of the pronotum is always different, and *Dichotomius* spp. always have a ruguse clypeus. Both *Dichotomius* species, especially *D. satanas*, have a fair amount of morphological variation within the sexes, but are not intrasexually polymorphic - they simply have a wide range of sizes.

a. First and second elytral striae clearly widened and usually brown in the posterior third of their length. Third, fourth and fifth striae may also be widened and usually brown, depending on size. Body length usually greater than 25mm ..... *Dichotomius annae*

b. Elytral striae not widened in the posterior third of their length. Body length usually less than 24mm..... *Dichotomius satanas*

Dichotomius annae

Size 18-36mm **Colouration** Black

Identification notes

Dichotomius annae is, on average, the largest species of dung beetle in CNP, although smaller individuals may appear similar to *D. satanas*. The widening of the posterior third of the elytra clearly separates the species, although the degree of widening and the number of widened stria varies between specimens. Whether the widened areas are brown depends on the width, as the brown is the aggregation of soil and dung particles. *D. annae* also has a less sharply developed pronotum and a bicuspid head horn compared with *D. satanas*.

Sex differences

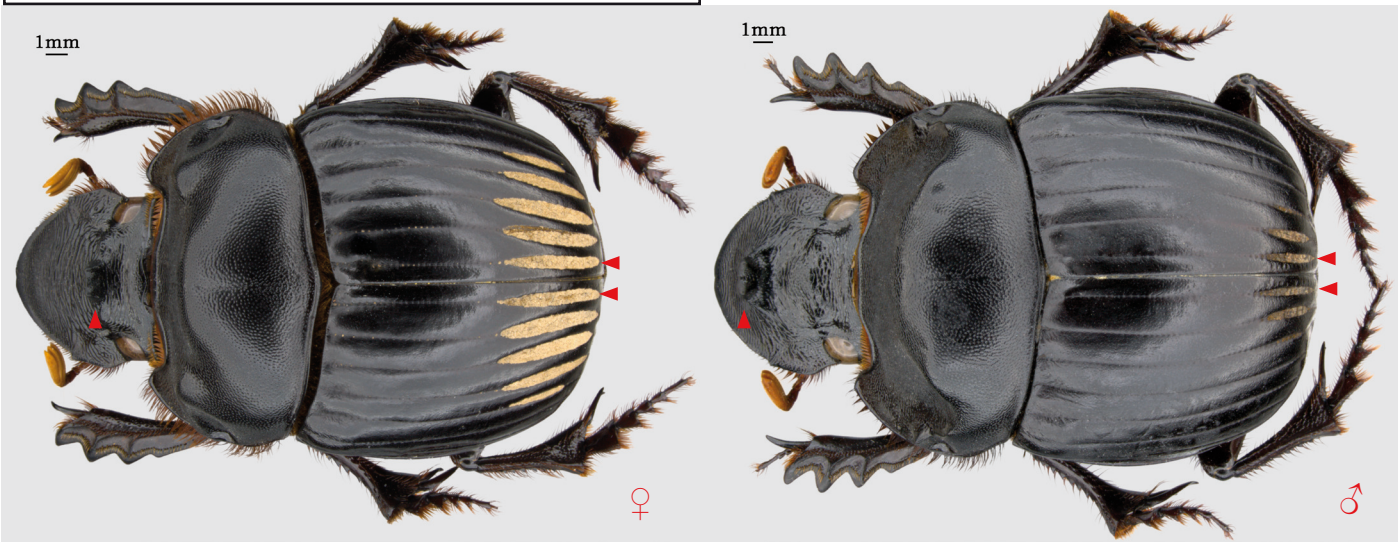
Females of *D. annae* tend to have more elytral striae with more and larger widened regions. The pronotum of females is usually less developed, without the small acute lateral prominences of males. The head horn on females is situated towards the posterior of the clypeus; on males, the horn is situated in the centre of the clypeus.

Ecology

Dichotomuis annae is a nocturnal paracoprid, and has only been found in dung traps in CNP. It is generally found at lower elevations in the park.

See Kohlmann & Solis 1997

Images not to scale



Dichotomius satanas

Dichotomius annae

Dichotomius satanas

Size 17-23mm **Colouration** Black

Identification notes

Dichotomius satanas is the smaller of the two *Dichotomius* species in CNP, but is of similar size to the smaller specimens of *D. annae*. The easiest way to separate these species is the widened striae of *D. annae*; additionally, both males and females of *D. satanas* have a more sharply developed pronotum and a head horn that is not bicuspid.

Sex differences

Males of *D. satanas* have a flattened, sloping pronotum with a wide sinuate carina situated at the posterior edge of the slope. In some males, this carina is strongly developed and resembles a central horn flanked by two smaller horns. The male head horn is situated in the centre of the clypeus. Females of *D. satanas* have a more convex pronotum, with an anteriorly projecting carina in the more developed individuals. The head horn is situated to the posterior of the clypeus, roughly in line with the anterior edge of the eyes.

Ecology

Dichotomuis annae is a nocturnal paracoprid. Is has only been found in dung traps in CNP, generally at lower and middle elevations.

See Howden & Young 1981

Images not to scale

CRYPTOCANTHON

Cryptocanthon sp.nov

Size ~3mm **Colouration** Black

Identification notes

Cryptocanthon sp.nov has so far not been identified and is thought to be a new species known only from CNP. It is the smallest dung beetle species found in CNP, and can often be difficult to notice in samples due to this, as well as the fact that it is often covered in dried soil grains, appearing to look like just another speck of dirt. This is a result of its most prominent identifying feature, its dorsal setae, which are usually only visible under a microscope or handlens. Once found, it can best be recognised by these setae, its small size and sheild-like elytra. It can sometimes be difficult to separate *Cryptocanthon sp.nov* from other non-Scarabaeinae beetles of its size. The key features are the lamellate antenna and broad, toothed foretibia that distinguish the Scarabaeinae.

Ecology

Cryptocanthon sp.nov has only been found at dung, and while its hind limbs suggest that it is a teleocoprid, its small size indicates that it is probably a paracoprid. It is probably nocturnal, has only been trapped using dung and is usually found at middle elevations in CNP, occasionally lower.

See N/A

Cryptocanthon sp.nov

Canthon

1.

a. Lateral margin of the pronotum adjacent to anteriolateral pronotal angle straight or slightly, sharply sinuate creating slight notch. Elytral striae extremely indistinct, almost absent. Body size less than 7.5mm.....*Canthon euryscelis*

b. Lateral margin of the pronotum adjacent to anteriolateral pronotal angle smoothly sinuate, creating small tooth. Elytral striae somewhat distinct, at least on elytral disc. Body size usually greater than 7.5mm.....*Canthon vazquezae*

Canthon euryscelis  *Canthon vazquezae*

Canthon euryscelis

Size 3.8-5.2mm **Colouration** Dark purple-blue

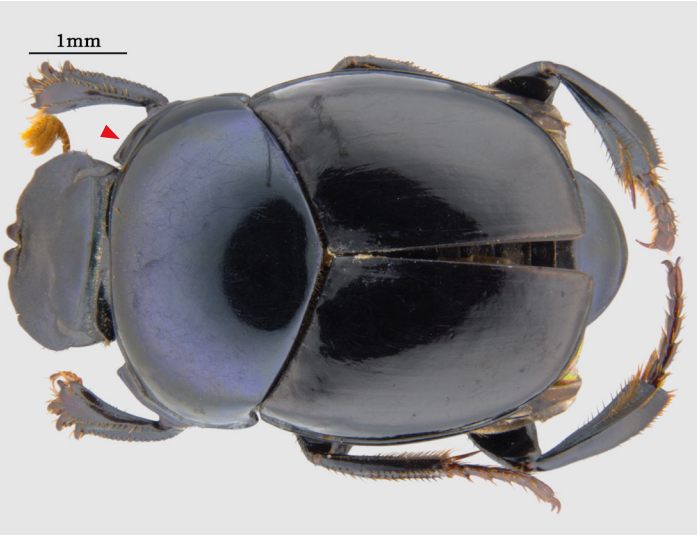
Identification notes

Canthon euryscelis is relatively easy to recognise by its extremely indistinct elytral striae and curved, elongated mid and hind tibia. Some other species overlap with *C. euryscelis*'s size range, and if in doubt the number of tibial teeth (three) and the lack of any head or pronotum ornamentation (besides clypeal teeth) should usually be distinctive. It can be distinguished from *C. vazquezae* by its colouration and size, always less than 7mm.

Ecology

Canthon euryscelis is a teleocoprid and has been found at both dung and carrion traps in CNP. It is so far only known from four specimens in the park, all of which were collected in Buenos Aires.

See Howden & Young 1981



Arrows indicate area of lateral pronotal carina for comparison; note sinuation in C. vazquezae

Canthon vazquezae

Size 8-9mm **Colouration** Dark purple-blue, sometimes green

Identification notes

Canthon vazquezae is relatively easy to recognise by its colouration, faint elytral striae and curved, elongated mid and hind tibia. Some other species overlap with *C. vazquezae*'s size range, and if in doubt the number of tibial teeth (three) and the lack of any head or pronotum ornamentation (besides clypeal teeth) should usually be distinctive. It can be distinguished from *C. euryscelis* by its colouration and its size, always greater than 7mm.

Ecology

Canthon vazquezae is a teleocoprid, and has been found at both dung and carrion traps in CNP. It is usually found at lower elevations in the park.

See Martinez, Halffter & Halffter 1964

Phanaeus

Phanaeus endymion

Phanaeus endymion

Size 11-20mm **Colouration** See notes

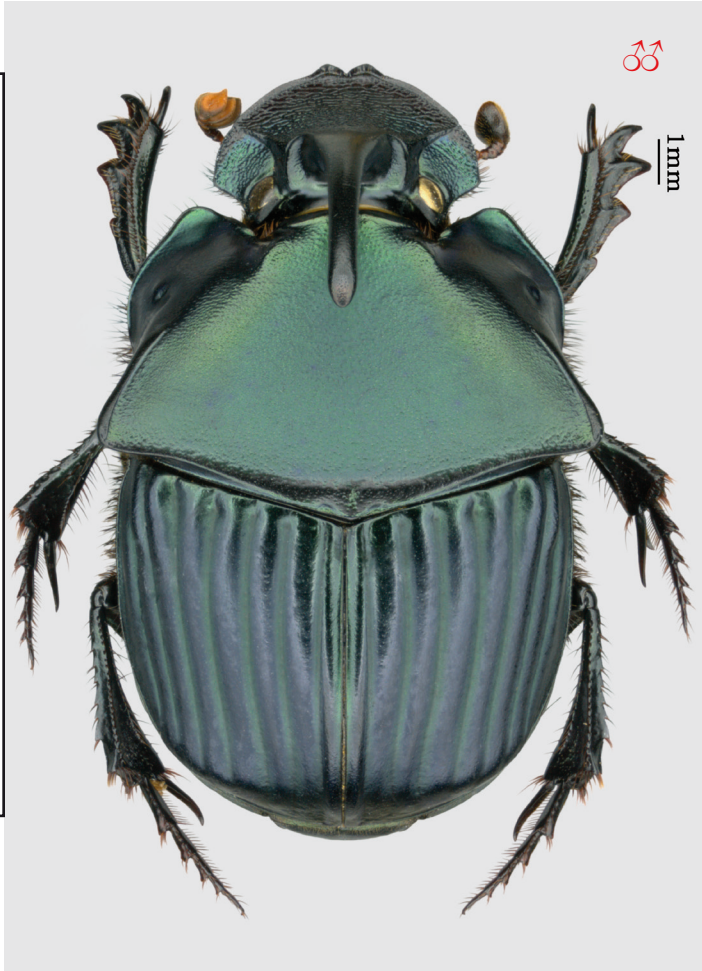
Identification notes

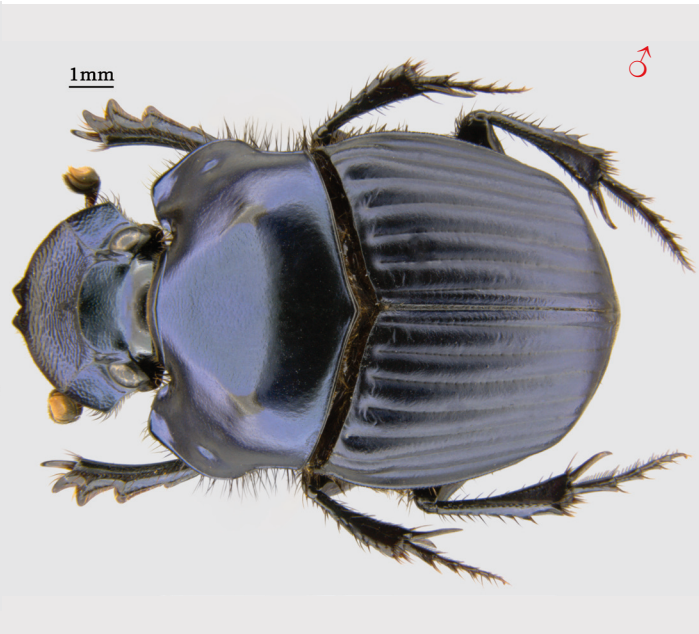
Phanaeus endymion is the only *Phanaeus* species found in CNP, and males are very distinctive due to their strong dark blue or green metallic sheen and, in males, the developed pronotum and cephalic horn. Females often lack the strong colouration, and are also without the pronotal and cephalic development, but can be distinguished from *Coprophanaeus spp.* by the lack of indentations lateral to the cephalic teeth and by its relatively smaller size. Another way that this species can be distinguished from the majority of CNP dung beetles is by the very clear elytral striae.

Ecology

Phanaeus endymion is a diurnal paracoprid. It has been found in carrion, fruit and dung traps in CNP, usually at lower elevations

See Arnaud 2002





EURYSTERNUS

The members of the *Eurysternus* genus are very distinctive, with their parallel-sided bodies and visible scutellum, so it is difficult to confuse them with other genera. With all *Eurysternus* species, males and females are best differentiated by the presence of a small pad or brush of setae on the underside of the foretibia of males. This is very difficult to see without a microscope, but there is usually a slight difference in the structure of the foretibia that is visible with the naked eye: the foretibial teeth of females are usually arranged in a typical Scarabaeinae fashion, whereas on males they are somewhat reduced, with a larger gap between the first and second teeth.

1.

a. Anterior ventral surface of abdominal segment acute between hind coxae, adjacent medial prominence at posterior of metasturnum. Pronotum bearing six to twelve very slight, often glossy protuberances, arranged circularly *2*

b. Ventral surface of abdominal segment between hind coxae truncated, no adjacent medial prominence at posterior of metasturnum. Pronotum without circle of protruberances *3*

2.

a. Pronotum bearing six glossy slight protuberances arranged circularly, easily visible. Posterior region of prosternum with distinct, acute turbercles either side of midline .... *Eurysternus magnus*

b. Pronotum with around 11 slight protuberances arranged circularly, only anteriomedial protuberances glossy, most indistinct. Posterior region of prosternum without tubercles, smooth ..... *Eurysternus mexicanus*

3.

a. Hind tibia often strongly curved, almost 90° arc, or ocassionally clearly sinuate. Pronotal surface somewhat sculptured. Foretibia often without tarsus, if present very pale. Large proportion of body surface with olive-green colouration, especially obvious on ventral surface..... *Eurysternus foedus*

b. Hind tibia only slightly curved. Surface of pronotum smooth besides punctures. Foretibia usually with tarsus, if present same colour as tibia. Body surface dark brown or cupreous in colour ..... *Eurysternus obliteratus*

L-R: Eurysternus mexicanus, E. magnus, E. foedus, E. obliteratus.
NB: E. magnus and E. foedus very variable in size, see boxes.

Comparison of ventral characters between the four Eurysternus species. Arrows denote acute/truncated anterior portion of abdominal segment between hind coxae and, where present, tubercles on posterior region of prosternum. L-R E. magnus, E. foedus, E. mexicanus, E. obliteratus

Eurysternus magnus

Size 12.5-19.0mm **Colouration** Matt black and brown, see notes

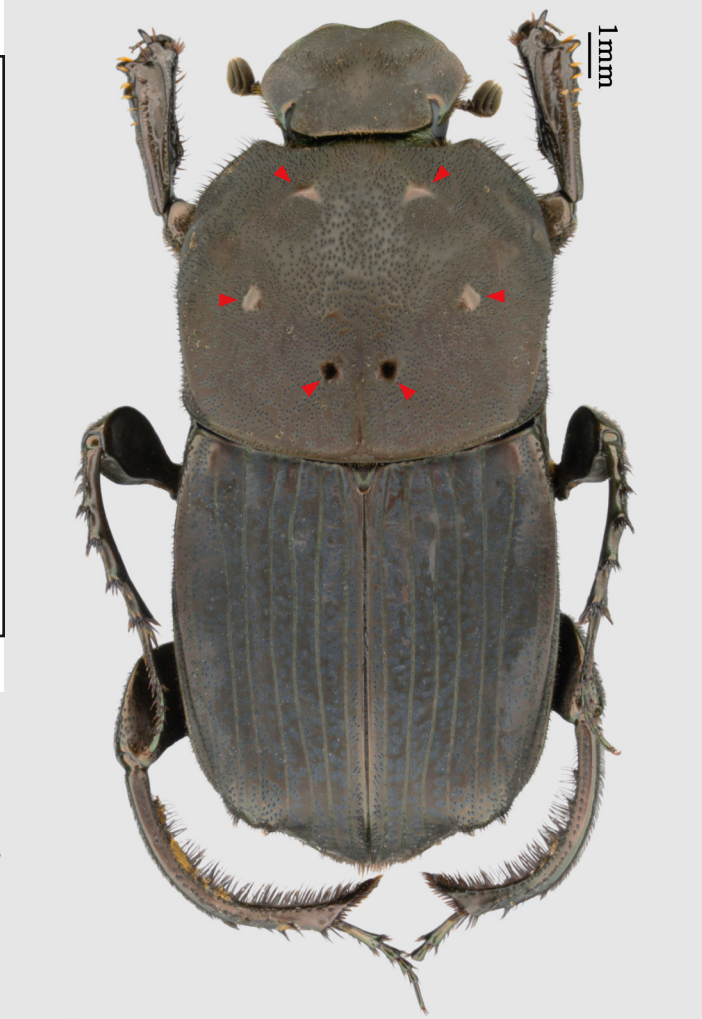
Identification notes

Eurysternus magnus overlaps with most other Eurysternus species in size as specimens can vary considerably. It is best recognised by the circle of six glossy spots on the pronotum. It is usually matt black and brown in colour, and often has mottled rust-coloured elytra.

Ecology

Eurysternus magnus is the most common CNP Eurysternus, and is a nocturnal teleocoprid. It has been found in both dung and carrion traps in CNP, usually at middle and low elevations.

See Genier 2009



Eurysternus mexicanus

Size 8.5-13.5mm **Colouration** Matt black and brown, see notes

Identification notes

So far, *Eurysternus mexicanus* is only known from a single specimen in CNP, originally misidentified as *E. foedus*. *E. mexicanus* overlaps with most other *Eurysternus* species in size, and is best recognised by the circle of around 11 slight spots on the pronotum, although these can be difficult to see as they may not always be especially prominent, especially in the posterior half of the pronotum. It is usually matt black in colour, but often has mottled rust-coloured elytra.

Ecology

Eurysternus mexicanus is a nocturnal teleocoprid, and has only been trapped with dung in CNP, though it has been found at both dung and carrion outside the park. It was found at lower elevations.

See Genier 2009

Eurysternus foedus

Size 13.0-19.0mm **Colouration** Brown with many olive-green areas

Identification notes

Eurysternus foedus overlaps with most other *Eurysternus* species in size, although this species is less variable than others. *E. foedus* is best recognised by its olive green colouration, though this can be difficult to make out without a well-lit, clean specimen. Compared with *E. obliteratus*, it has a more sculptured pronotum and the width of the anterior portion of the first abdominal segment is much greater. It is also the only *Eurysternus* species in CNP that usually lacks the foretarsi.

Ecology

Eurysternus foedus is a nocturnal teleocoprid, and has been trapped with dung and carrion in CNP. It is found at lower and middle elevations in the park.

See Genier 2009

Eurysternus obliteratus

Size 17.0-20.0mm **Colouration** Matt black and brown

Identification notes

So far, *Eurysternus obliteratus* is only known from a single specimen in CNP, originally misidentified as *E. foedus*. *E. obliteratus* overlaps with most other *Eurysternus* species in size, although it is less variable and larger on average than the other species. It is most easily recognised by its featureless pronotum and lack of green colouration, though this may be somewhat variable so use the key if there is any doubt.

Ecology

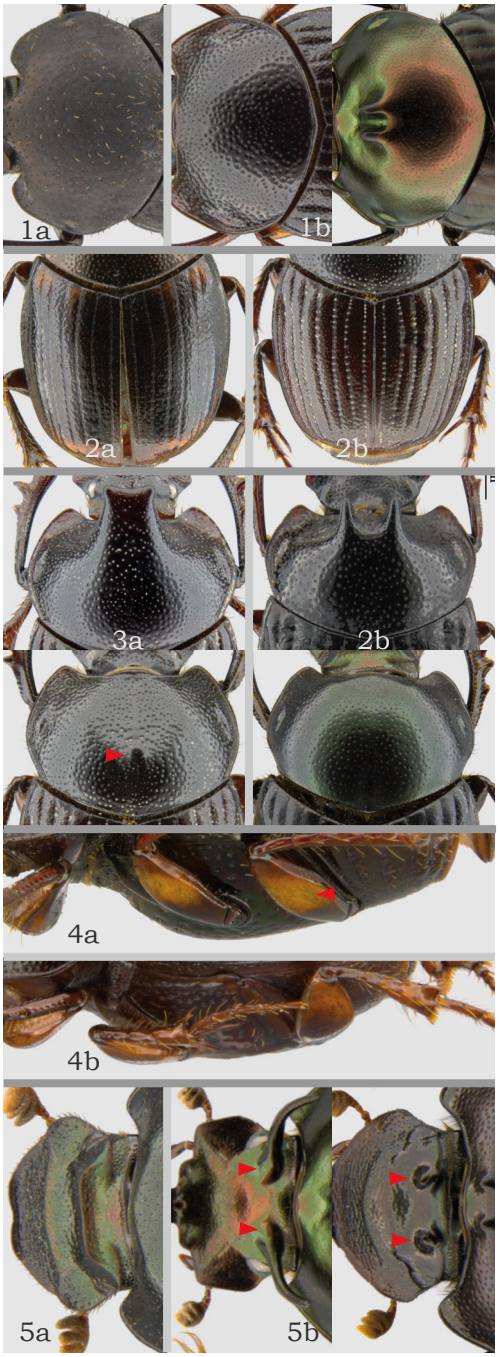
Eurysternus obliteratus is a nocturnal teleocoprid, and has only been trapped with dung in CNP, though it has been found at both dung and carrion outside the park. It was found at lower elevations.

See Genier 2009

Onthophagus

The Onthophagus genus is the largest in CNP, comprising nine species of medium to small dung beetles. These species have a fairly characteristic body shape that is easily recognised with practice, but they can also be recognised by the four teeth on their elongated foretibia. Usefully, each CNP species has at least one character that distinguishes it from the other members of its genus.

L-R: Onthophagus petenensis, O. sp.nov, O. anthacinus, O. longimanus, O. andersoni, O. rhinolophus, O. breviconus, O. cyanellus



1.

a. ♀ Dorsal surface with at least some scattered setae. Pronotum evenly convex, with no prominences or with large rounded protruberance extending over head. Matt black or dark brown colouration, no metallic hue .. *Onthophagus aff. anthracinus*

b. ♀ Dorsal surface with no setae. Possibly with pronotal prominences. Colouration not matt, possibly with metallic hue..... *2*

2.

a. Eltrya either same colour as pronotum but with mottled tan colouration basally and posteriorly, or elytra and pronotum different in colour ..... *Onthophagus nov.sp.*

b. Elytra same colour as pronotum, uniform in colour *3*

3.

a. Pronotum heavily punctuate with single anterior median horn or prominence, in males extending over head and bifurcate apically. If no horn or prominence, pronotal declivity with flat circular region and posterior tubercle. No blue colour cast ..... *Onthophagus breviconus*

b. Pronotum punctuate and either evenly convex or with paired horns or tumosities. Colour variable *4*

4.

a. Middle and hind femora bicoloured, with yellow patches ..... *Onthophagus petenensis*

b. Middle and hind femora not bicoloured, not differing greatly in colouration from ventral surfaces..... *5*

5.

a. Vertex without paired prominences. Anterior clypeal margin without strong medial indentation or distinct reflexed region *6*

b. Vertex with paired prominences. Anterior clypeal margin with medial indentation forming two acute teeth in females, or with distinct, reflexed medial region (often forming apically expanded horn) in males..... ..... *Onthophagus clypeatus group (page 44)*

6. *(See facing page)*

a. Anterior clypeal margin broadly rounded with broad shallow indentation in females, broad and straight forming 90° anteriolateral angle in males. Dorsal surface with blue-cyan hue. Body size 7.5-10.5mm..... *Onthophagus cyanellus*

b. Clypeus narrowed anteriorly, anterior margin with very slight median indentation forming two obtuse teeth. Dorsal surface with green hue. Body size 5.0-6.0mm ..... *Onthophagus longimanus*

Onthophagus cyanellus

Size 7.5-10.5mm **Colouration** Black with blue-cyan hue

Identification notes

Onthophagus cyanellus is fairly easy to identify due to its large size relative to most other CNP *Onthophagus* species, and its blue-cyan hue. Compared with the similar-sized *O. breviconus*, *O. cyanellus* lacks horns on the head or pronotum, does not have clypeal teeth, and has less distinct elytral striations.

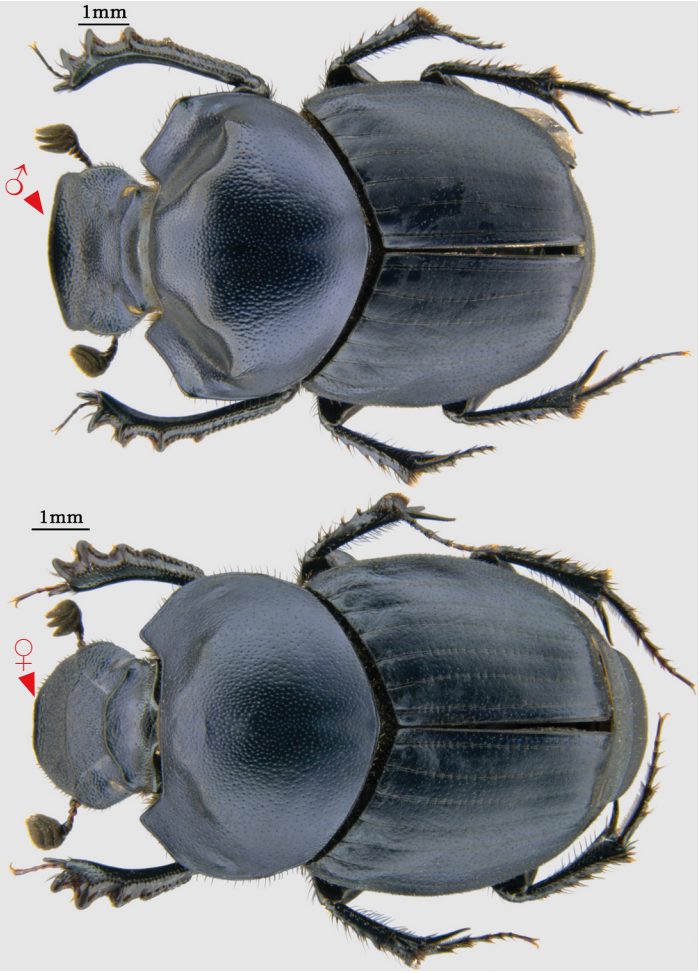
Sex differences

Females of *Onthophagus cyanellus* have a rounded clypeus with a shallow central indentation, while in males the anterior margin is almost straight. Males have a more developed pronotum than females, and may be somewhat darker in colour.

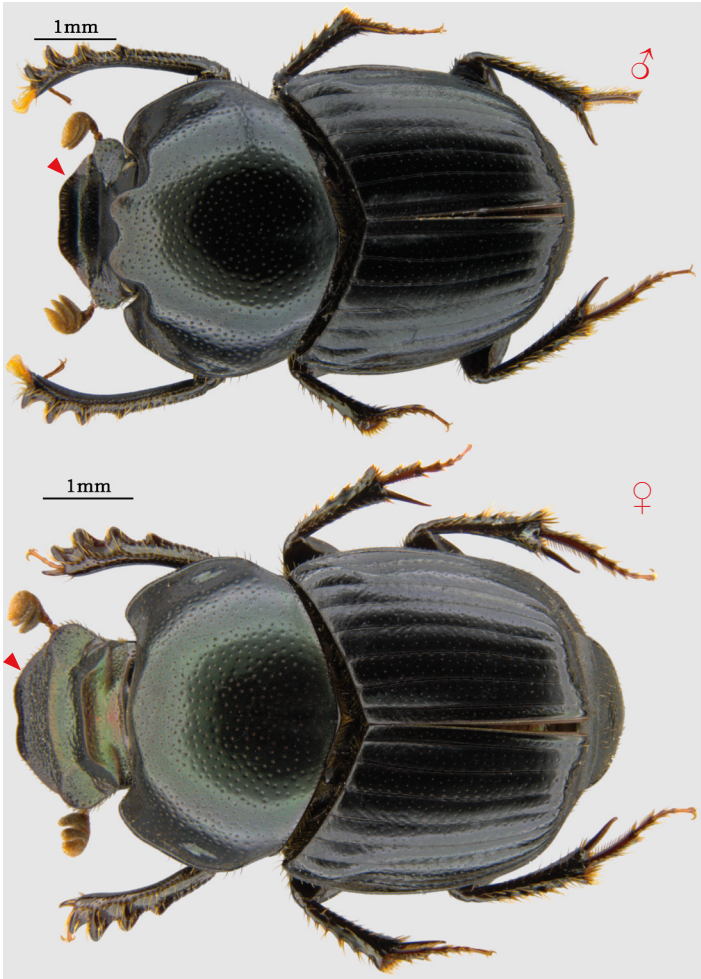
Ecology

Onthophagus cyanellus is probably nocturnal, and is a paracoprid. It has been found in carrion and dung traps in CNP, and occurs at middle elevations in the park.

See Howden & Young 1981



Right: arrows indicate sex differences



Onthophagus longimanus

Size 5.0-6.7mm **Colouration** Black with greenish hue

Identification notes

Onthophagus longimanus is similar in size to several other CNP *Onthophagus* species, and can sometimes be difficult to differentiate from these. *O. longimanus* is generally black with a greenish hue, although the amount of green varies substantially. The key provides definitive separation.

Sex differences

In males, the anterior clypeal margin is broad and sharply reflexed, which can usually be seen without a microscope, and the foretibia have a distinctive tuft of wavy setae at the apex; these characters are not seen in any other CNP *Onthophagus*. Females are more difficult to distinguish, the key should be followed if in doubt.

Ecology

Onthophagus longimanus is probably nocturnal, and is a paracoprid, and has only been found in dung traps in CNP, generally at lower elevations.

See (no available discription)

Left: arrows indicate reflexion of anterior clypeal margin

Onthophagus aff. anthracinus

Size 3.0-6.5mm **Colouration** Matt black

Identification notes

Onthophagus aff. anthracinus is most easily recognised by the setae present on its dorsal surface, which usually require a microscope to see. *O. aff. anthracinus* is similar in size to several other CNP *Onthophagus* species, but generally has a more matt colouration and no metallic hue, and is also very slightly furry to the touch.

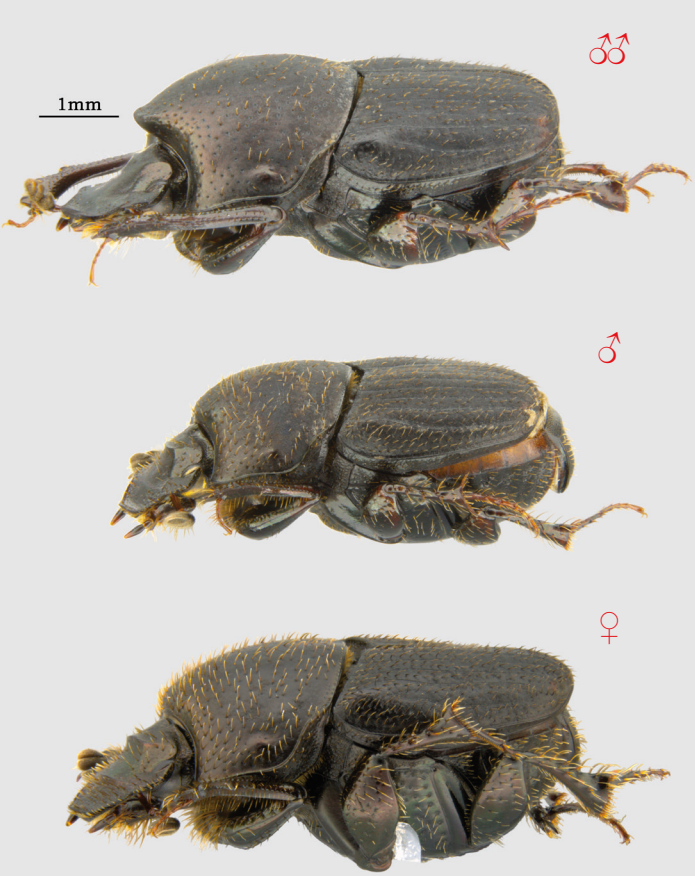
Sex differences

Males of *Onthophagus aff. anthracinus* are polymorphic: major males have the anterior portion of the clypeus bent upwards, a forward-extending prominence of the pronotum and tufts of setae at the apex of the foretibiae; minor males lack the tufts and the pronotal prominence, but has a transverse ridge between the eyes. Females have a smoothly convex pronotum and a slight transverse ridge in the centre of the head as well as between the eyes.

Ecology

Onthophagus aff. anthracinus is a nocturnal paracoprid, and has only been found on dung in CNP. It has been found sporadically throughout the park at a range of elevations.

See Kohlmann & Solis 2001



Onthophagus sp.nov

Size ~5.5mm **Colouration** Black with brown elytral patches

Identification notes

Onthophagus sp.nov has so far not been identified and is thought to be a new species known only from CNP. It is most easily recognised by the mottled colouration of the elytra, noticeable in most species as a tan-coloured stripe at the extreme end of the dorsal surface of the body. Occasionally, the elytra are completely tan-coloured, while the pronotum is always dark. No other *Onthophagus* species have a this colouration.

Sex differences

Males of *Onthophagus sp.nov* are polymorphic and major males have a single head horn that narrows slightly towards the apex - this is shared only by *O. breviconus*, but the latter is invariably larger in body size. Major males also have a very developed pronotum with paired prominences, while minor males have a less developed version. Females have no pronotal or head development, but have two clypeal teeth.

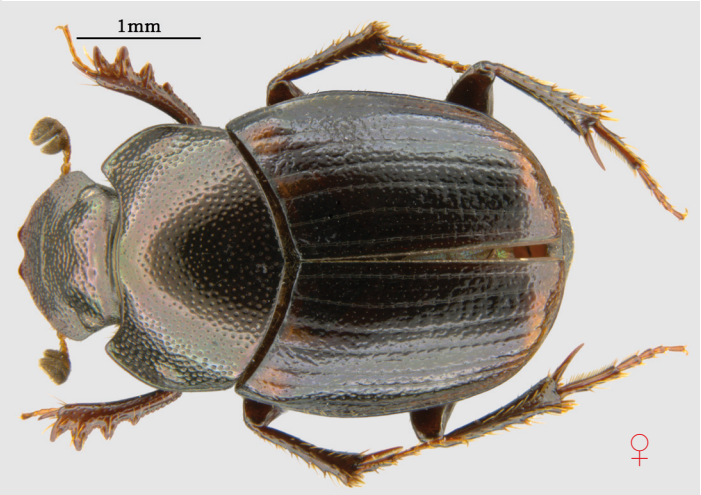
Ecology

Onthophagus sp.nov has been found at carrion, fruit and dung in CNP, though primarily the latter. It is generally found at higher elevations in the park, and is probably a paracoprid.

See (not yet described)

Arrows indicate characteristic elytral colouration.

Images not to scale



Onthophagus breviconus

Size 7.0-11.0mm **Colouration** Black

Identification notes

Onthophagus breviconus is the largest CNP *Onthophagus* and is fairly easy to identify from the distinctive pronotal horn in males and the flat circular area on the pronotum of females. It may be confused with *O. cyanellus*, but *O. breviconus* lacks a blue-cyan hue and has a head horn in males and prominent clypeal teeth in females. *O. breviconus* also has distinct elytral striae.

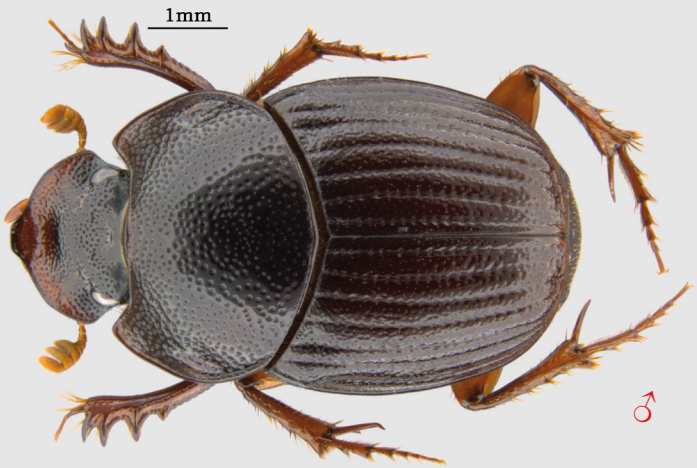
Sex differences

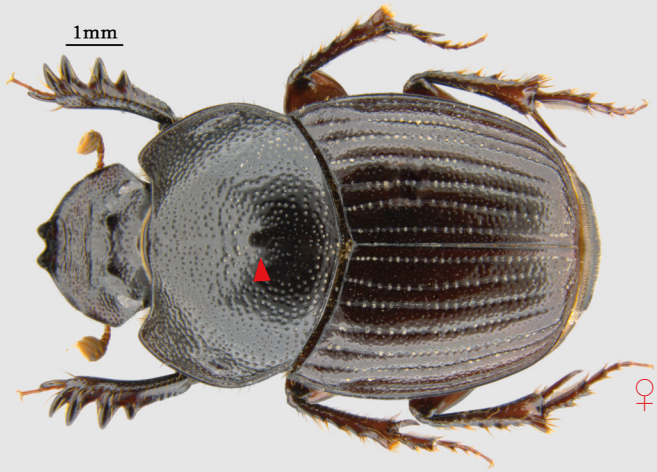
Major males of *O. breviconus* have a single central pronotal horn which splits into two at its end, whereas females have a convex pronotum with a flattened circular region. In males, a head horn arises from the anterior clypeal margin, while in females the margin forms two acute teeth. In minor males, the pronotum and head horns are less developed.

Ecology

Onthophagus breviconus is a nocturnal paracoprid. It has been found in dung and fruit traps, throughout the park.

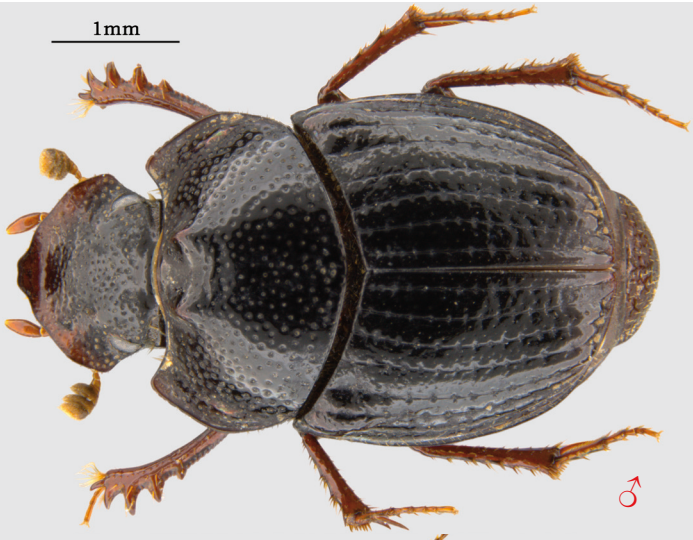
See Howden & Gill 1987





Arrow indicates small pronotal female pronotal tubercle posterior to flat circular area of pronotal declivity.

Images not to scale



Onthophagus petenensis

Size 5.0-6.3mm **Colouration** Glossy black, see notes

Identification notes

Onthophagus petenensis is similar in size to several other CNP *Onthophagus* species, and can sometimes be difficult to differentiate from these. *O. petenensis* has no dorsal setae and never has horns or swellings at the posterior of the head. The most distinctive character of this species is its bicoloured femora, with a clear yellow spot on the mid and hind limbs.

Sex differences

Major males have a head horn arising from the anterior clypeal margin and splits into a Y-shape. The two parts of the split are relatively small, and don't stretch backwards. Major males also have a developed pronotum, which in minor males is reduced along with the head horn. Females have a greenish metallic hue, and have a smoothly convex, punctate pronotum.

Ecology

Onthophagus petenensis is probably a nocurnal paracoprid. It has been trapped with dung and fruit, in sporadic locations throughout the park.

See Howden & Gill 1993

Arrows indicate characteristic horn shape in major males and characterist femoral colouration

Images not to scale.

Onthophagus clypeatus group

1. *These two species are easier to distinguish if the sex of the specimen is known:*

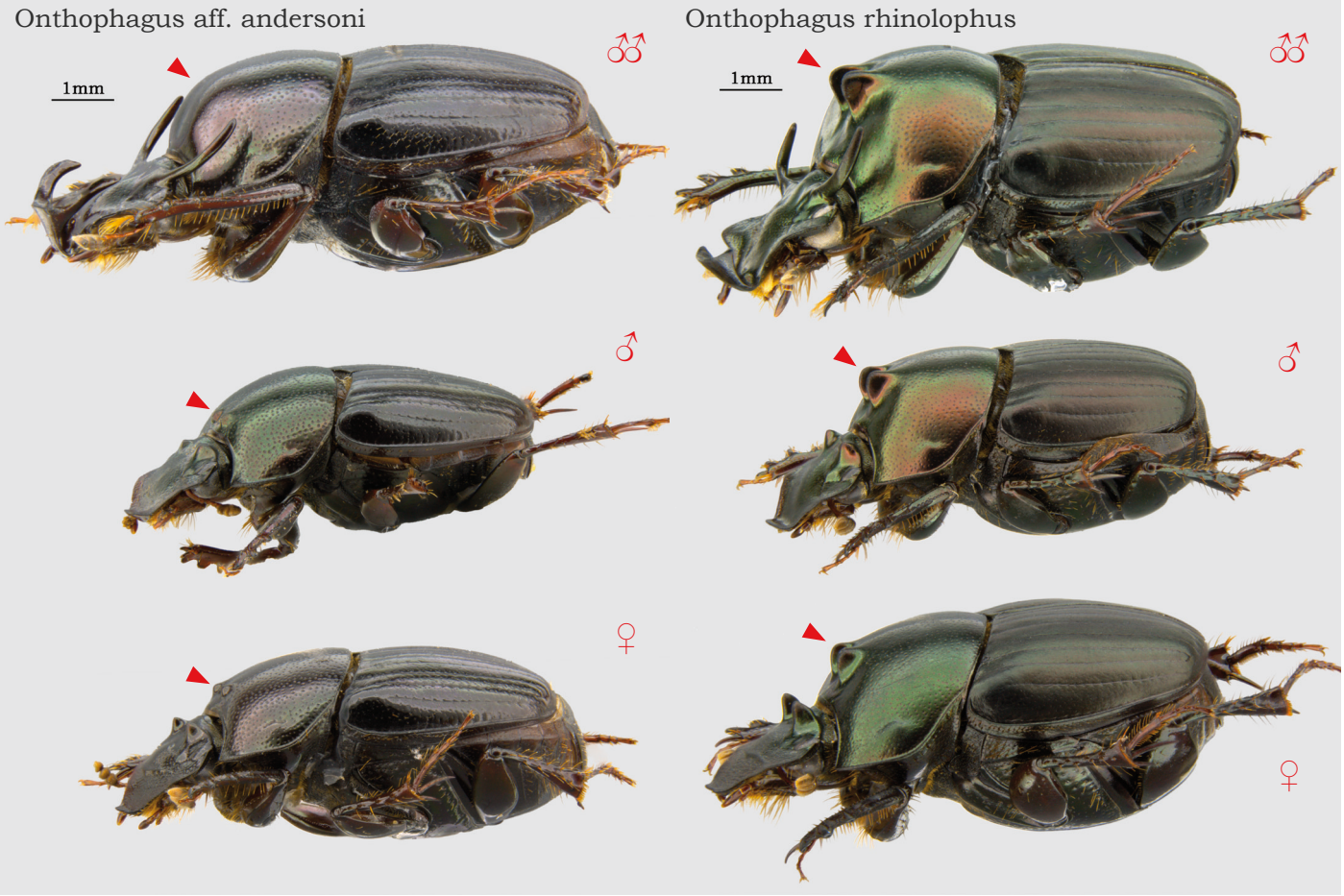
   a. Anterior clypeal margin forming single horn that may widen at apex (major males). Head without transverse carina. ♀ Apex of foretibia bearing tuft of elongate setae.....*2* (**male**)

   b. Anterior clypeal margin with medial indentation, forming two clear teeth. Head with transverse carina. ♀ Apex of foretibia without tuft of elongate setae .....*2* (**female**)

2.

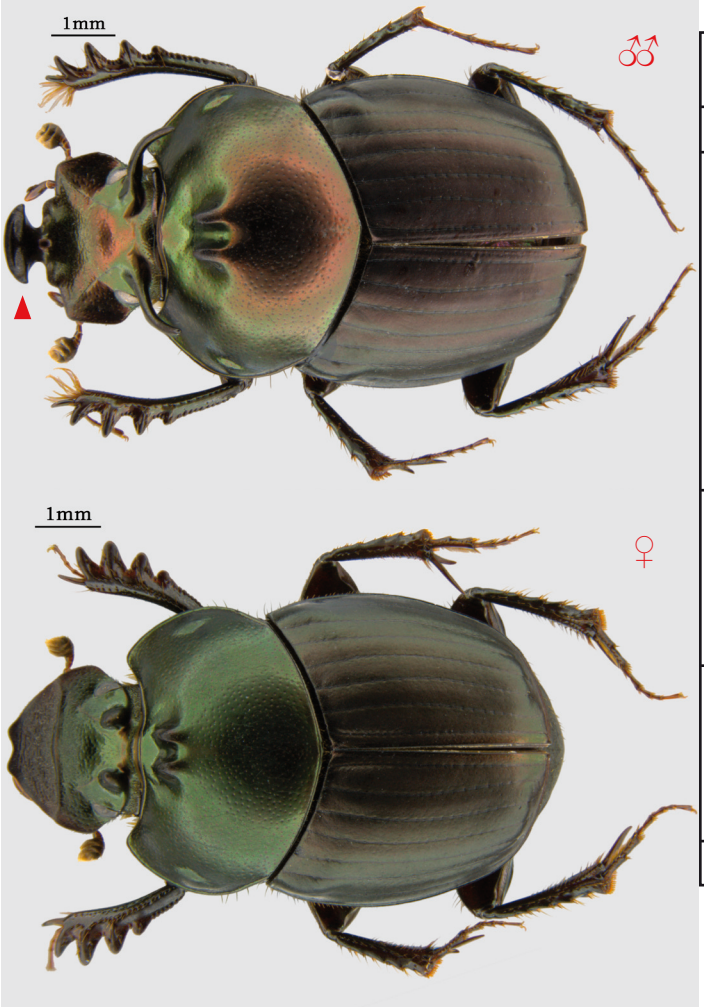
   a. In **males**, anterior clypeal horn not laterally extended and curved backwards following lateral margin of head. Pronotum with paired prominences extending anteriorly from the top of the dorsal surface of the pronotum. In **females**, teeth of anterior clypeal margin not reflexed. In **both sexes**, ♀ anterior portion of lateral margin of pronotum straight, leading to acute or near-acute anteriolateral angle of pronotum. Body usually with metallic green hue, but often matt black .....*Onthophagus rhinolophus*

   b. In **males**, anterior clypeal horn laterally extended and curved backwards following lateral margin of head (major males only). Pronotum without paired prominences (major males), or with two slight prominences arising upon the pronotal declivity. In **females**, teeth of anterior clypeal margin somewhat reflexed. In **both sexes**, ♀ anterior portion of lateral margin of pronotum curved, leading to rounded anteriolateral angle of pronotum. Body generally slightly glossy black ..... *Onthophagus aff. andersoni*



Above: arrows highlight position of protonal horns (or lack thereof)

Below: arrows indicate area of anteriolateral angle of pronotal margin for shape comparison



Onthophagus rhinolophus

Size 7-9mm **Colouration** Glossy green and/ or red reflections

Identification notes

Onthophagus rhinolophus is easily distinguished from most other *Onthophagus* species of its size by the two swellings or horns at the rear of the head. However, this character is shared by *Onthophagus aff. andersoni*, and the two species can often be difficult to tell apart. The key opposite is therefore very detailed, and should differentiate the two species definitively. In males, the presence of pronotal prominences is the easiest character.

Sex differences

Males and females of this species are quite different, the most obvious difference being that the anterior clypeal margin bears two teeth in females and a single horn in males.

Ecology

Onthophagus rhinolophus is a diurnal paracoprid and has been found in dung, carrion and fruit traps in CNP. It is usually found at lower elevations in the park.

See (no available description)

Left: Dorsal and lateral views of O. rhinolophus

Onthophagus aff. andersoni

Size ~7-9mm **Colouration** Glossy green and/ or red reflections

Identification notes

Onthophagus aff. andersoni is easily distinguished from most other *Onthophagus* species of its size by the two swellings or horns at the rear of the head. However, this character is shared by *Onthophagus rhinolophus*, and the two species can often be difficult to tell apart. The key opposite is therefore very detailed, and should differentiate the two species definitively. In males, the lack of pronotal prominences is the easiest character, but relies on accurate sexing of a specimen.

Sex differences

Males and females of this species are quite different, the most obvious difference being that the anterior clypeal margin bears two teeth in females and a single horn in males, and the pronotum has two prominences in females, but not in males.

Ecology

Onthophagus aff. andersoni is a diurnal paracoprid has been found in dung and carrion traps in CNP. It is generally found at lower elevations in the park.

See Howden & Gill 1987

Right: dorsal and lateral views of O. aff. andersoni

Uroxys

The *Uroxys* genus includes three species in CNP, all of which are less than 5mm in length. They can often look similar to members of the *Ateuchus* or *Canthidium* genera, but are always a relatively matt black in colour and quite rounded. Males also have distinctly angular lateral pronotal prominences, but all members of this genus can be distinguished with certainty by the lateral pronotal groove mentioned in the generic key.

1.

a. Dorsal ocular area approx. as long as wide. Interocular distance approx. two to three eye widths ..... *Uroxys aff. boneti*

b. Dorsal ocular area at least twice as long as wide. Interocular distance at least four eye widths .. *2*

2.

a. ♀ Basal sulcus of pygidium broad and strongly sinuate; medial section of sulcus truncate, lateral sections rounded ..... *Uroxys sp.DJM*

b. ♀ Basal sulcus of pygidium thin and sinuate; medial and lateral sections rounded .... *Uroxys aff. micros*

L-R: Uroxys aff. boneti, U. micros, U sp.DJM

Uroxys sp.DJM *(temporary name)*

Size ~4.8mm **Colouration** Black

Identification notes

Uroxys sp.DJM can usually be distinguished from *U. aff. boneti* by its slightly larger size (greater than 4mm), small dark eyes and less prominent clypeal teeth. However, *U. aff. micros* is generally very similar to *U. sp.DJM* with the naked eye. The shape of the groove in the pronotum, only visible under a microscope, is the clearest way to distinguish these two species. This character can sometimes be partially obscured by the apex of the elytra, but the difference should still be evident.

Sex differences

Females of *Uroxys sp.DJM* are almost identical to males. As in other species of *Uroxys*, males may have slightly more right-angled anterior lateral pronotal angles, but this is often difficult to see.

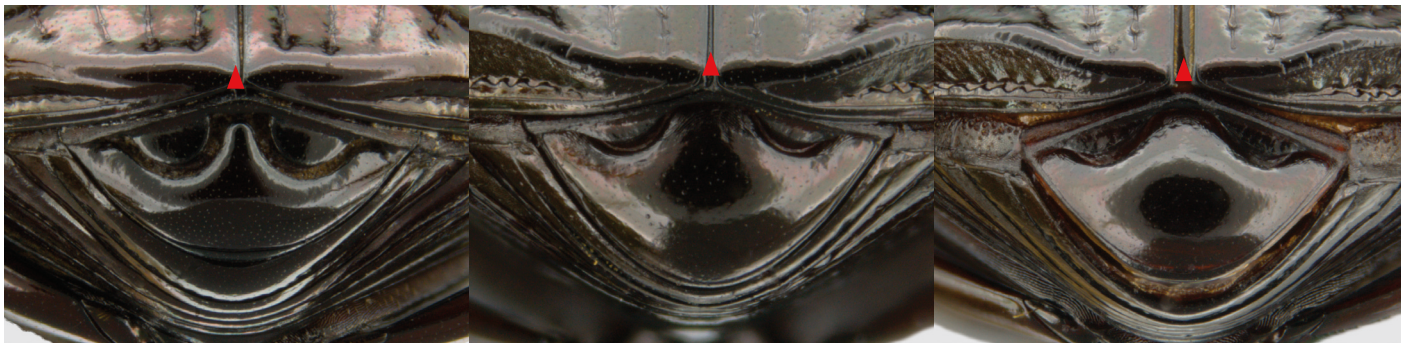
Ecology

Uroxys sp.DJM is a nocturnal paracoprid and has only been found on dung in CNP. It is generally found at lower elevations in the park.

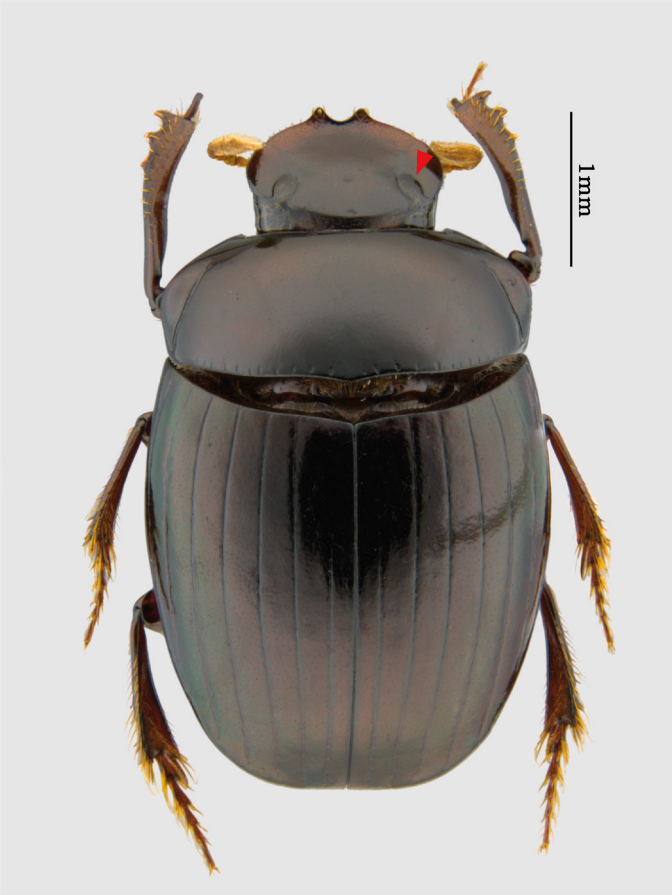
See N/A

Arrow highlights eye size difference

Dorsal image to scale with facing page



Comparison of the shape of the basal sulcus of the pygidium in Uroxys sp.DJM (left) and Uroxys aff. micros (centre and right). Arrows indicate varying centre section. Note how the apices of the elytra can obstruct the view of the extreme base of the pygidium.



Uroxys aff. micros

Size 4.0-4.5mm **Colouration** Black

Identification notes

Uroxys aff. micros can usually be distinguished from *U. aff. boneti* by its slightly larger size (greater than 4mm), small dark eyes and less prominent clypeal teeth. However, *U. aff. micros* is generally very similar to *U. sp.DJM* with the naked eye. The shape of the groove in the pronotum, only visible under a microscope, is the clearest way to distinguish these two species. This character can sometimes be partially obscured by the apex of the elytra, but the difference should still be evident.

Sex differences

Females of *Uroxys aff. micros* are almost identical to males. As in other species of *Uroxys*, males may have slightly more right-angled anterior lateral pronotal angles, but this is often difficult to see.

Ecology

Uroxys aff. micros is a nocturnal paracoprid, and has only been found on dung in CNP. It is usually found at lower elevations in the park.

See Howden & Young 1981

Arrow highlights eye size difference

Dorsal image to scale with facing page

Uroxys aff. boneti

Size ~3.3-3.7mm **Colouration** Black

Identification notes

Uroxys aff. boneti is generally smaller than the two other CNP *Uroxys*, less than 4mm, but otherwise the species in this genus are not easy to distinguish. Compared with *U. sp.DJM* or *U. aff. micros* with the naked eye, boneti has relatively long and narrow clypeal teeth that are more distinct relative to body size, although this often needs practice to distinguish consistently. *U. aff. boneti* also has relatively large and light-coloured eyes, compared with small and dark in the other two species.

Sex differences

Females of *Uroxys aff. boneti* are almost identical to males. As in other species of *Uroxys*, males may have slightly more right-angled anterior lateral pronotal angles, but this is often difficult to see.

Ecology

Uroxys aff. boneti is a nocturnal paracoprid, and has been found on dung and carrion in CNP. It is found at lower and middle elevations in the park.

See Howden & Young 1981 (*U. bidentis*, synonym)

Arrow highlights eye size difference

Glossary

Abdomen: the final insect tagma*

Acute: an angle that is sharp, less than 90°

aff.: shorthand for 'affiliated to', used when the name given to a species is unconfirmed, usually because the species is morphologically* very similar to the published species description (and not any other), but certain morphological* characters do not fit, within a reasonable margin of error.

Antennal club: a group of enlarged antennal segments at the apex* of the antenna

Anterior: toward the head*

Apex (apices), apical: the point, tip, often distal* end of a structure

Base, basal: the base, point of origin, often proximal* end of a structure

Bi-arcuate: having a pair of curves

Bicoloured: having two distinct colours

Bicuspid: having two cusps or small mounds, or appearing to be very slightly bifurcate*

Bifurcate: one structure that splits into two parts, often in a rough Y-shape, though occasionally in a more drastic T-shape

Bycatch: any species collected in a sample which are not members of the taxa of interest

Canthus: the section of the lateral* margin* of the head* that protrudes over the eye

Carina: a ridge

Clypeus: the first dorsal sclerite* of the head*

Concave: curving inward

Convex: curving outward

Coxa: the first/basal* section of the insect limb, often recessed into the sclerite* from which it arises

Crepuscular: active at dawn and/or dusk

Cupreous reddish-brown in colour, like polished copper

Declivity: a downward slope or bend. The pronotal* declivity is the curving slope down from the highest point of the pronotum to the anterior* margin*

Diel activity: the time of day that a species is active

Distal: situated away from the centre or point of origin

Diurnal: active in daylight

Dorsal: the back or upper surface

Ecozone: large-scale biogeographic classification of the Earth's land surface based on distribution patterns of terrestrial plants and animals

Elytra: the hardened forewings of beetles, held closed over the abdomen*. In dorsal* view, the large posterior* area

Endocoprid: 'dwellers', dung beetle species where the beetles and their larvae live freely within dung or females construct a nest for their offspring inside dung.

Femur: the third section of the insect limb

Fore (body part): the most anterior* (body part or parts)

Fovea: a slight depression or pit

Head: the first insect tagma*

Hind (body part): the most posterior* (body part or parts)

Hirsute: hairy

Humerus: the exterior basal* angle of the elytra*. 'The top corners of the shield of the elytra*'

Interstria(e): the area(s) of the elytra* in between striations*

Lamellate: multiple flattened segments that appear to be able to stack

Lateral: the side(s)

Margin: edge

Median: situated in the middle or centre

Metasternum: the ventral* sclerite* of the metathorax*. Enlarged to form the large plate between the second and third pair of legs

Mid (body part): the centrally located (body part or parts)

Morphology: the form, structure and configuration of an organism

Morphospecies: a group of individuals thought to be the same species based on morphological* characteristics, but not yet formally identified as one specific species

Nearctic: the ecozone* encompassing most of North America

Neotropic: the ecozone* encompassing most of Mesoamerica, South America and the Caribbean

Nocturnal: active in darkness

Ocular: of or relating to the eye (often, but not always, the area of the eye that is visible dorsally*)

Palearctic: the ecozone* encompassing most of Eurasia and North Africa

Paracoprid: 'tunellers', dung beetle species that dig burrows and nest chambers beneath dung (or other resource) and bringing food down from above.

Posterior: toward the back end

Pro-, Meso-, Meta- thorax: The first, second and third segments of the thorax*

Prominence: a structure that extends from its surroundings, often in such a way that the prominent structure is clearly delimited. E.g. a horn or tooth

Pronotum: the dorsal sclerite* of the prothorax*. Enlarged in beetles to form the dorsal area between the head and the elytra

Protuberance: a structure that bulges out from its surroundings, usually having no definite delimitation. E.g. a bump or mound

Proximal: situated close to the centre or point of origin

Punctate: having punctures, i.e. rounded shallow indentations.

Pygidium: the final segment of the abdomen*

Reflexed: sharply bent at a single point or along a single line, forming clear angle

Rugose: having wrinkles, creases or ridges

Sclerites: the hardened plates of a segment

Sculptured: having a clear pattern of relief, i.e. not totally smooth, but not necessarily with any prominences* or protruberances*

Scutellum: the posterior portion of either the mesonotum* or metanotum*, which is visible dorsally as a small triangular plate between the base of the elytra*

Setae: stiff hairs or bristles

Sinuate: curved or wavy

sp.: shorthand for a single species, used in binomials when the specific name is unknown. Often used with a unique suffix to avoid confusion with other unknown species of the same genus

sp.nov: shorthand for "species nova" used as a suffix after or in place of a species name when the species is new to science and undescribed

spp. agg.: a term used in place of a species name in a binomial used to encompass any and all members of a particular genus

spp.: shorthand for multiple species

Sternites: the ventral sclerites of the abdominal* segments

Stria(e)/striation(s): one or many of the (roughly) parallel grooves on the elytra*

Sulcus: a groove

Tagmata: the body sections of an insect, formed of multiple segments

Tarsus: where present, the last section of the insect leg, arising from the tibia* and having up to five segments, the last sometimes ending in claws

Teleocoprid: 'rollers', dung beetle species that form balls of dung (or other resource) that they roll away from the source and later bury.

Teneral: the condition of recently-moulted individuals, where, in beetles, the exoskeleton is often a dark red in colour

Thorax: the middle insect tagma*

Tibia: the fourth section of the insect limb, and the most visible dorsally*. Often developed in *Scarabaeinae*, having ridges or teeth, flattened, elongated or curved.

Tibial spur: the single, pointed, unsegmented process arising from the distal* end of the tibia*

Transverse: going across

Trochanter: the second section of the insect limb, usually forming a small triangle at the base of the femur*

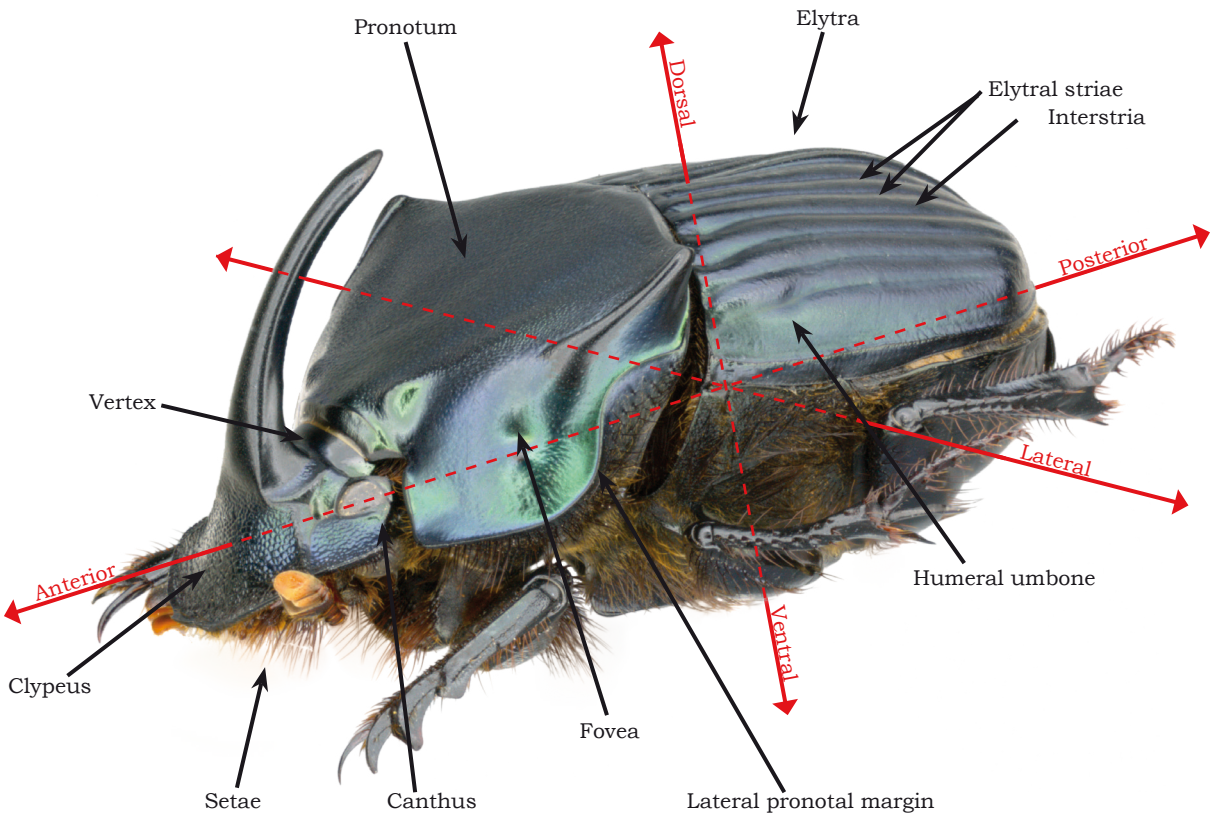
Truncated: cut off or cut short, leaving a squared-off end

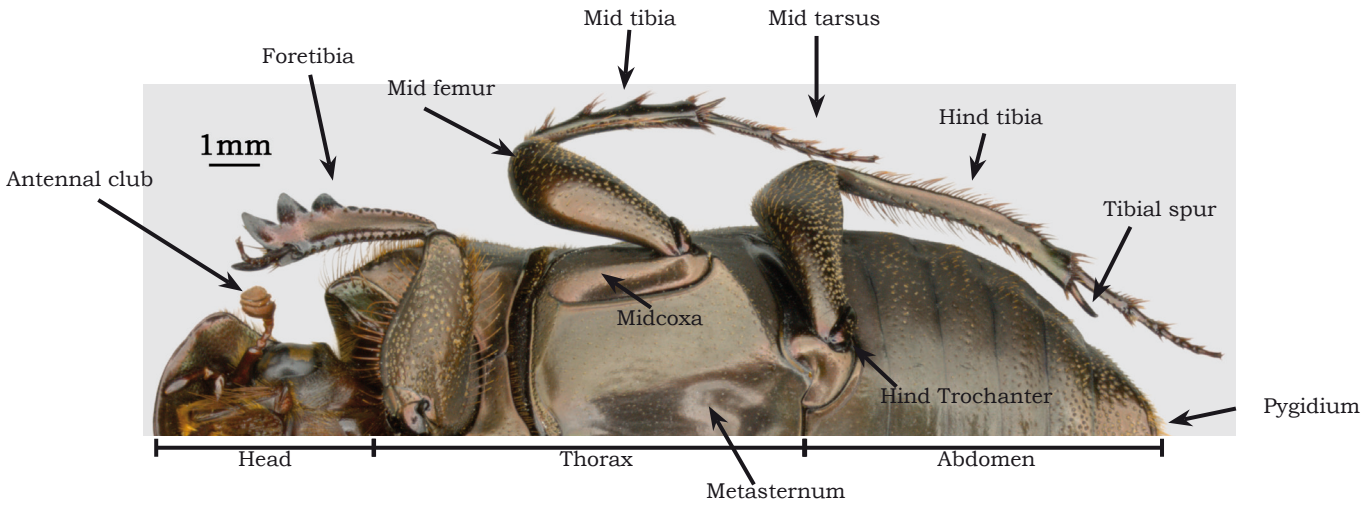
Tubercle: a small rounded prominence* or protruberance *

Umbone: the sometimes prominent* and convex* region of the elytra* near the humerus*

Ventral: the underside

Vertex: the posterior* area of the head*, generally behind the eyes


Pronotum
Elytra
Dorsal
Elytral striae
Interstria
Posterior
Vertex
Lateral
Anterior
Humeral umbone
Ventral
Clypeus
Fovea
Setae
Canthus
Lateral pronotal margin


Mid tibia
Mid tarsus
Foretibia
Mid femur
Hind tibia
1mm
Antennal club
Tibial spur
Midcoxa
Hind Trochanter
Pygidium
Head
Thorax
Abdomen
Metasternum

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