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Systematics and biology of the Ichnestomina, including new genera and species (Coleoptera: Scarabaeidae, Cetoniinae)

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Abstract
The subtribe Ichnestomina, endemic to southern Africa, exhibits a suite of plesiomorphic features that reflects a particularly old evolutionary age among the Goliathini. Sexual dimorphism is extreme and females are generally brachypterous and unable to fly. Also, adult stages do not feed, and therefore remain active for only a few days after emerging from the soil, devoting all their energy reserves to reproduction. Consequently, populations are range-bound to small areas, often completely isolated on high mountain peaks or ridges, leading to rapid speciation. Results of recent investigations and historical data are hereby combined to provide an updated and revised structure of the systematics of this subtribe. As a result, four genera are now recognised in place of the perceived uniformity earlier expressed with much reservation by Holm (1992). This involves the rehabilitation of the original name of *Gariep* Gory & Percheron, 1833, to accommodate species with fully winged and flying females as well as elongate and incision-free dorsal lobes of parameres (*Gariep patera* and *G. perstriata*). It is further proposed that the genus *Ichnestoma* Gory & Percheron, 1833 be restricted to species with moderate female brachyptery and males with cretaceous markings on their body surface. Consequently, two new genera are erected (*Karooida* gen. nov., *Mzansica* gen. nov.) and four species-complexes (*Ichnestoma cuspidata, I. albomaculata, Mzansica nasula* and *M. luridipennis*), are added in order to account for key differences among species, including degree of female brachyptery (wing:elytron length ratio), presence/absence of cretaceous markings, aedeagal structure and biogeographic distribution. Eleven new species (*Ichnestoma carbonaria* sp. nov., *I. dealbata* sp. nov., *I. furcata* sp. nov., *I. karoominoris* sp. nov., *I. spatulata* sp. nov., *Karooida balli* sp. nov., *K. sagittata* sp. nov., *Mzansica botswanica* sp. nov., *M. clarki* sp. nov., *M. denticulata* sp. nov., *M. falcipata* sp. nov.) are added to the 13 species and three subspecies currently recognised in this subtribe. The three subspecies are elevated to species status (*Ichnestoma cochleata* stat. nov., *I. fuscipennis* stat. nov., *Karooida kikvorsti* comb. et stat. nov.). The diagnostic characters of each taxon are described along with all available knowledge on the habitat characteristics and general biology of each species.

Key words: Goliathini, new genera, resurrected genus, new species, revised status, South Africa.

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Introduction

Among the Afrotropical Cetoniinae, members of the Ichnostomina (sensu Krikken 1984) are extraordinary and unique in their morphology and biology. Species exhibit extreme sexual dimorphism, as their females have very reduced and undifferentiated traits, with most being brachypterous and, consequently, unable to become airborne (Holm 1992; Perissinotto et al. 1999). Neither sex is capable of feeding at the adult stage and the energy reserves accumulated during larval growth are entirely used to reproduce. This means a very short life span as adults, since their reserves cannot be renewed through feeding on nutritious sources like most Cetoniinae do (Perissinotto et al. 1999).

Although their phylogenetic relationships with the other Cetoniinae of the region are still poorly known and in need of more thorough investigations, it is clear that they belong to a clade positioned very closely to the most basal taxa (Holm 1992; Holm & Marais 1992; Sakai & Nagai 1998; Perissinotto & Šípek 2019). Their most primitive traits include approximated mesocoxae, narrow and undifferentiated mesosternal process, wide scutellum and dull colours as well as shallow submumeral elytral emargination (Krikken 1984; Holm 1992; Holm & Marais 1992). Species of the subtribe have also been regarded as relics, generally living in arid to semi-arid environments or in leached soils at high altitudes (Perissinotto et al. 1999; Holm & Perissinotto 2004). Most populations occur isolated on high mountain peaks or ridges and their separation from the ancentral common lineage appears to be old enough to have progressed to speciation in most cases (Holm & Perissinotto 2004). For this reason, many of them can also be regarded as typical microendemics.

Although all the species are currently included in one single genus, *Ichnestoma* Gory & Percheron, 1833, Holm (1992) had already recognised that its old evolutionary age probably warranted a redefinition into separate species clusters. In particular, both *I. perstriata* and *I. patera*

were singled out as suffiently distinct to justify the possibility of eventually erecting different taxonomic groupings. This was further supported in Holm & Perissinotto (2004), where the female characteristics of the two species were either freshly discovered or refined using novel material. The key findings revealed that females of both species are actually fully winged and capable flyers; they also exhibit deeply costate elytra like their male counterparts. This, along with results of morphometric studies carried out more recently, has highlighted a gradient in reduction of wing size and flight ability in the females, together with a reduction of elytral costae across this taxon. This gradient appears to range from the most plesiomorphic *I. perstriata* to the more apomorphic species, leading to the conclusion that female brachyptery is a secondarily derived trait within the broader grouping, as expected (Holm & Perissinotto 2004). Furthermore, preliminary DNA analyses conducted on seven Ichnestomina taxa from the Eastern Cape Province, South Africa, have revealed a genetic distance between them oscillating between 11 and 18 % (D. Vondráček & P. Šípek, pers. comm.), thereby supporting the need of erecting some supraspecific groupings.

The following is a summary of the taxonomic structure generally recognised for the subtribe according to the current taxonomic arrangement, with all species included in one single genus.

Genus: *Ichnestoma* Gory & Percheron, 1833
Ichnestoma albomaculata albomaculata Gory & Percheron, 1833
Ichnestoma albomaculata fuscipennis Holm, 1992
Ichnestoma coetzeri (Allard, 1986)
Ichnestoma cuspidata (Fabricius, 1787)
Ichnestoma cuspidata cochleata Holm & Perissinotto, 2011
Ichnestoma ficqi Stobbia, 1995
Ichnestoma krikkeni Holm, 1992
Ichnestoma luridipennis (Burmeister, 1842)
Ichnestoma nasula (Schaum, 1848)
Ichnestoma patera (Gory & Percheron, 1833)
Ichnestoma perstriata Holm, 1992
Ichnestoma pringlei Perissinotto, Smith & Stobbia, 1999
Ichnestoma rostrata Janson, 1878
Ichnestoma stobbiai Holm, 1992
Ichnestoma struempheri Holm & Perissinotto, 2004
Ichnestoma struempheri kikvorsti Holm & Perissinotto, 2011

Note. Current taxonomic status: 13 species and three subspecies. *Ichnestoma picta* (Péringuey) was erroneously included in the work of Beinhundner (2017). As already reported by Holm (1992), this species was first described as *Haematonotus pictus* by Péringuey (1885: 96) and later synonymized with *H. turbidus* by the same author (Péringuey 1907: 337).

The new proposed structure below includes the resurrection of the genus *Gariep* Péringuey, 1907, the erection of two new genera and four species-complexes, as well as the description of 11 new species and the elevation of the three subspecies to full species level.

Genus: *Gariep* Péringuey, 1907
Included species:
Gariep patera (Gory & Percheron, 1833)
Gariep perstriata (Holm, 1992) comb. nov.

Genus: *Ichnestoma* Gory & Percheron, 1833
Included species and species-complexes:
Species-complex: *cuspidata*
Ichnestoma carbonaria sp. nov.
Ichnestoma coetzeri (Allard, 1986)
Ichnestoma cuspidata (Fabricius, 1787)
Ichnestoma dealbata sp. nov.
Ichnestoma karoominoris sp. nov.
Ichnestoma rostrata Janson, 1878
Species-complex: *albomaculata*
Ichnestoma albomaculata Gory & Percheron, 1833
Ichnestoma cochleata Holm & Perissinotto, 2011 stat. nov.
Ichnestoma furcata sp. nov.
Ichnestoma fuscipennis Holm, 1992 stat. nov.
Ichnestoma spatulata sp. nov.

Genus: *Karooida* gen. nov.
Included species:
Karooida balli gen. et sp. nov.
Karooida kikvorsti (Holm & Perissinotto, 2011) comb. et stat. nov.
Karooida krikkeni (Holm, 1992) comb. nov.
Karooida pringlei (Perissinotto, Smith & Stobbia, 1999) comb. nov.
Karooida sagittata gen. et. sp. nov.
Karooida struempheri (Holm & Perissinotto, 2004) comb. nov.

Genus: *Mzansica* gen. nov.
Included species and species-complexes:
Species-complex: *nasula*
Mzansica botswanica gen. et sp. nov.
Mzansica ficqi (Stobbia, 1995) comb. nov.
Mzansica nasula (Schaum, 1848) comb. nov.
Mzansica stobbiai (Holm, 1992) comb. nov.
Species-complex: *luridipennis*
Mzansica clarki gen. et sp. nov.
Mzansica denticulata gen. et sp. nov.
Mzansica falcipata gen. et sp. nov.
Mzansica luridipennis (Burmeister, 1842) comb. nov.

Material & Methods

Specimens and observations for this study were obtained mainly through field and laboratory work undertaken during the period 1995–2018, or from museum and histori-

cal collections (as per list provided below). Fresh specimens were either caught in flight using standard nets after rainfall events, collected dead on the ground, or retrieved drowned from a variety of water bodies, including farm dams, troughs and rain pools. Occasionally, mature adults ready to emerge were excavated from underground still in their cocoons, or obtained after rearing third instar larvae collected in the wild under laboratory controlled-conditions. In the latter case, larvae were kept in plastic containers of 1–5 L capacity, containing the natural soil and detrital material found in situ. Water was sprayed at the soil surface at regular intervals of about 1–2 weeks until pupation.

The holotype specimen of "*Ichnestoma luridipennis*" (Burmeister, 1842) (♂ "*luridipenis*, *, P. nat. Dry.") was studied in detail through high-resolution photographs kindly provided by Karla Schneider (MLUH). Similarly, detailed photos of a number of specimens with unknown or controvertial identification were obtained from collection curators, when direct access to the specimen could not be arranged due to logistical reasons. Complementary information on distribution, period of adult activity and other biological data for some species were also obtained from the following literature sources: Péringuey (1907), Holm (1992), Holm & Marais (1992), Holm & Stobbia (1995), Sakai & Nagai (1998), Perissinotto et al. (1999), Holm & Perissinotto (2004), Kryger & Scholtz (2008), Deschodt et al. (2009), Holm & Perissinotto (2011), Malec & Šípek (2017) and Beinhundner (2017). Research-grade observation records were also downloaded from the citizen science platform iNaturalist (http://www.inaturalist.org/), by courtesy of Riaan Stals (SANC).

The key geographic abbreviations used within the text are as follows: BOT = Botswana; LES = Lesotho; NAM = Namibia; RSA = South Africa; WC = Western Cape Province (RSA); NC = Northern Cape Province (RSA); EC = Eastern Cape Province (RSA); LP = Limpopo Province (RSA); GP = Gauteng Province (RSA); KZN = KwaZulu-Natal Province (RSA); FS = Free State Province (RSA); NW = North-West Province (RSA).

The terminology used in the description of morphological characters follows in particular Krikken (1984) and Holm & Marais (1992). Specimen total length (TL) and maximum width (MW) were measured using a Vernier calliper, from the anterior margin of the clypeus to the apex of the pygidium and at the widest point of the elytra, respectively. Wing to elytron length ratios (W:E) were measured in females from tip to point of body attachment, in order to establish an objective rating of brachyptery. Due to the potential destructive impact of extracting wings in rare and often unique type material, ratios were generally based on single measurements. However, where several females were available for a species, at least three extractions were used and these consistently showed a remarkable stability in the ratio, despite the variability in the organs length.

Photos of specimen dorsal, ventral and lateral views were taken with a Nikon CoolPix S9700 digital camera with macro setting, while higher-resolution photos of specimen's clypeus, pygidium and male genitalia were obtained using a Nikon DigitalSight DS–Fi2 camera attached to a Nikon SMZ25 dissecting microscope. The background, pin-holes and other disturbances were removed from the photos using Microsoft Word 2010 (Picture Tools), in order to increase clarity and resolution of the images. The Combine ZP Image Stacking Software by Alan Hadley (alan@micropics.org.uk) was used to obtain z-stacked composite images.

In this work, all the species currently known within the subtribe are comprehensively illustrated with photos of both female and male, highlighting their key diagnostic chatacters, as these were generally only partially reported in previous publications. However, only newly recognised species are described in full, while summary remarks are provided for the taxa that were already adequately described or redescribed in previous publications. Examples of habitat landscape are reported for each species, while distribution maps are presented only for those species that occur at least in two separate localities, while for microendemic species the single locality is only described within the text.

Public and private specimen repositories are abbreviated as follows:

BMNH Natural History Museum, London, United Kingdom

BMPC Jonathan Ball and Andre Marais Private Collection, Cape Town, South Africa

CEMT Instituto de Biociências, Federal University of Mato Grosso, Brazil

DEIC Taxonomie der Insekten, Institutes für Pflanzenschutzforschung, Eberswalde, Germany

DMPC Daniel Moore Private Collection, Oro Valley, USA

DMSA Durban Natural Science Museum, Durban, South Africa

EPPC Ernest Pringle Private Collection, Bedford, South Africa

GBPC Gerhard Beinhundner Private Collection, Euerbach, Germany

HMPC Heinz Mitter Private Collection, Ansfelden, Austria

HMUG Hunterian Museum , Glasgow University, United Kingdom

ISAM Iziko South African Museum, Cape Town, South Africa

MDPC Michele De Palma Private Collection, Lausanne, Switzerland

MLUH Martin Luther Universität Zoologische Sammlung, Halle, Germany

MHNG Muséum d'Histoire Naturelle, Genève, Switzerland

NBCN Naturalis Biodiversity Center, Leiden, The Netherlands

NMCR Národní Museum, Prague, Czech Republic
PMPC Petr Malec Private Collection, Brno, Czech Republic
RBIN Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium
SANC South African National Collection of Insects, Pretoria, South Africa
SNMC Statens Naturhistoriske Museum, Københavns Universitet, Copenhagen, Denmark
TGPC Thierry Garnier Private Collection, Montpellier, France
TMSA Ditsong National Museum of Natural History, Pretoria, South Africa
UKCR Univerzita Karlova, Katedra Zoologie, Prague, Czech Republic
UPSA University of Pretoria, Department of Zoology & Entomology, South Africa
UZIU Universitets Zoologiska lnstitut, Uppsala, Sweden
ZMHB Museum für Naturkunde der Humboldt Universität, Berlin, Germany

Taxonomy

Although all species within this subtribe share the same key symplesiomorphies, recent work has revealed that there are consistent characters within different groups of species that warrant the subdivison of the single genus recognised by Holm (1992) and subsequent authors into at least four different genera. The following classification scheme is therefore used, in order to account for the differential degree of female wing development, male elytral ornamentation and aedeagal shape as well as habitat association of the different clusters.

Key to genera

1. Elytra with markedly raised costae; female fully winged and capable of flying; aedeagal parameres with dorsal lobes without longitudinal incavations; pygidium with rugose or round macrosculpture in both sexes; distribution range restricted to Gariep Desert and Nama-Karoo regions .... *Gariep* Péringuey, 1907
- Elytra with costae absent or depressed; female with various degrees of brachyptery; aedeagal parameres with dorsal lobes exhibiting deep longitudinal incavations of various shapes; pygidial sculpture ultrafine and smooth in male, but variable in female; distribution range across whole South Africa and southern Botswana 2
2. Elytra generally black or dark-brown; white cretaceous markings present in all species, but often reduced and even absent in few individuals; female wings substantially reduced, with W:E length ratio ≥ 0.80 (except *I. rostrata*); parameres with longitudinal incavation on dorsal lobes bean-shaped; pygidium with only ultrafine sculpture in male, but often with scattered round punctures in female; distribution range broad, from escarpment to coastal plain across Karoo region ..... *Ichnestoma* Gory & Percheron, 1833
- Elytra fuscous-brown; cretaceous markings absent; female wings drastically reduced, with W:E length ratio in range 0.70-0.80; parameres with longitudinal incavation on dorsal lobes short and round, with smooth external margin; pygidial sculpture ultrafine and smooth in both sexes; inhabitants of mountain slopes on Great Karoo plateau .... *Karooida* gen. nov.
- Elytra testaceous to brick-red; cretaceous markings absent; female wings extremely reduced, with W:E length ratio < 0.70; parameres with longitudinal incavation on dorsal lobes oblong, sausage-shaped; pygidial surface ultrafine and smooth in male, but rugose with variable shallow sculpture in female; inhabitants of high mountain slopes above Great Escarpment across southern Africa ... *Mzansica* gen. nov.

Genus *Gariep* Péringuey, 1907

Gariep Péringuey, 1907: 379; Schenkling 1921: 80; Krikken 1984: 53; Holm 1992: 368 (= *Ichnestoma*); Sakai & Nagai 1998: 206.

Type species. *Cetonia patera* Gory & Percheron, 1833 (by monotopy).

Remarks. Holm (1992) had already recognised the special status of *G. patera* in the context of *Ichnestoma* typical characters, and in particular by its low level of apomorphy. It has since been confirmed that females of this species are indeed fully winged and capable of flying (Holm & Perissinotto 2004). This combined, with the markedly elevated elytral costae and the exceptionally developed and arcuate antennal clubs, makes its taxonomic position within the genus *Ichnestoma* untenable. It is hereby proposed that the genus *Gariep* Péringuey, 1907 be rehabilitated to accommodate the special features of *G. patera* and those of the closely related *G. perstriata*. Both species share basic characters of diagnostic importance that allow their easy separation from both *Ichnestoma* and the other two genera described below such as: 1) fully winged females; 2) highly elevated elytral costae; and 3) aedeagal parameres with dorsal lobes lacking the typically deep, longitudinal incavations found in all the *Ichnestoma, Karooida* and *Mzansica* species.

According to label data accompanying the paratype specimen of *G. perstriata* (see Holm 1992), Krikken had tentatively allocated this species to a yet undescribed genus "*Ichnestomidia*". While this proposal may have some merits, analysis of the more comprehensive series of specimens now available point in the direction of a close similarity between this species and *G. patera,* notwithstanding their significant differences, particularly at the level of clypeal armour shape, antennal club size, number of elevated elytral costae and presence/absence of cretaceous markings on the body surface. These, however, may be due to adaptive divergence related to the physical nature of their respective habitats. Although the two species share similarly dry habitats, in the Gariep Desert (*G. perstriata*) and the Nama-Karoo biomes (*G. patera*) (Mucina & Rutherford 2011), the former environment is substantially drier and hotter than the latter and therefore imposes special physiological and morphological adaptations, as also seen in other desert cetoniines.

Amendments to the description of this genus by Péringuey, 1907: Male clypeus broad with truncate apex or narrow with furcate apex; aedeagal parameres with smooth depression on dorsal lobes but lacking deep longitudinal incavations; female fully winged; both sexes with or without cretaceous markings; inhabitants of Namaqualand-Kalahari plateau.

***Gariep patera* (Gory & Percheron 1833)** (Figs 1-3)

Cetonia patera Gory & Percheron, 1833: 62, 620.

Ischnostoma patera (Gory & Percheron). Burmeister 1842: 608.

Gariep patera (Gory & Percheron). Peringuey 1907: 379; Schenkling 1921: 80; Sakai & Nagai 1998: 206, 378.

Ichnestoma patera (Gory & Percheron). Holm 1992: 371; Holm & Marais 1992: 25; Beinhundner 2017: 1142.

Remarks. Specimens from the driest and northernmost parts of the distribution range of this species often lack completely in cretaceous markings (Holm & Marais 1992; Sakai & Nagai 1998; Beinhundner 2017). Also, as a general trend markings are more well-developed in males than females, both in terms of numbers and surface cover. Females are fully winged, with a W:E length ratio = 1.63. Body size ranges as follows, in male and female respectively: TL = 14.0-17.5 mm, MW = 7.5-9.5 mm (n = 18); TL = 15.1-19.0 mm, MW= 8.2-10.9 (n = 7).

Distribution. This species shows a relatively large range, occurring from the edge of the Namib Desert in southern Namibia to the Karoo region of the South African Eastern Cape (Fig. 3 E). Most available records are from Namaqualand in the Northern Cape. The three old records

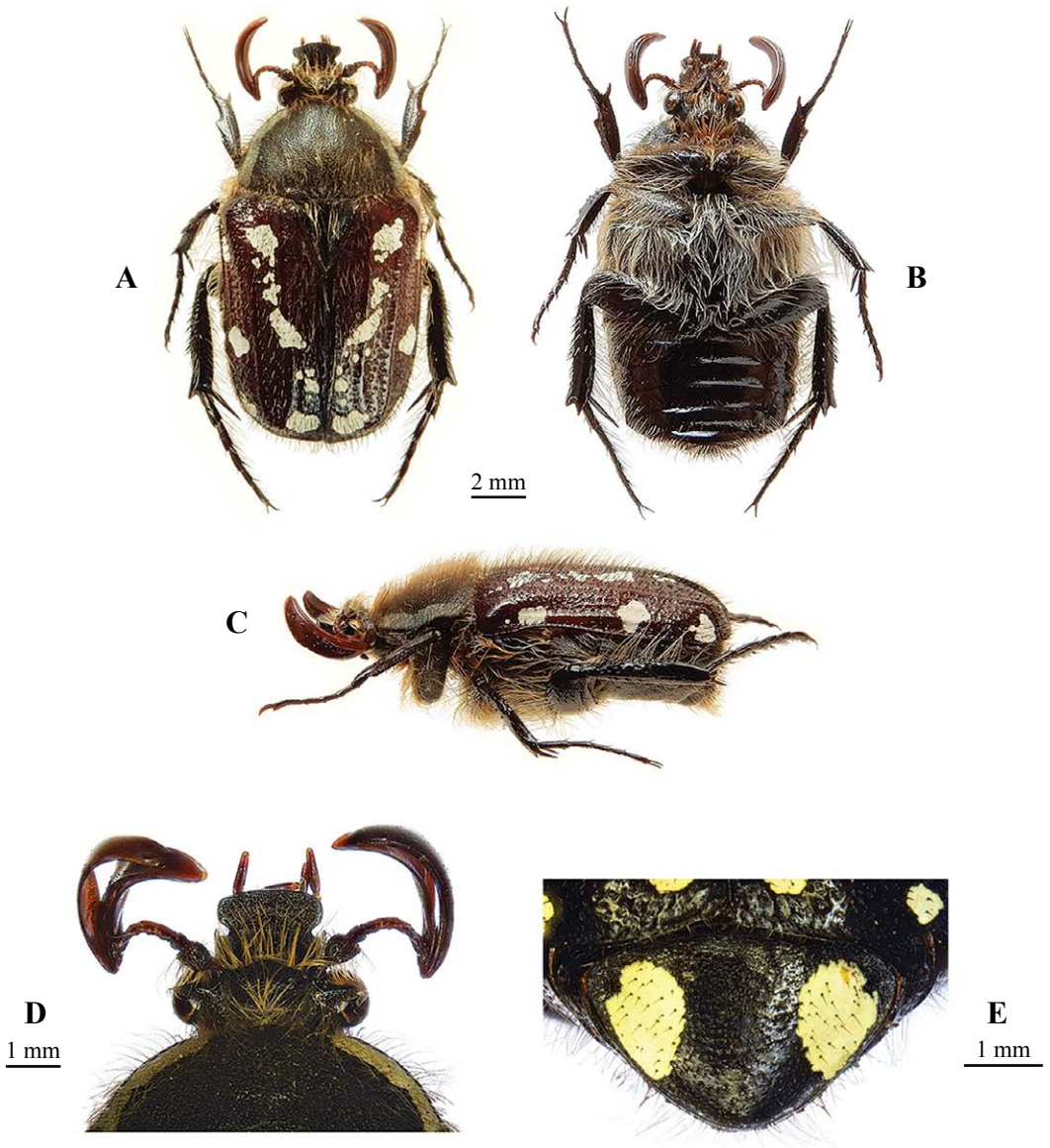

Fig. 1 – *Gariep patera* (Gory & Percheron 1833), male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

from "Willowmore, xii.1902" in Dr Brauns' collection are included here with caution, as the species has not been confirmed from there since, despite the extensive investigations conducted in the area during the past two decades.

Biology. Like for the congeneric species, field observations have confirmed that the female can undertake flight activities like the male, albeit with low and more occasional frequency (pers. obs.). In recent years, numerous larvae obtained from hyrax dung accumulations have been successfully reared to adulthood (AP Marais, pers. comm.). This seems to be the main source of food used by this species for its larval development, and many cocoons, fresh adults as well as carcasses have been obtained from hyrax deposits throughout its distribution range. This is however not an obligatory dietary dependency, as both larvae and adults have been regularly observed among leaf litter in the shade of trees with particular wide-canopy, with no traces of hyrax dung in the vicinities.

Data. Holotype: Not traced (cf. Holm 1992). Other material: **Republic of South Africa**: 3♂♂, Willowmore, Dec 1902, Dr Brauns (TMSA-CPH7904, ISAM-COL-A027362, SANC-COLS-17219); 1♂, Richtersveld, SWA., Jan 1900, H. Bailey (BMNH); 1♂, Calvinia distr., Loeriesfontein, G. Alston (SANC-COLS-17218); 1♂, O' Okiep (ISAM); 1♀, Namaqualand (Péringuey 1907); 1♂, RSA-NC, Richtersveld, Noemeesberg Mine 14 Apr 1990, R.H. Watmough (SANC-COLS-16022); 2♂♂, RSA Cape, Kliprand Dist., 1 Apr 1997 (emerged), AP & M Marais (BMPC); 2♂♂, RSA Cape, Kamieskroon, 24 Apr 1997 (emerged), AP & M Marais (BMPC); 4♂♂, South Africa, NC, Gr Tafelberg, 2 Jan 2006, R Perissinotto & L Clennell (BMPC); 2♀♀; 1♀, South Africa NC, Komsberg, 22 Mar 2015, D Clark legit (BMPC); 1♀, South Africa NC, Tankwa NP, 5 Jan 2013, R Perissinotto & L Clennell (BMPC); 9♂♂, South Africa, NC, Kamieskroon, Feb 2006 (GBPC, TGPC, DMPC, MDPC); 1♀, *ibidem* ex pupa, emerged Apr 1997 (TGPC); 1♀, *ibidem* larva collected Dec 1996, hatched 24

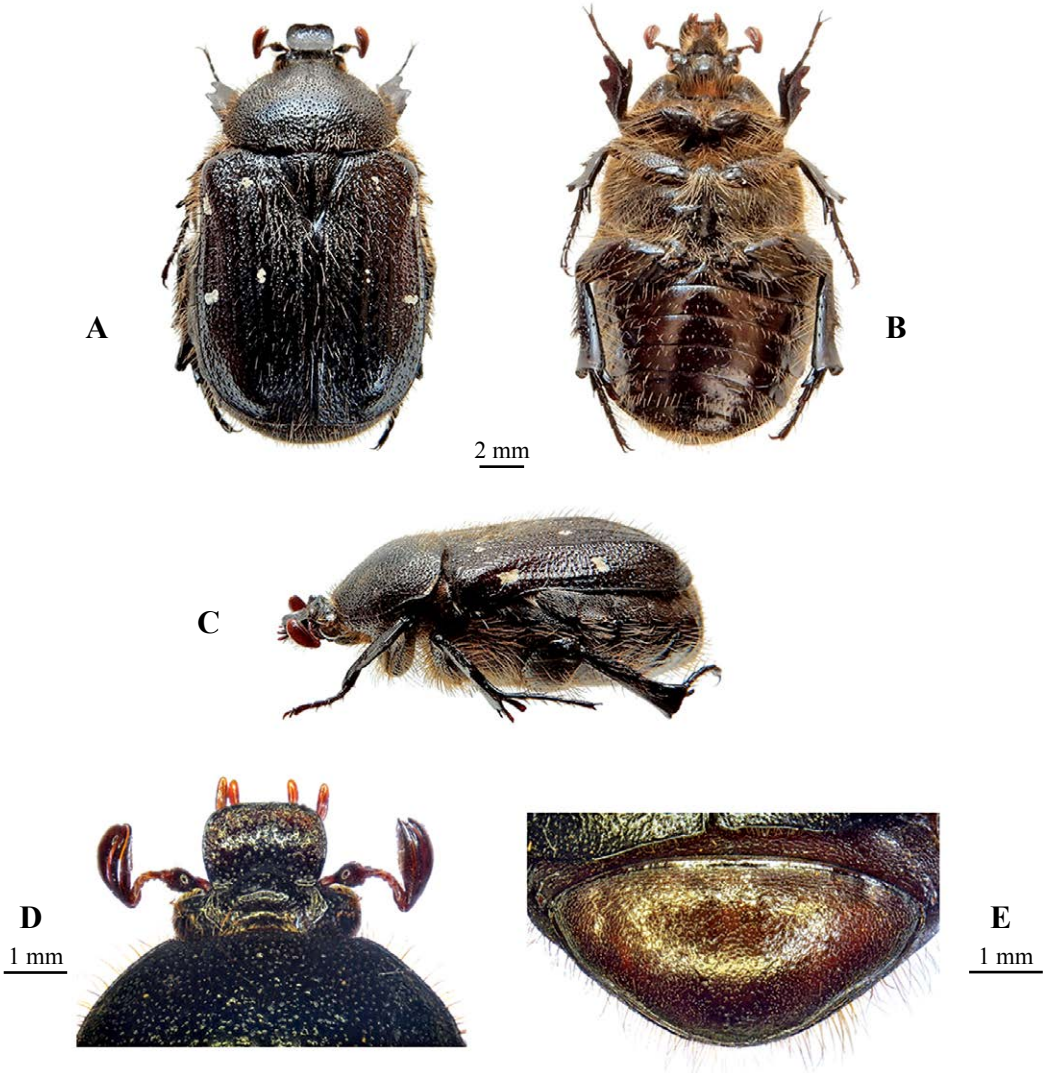

Fig. 2 – *Gariep patera* (Gory & Percheron 1833), female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

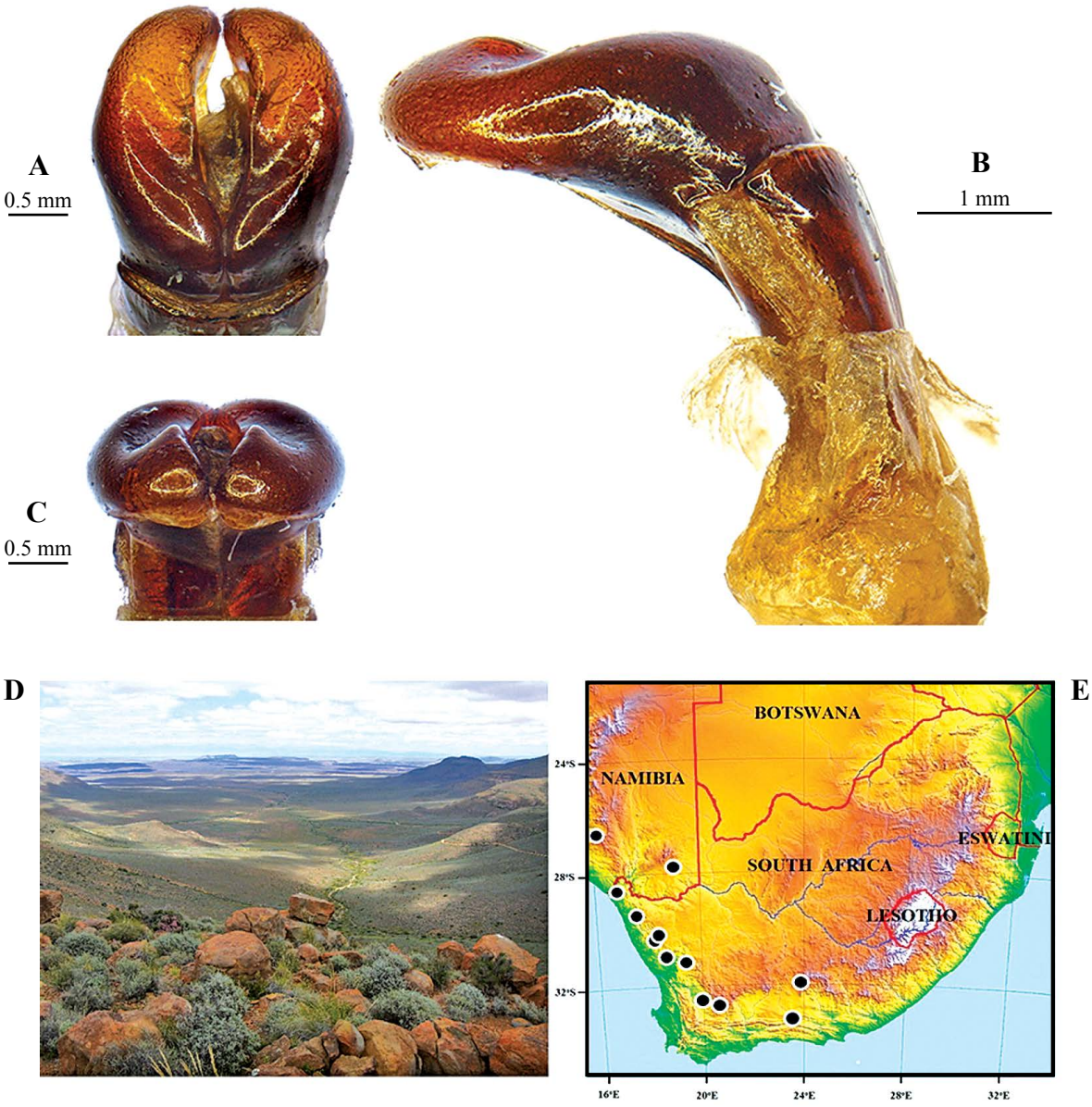

Fig. 3 – *Gariep patera* (Gory & Percheron 1833): **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Tankwa Karoo National Park; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

Mar 1996, R. Perissinotto & L. Clennell (TGPC); 1♂,1♀, South Africa NC, Witwater, Feb 2014 (DMPC). **Namibia**: Namaland, Klein-Aus, 8 Jan 2007 (BMPC); 1♂, Kubub, DSWA (DEIC); 1♀, Namibia, 1920 (BMNH, in Sakai & Nagai 1998).

***Gariep perstriata* (Holm, 1992) comb. nov.** (Figs 4-6)

Ichnestoma perstriata Holm, 1992: 370; Holm & Marais 1992: 24; Holm & Perissinotto 2004: 76; Beinhundner 2017: 1150.

Remarks. Both males and females of this species are consistent in their body colour, which is completely black and shiny, with densely costate elytra. This is a recurrent feature of cetoniines inhabiting the desert biome of southern Africa, and probably constitutes a natural barrier aimed at maximising the absorption and dissipation of heat at the external surface of the body. The female is fully winged with a W:E length ratio = 1.68. Body size ranges as follows, in male and female respectively: TL = 17.7-23.0 mm, MW = 9.4-10.6 mm (n = 8); TL = 20.1-22.7 mm, MW= 10.7-11.6 mm (n = 3).

Distribution. Recent investigations have shown that this species occurs throughout the Gariep Desert of the South African Northern Cape, albeit in a very scattered pattern,

from Vioolsdrift in the west to Pofadder in the east (Fig. 6 E). Holm & Perissinotto (2004) reported also a record from the upper reaches of the Boomrivier in southern Namibia, and it is thus likely that its range may actually extend quite deeply into the Ai-Ais and Fish River Canyon region of Namibia and adjacent dry areas towards the eastern part of that country.

Biology. The description of the female has only been recently reported in Holm & Perissinotto (2004), with confirmation of its fully-winged character. It has now also been established through direct field observations that the female is a capable flyer that undertakes airborne activity throughout the hottest part of the day. While the female specimen described in Holm & Perissinotto (2004) was found freshly dead in hyrax dunghills, other females have been observed landing in the proximity of dense bushes of *Euphorbia gregaria* and other smaller unidentified plants, indicating the possibility that the larval stages of this species may utilise a wide variety of habitats and food sources, in order to maximise their growth potential in this desert environment.

Data. Republic of South Africa: Holotype: ♂, Vioolsdrif, North Namaqualand, Museum staff, Mar 1935, *Ichnestoma* sp. ign.' [handwriting of H. Andreae], luridipennis Burm [printed], "*Ichnestomidia perstriata* m., J. Krikken ms 1985, paratype" (ISAM). Paratypes: 1♂, [unknown data] (NBCN). Other material: 1♀ (elytra only), South Africa, NC, Klein Pella, 22 Jan 2005, R Perissinotto & AK Brinkman (BMPC); 7♂♂, 1♀, South Africa, NC, Dabenoris, 23-24 Jan 2005, R Perissinotto & AK Brink-

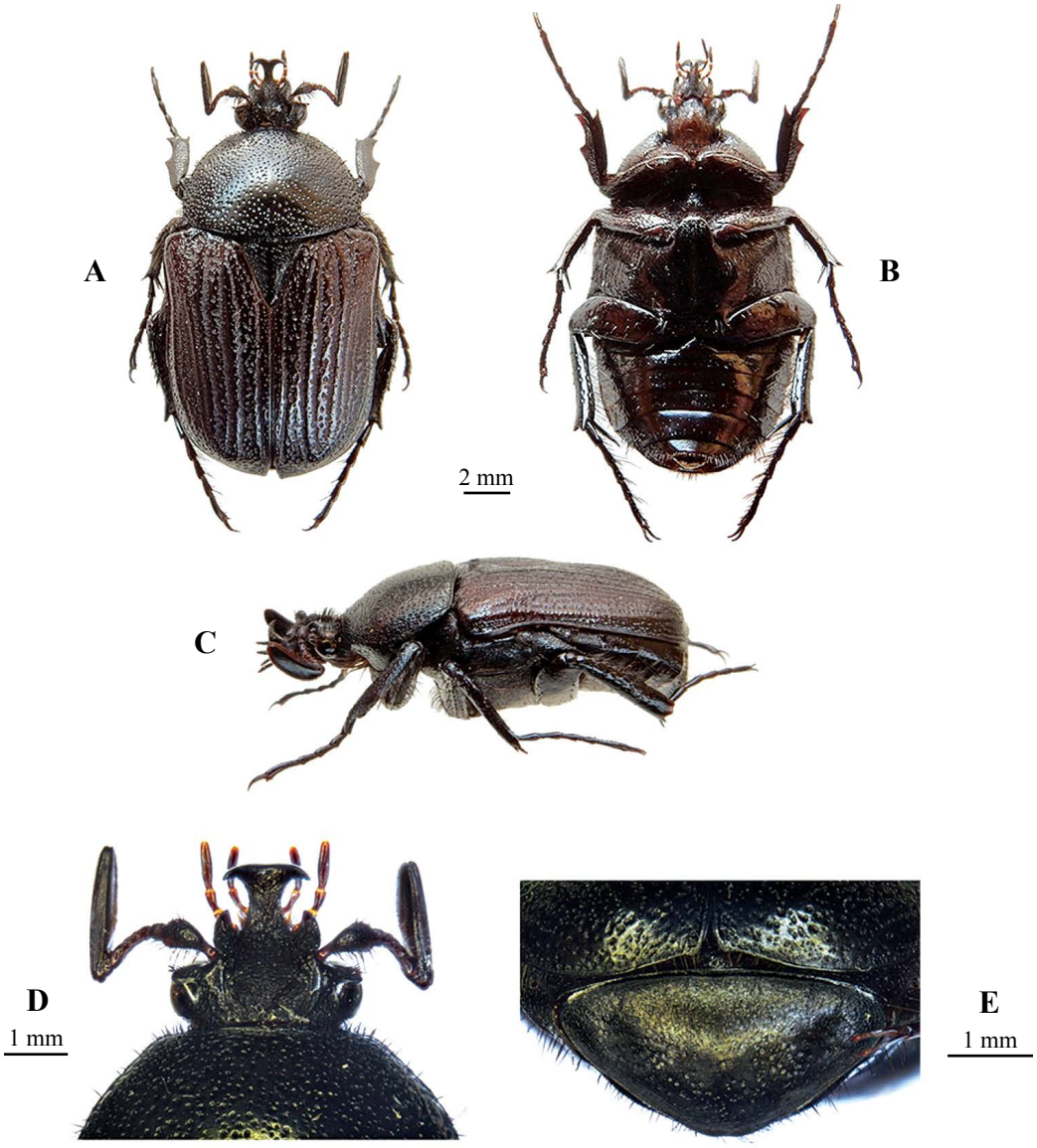

Fig. 4 – *Gariep perstriata* (Holm, 1992) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

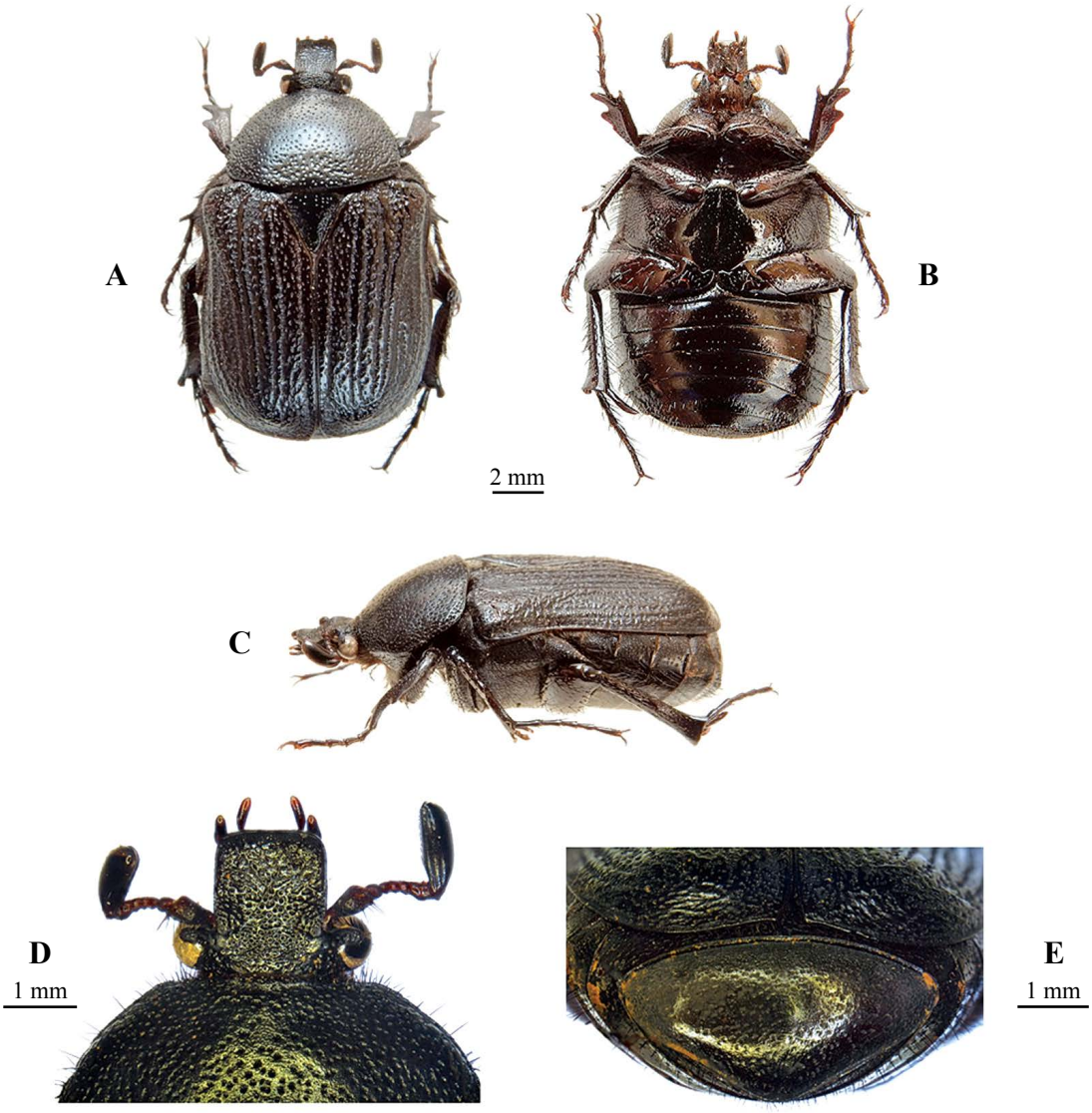

Fig. 5 – *Gariep perstriata* (Holm, 1992) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

man (BMPC, MDPC); 2♂♂, 1♀, South Africa, NC, Pofadder 17-18 Feb 2018, drowned in farm trough/dam, R Perissinotto & L Clennell (pers. obs.). 1 ♀, **Namibia**: Upper Boomrivier, 27°52'S 17°00'E, 4 Apr 2002, Holm and Gebhardt (SMWN);

Genus *Ichnestoma* Gory & Percheron, 1833

Ichnestoma Gory & Percheron, 1833: 302; Castelnau 1840: 167; Krikken 1984: 53; Holm 1992: 367; Holm & Marais 1992: 22; Sakai & Nagai 1998: 205; Holm & Perissinotto 2004: 74; Beinhundner 2017: 1142.

Ischnostoma Gory & Percheron: Macleay 1838: 42; Burmeister 1842: 606: Schoch 1894: 200; 1895: 24; Peringuey 1907: 372: Schenkling 1921: 79; Schein 1961: 89; Allard 1991: 100.

Type species: *Ichnestoma heteroctyta* (designated by Marais & Holm 1992).

Remarks. This genus has encompassed species now separated into four different genera. Thus, the original redescription reported in Holm (1992) and Holm & Marais (1992) needs to be amended in some key aspects as follows. Medium to large size species (TL > 15 mm); elytral costae hardly discernible; body black or dark-brown with white cretaceous markings present in all species, but often reduced and even absent in some individuals; female wings substantially reduced, with W:E length ratio ≥ 0.80 (except *I. rostrata*); aedeagal parameres with longitudinal incavation on dorsal lobes bean- or club shaped; pygidial sculpture ultrafine and smooth in males, but occasionally with round punctures in females; distribution range broad, from escarpment to coastal plain across Karoo region. Two species complexes are further proposed to recognise secondary differences in parameral structure. Thus, the *cuspidata* spp-complex includes species that exhibit dorsal

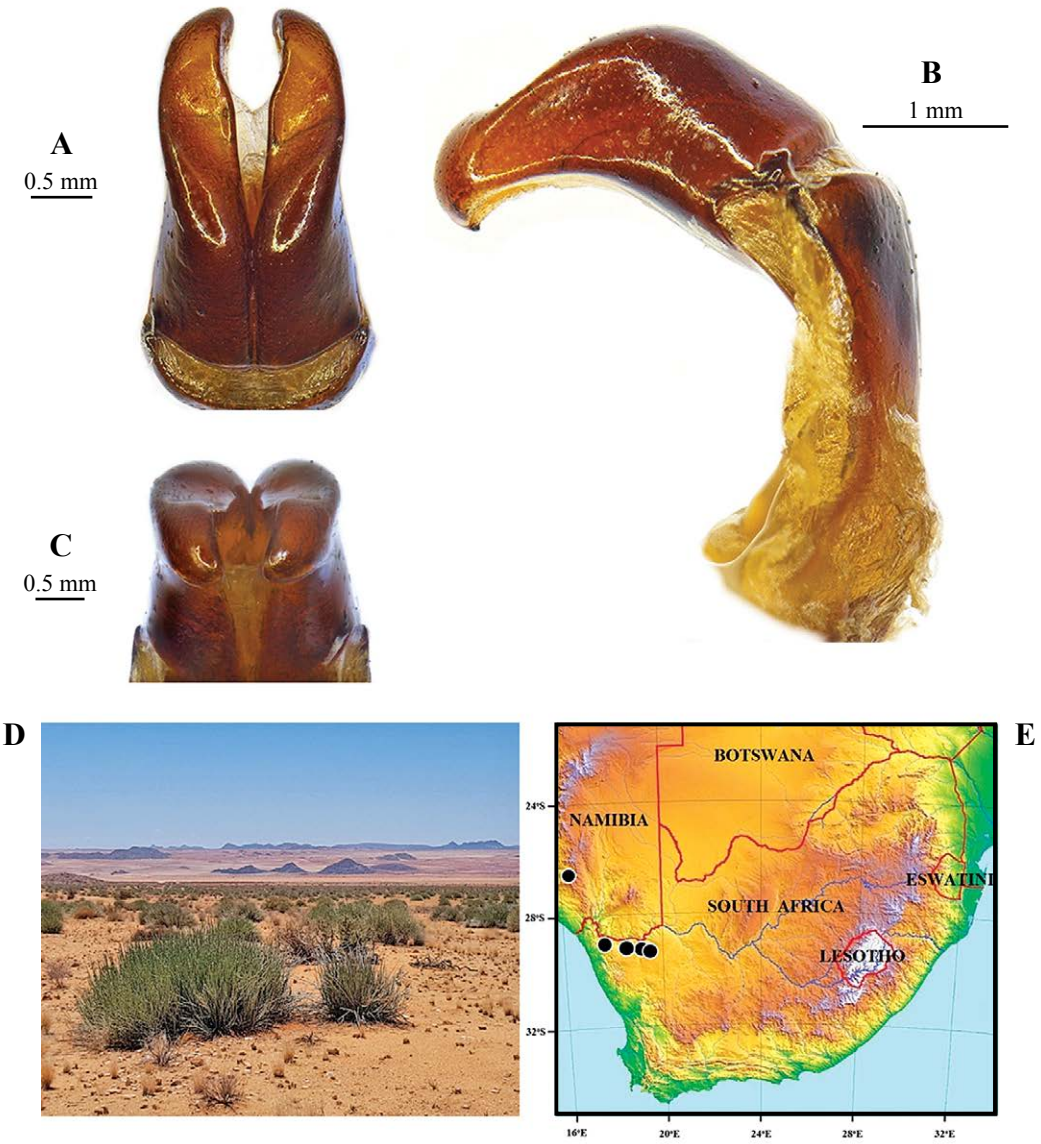

Fig. 6 – *Gariep perstriata* (Holm, 1992) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Gariep Desert near Pofadder; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

lobes of parameres with external margins smooth, while those with dark ridge and spinal projection on external margins are grouped in the *albomaculata* species-complex.

Ichnestoma cuspidata species-complex

Key characteristics

1) Dorsal lobes of aedeagus with distinct incavation, but lacking the dark ridge with spinal projection on the outer margin;
2) both male and female clypeus progressively elongating form lowland species (*I. cuspidata*) to high altitude dwellers (*I. coetzeri*);
3) pygidium smooth in males but with round punctures in females;
4) currently, five species are known in this group: *I. carbonaria* sp. nov., *I. coetzeri*, *I. cuspidata*, *I. dealbata* sp. nov. and *I. karoominoris* sp. nov.;
5) restricted to Western and Northern Cape, across a south-north gradient from near-coastal lowland to high mountain habitats;
6) species-complex named after *I. cuspidata*, the first species to be historically recognised and described within this group.

Key to species

1. Male clypeus with apex sinuate and without white cretaceous markings on frons 2
- Male clypeus with apex furcate and with white cretaceous markings on frons 3
2. Clypeus short in both sexes, tapering gradually from base

to apex in male; dorsal lobes of parameres inverse oval in dorsal view; female W:E ratio = 0.86; female clypeus with smoothly rounded lateral margins in apical half but straight towards base; medium species ≈ 16-20 mm TL; distribution: WC, southern lowlands .... *I. cuspidata* (Fabricius, 1787)

- Clypeus elongate in both sexes, tapering rapidly above base and then laterally parallel in male 4

3. Male clypeus elongate and markedly constrained at middle; dorsal lobes of parameres smoothly angulate at middle in dorsal view; female W:E ratio = 1.04; female clypeus with smoothly rounded lateral margins and deeply sinuate apex; large species > 21 mm TL; distribution: NC, Swarweerberg and Komsberg ..... *I. coetzeri* (Allard, 1986)

- Male clypeus short and wide, mildly constrained at middle; dorsal lobes of parameres wide ellyptical in dorsal view; female W:E ratio = 0.85; female clypeus with lateral margins constrained in apical half and deeply sinuate apex; medium species ≈18-21 mm TL; distribution: WC, Swartberg foothills (Little Karoo) ..... *I. dealbata* sp. nov.

4. Male clypeus with basal invaginations wide; white cretaceous markings reduced or absent; dorsal lobes of parameres wide ellyptical in dorsal view; female W:E ratio = 0.88; female clypeus with lateral margins parallel and deeply sinuate

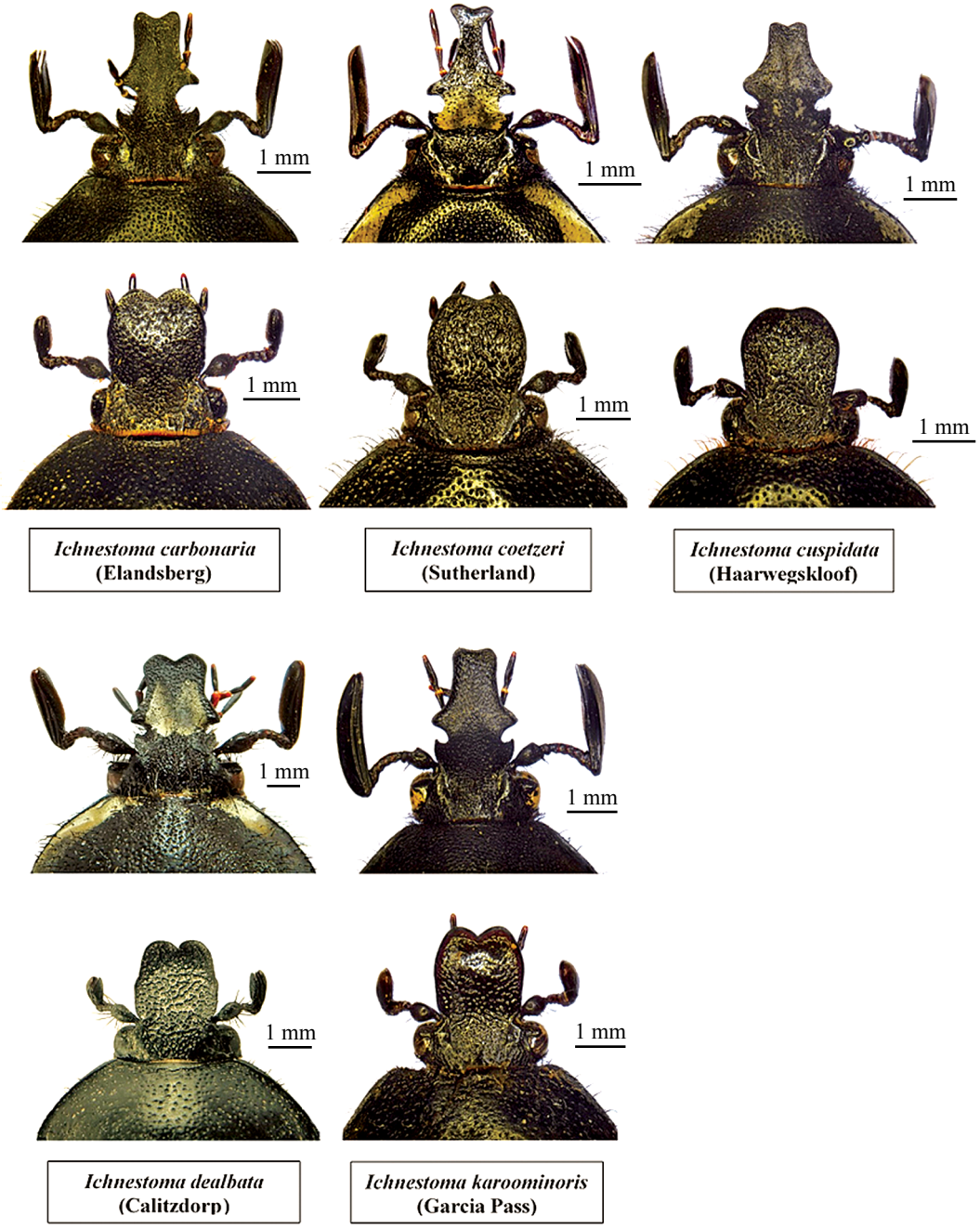

Fig. 7 – Comparative clypeal shape of the species of the *Ichnestoma cuspidata* species-complex: male (top row) and female (bottom row) dorsal views.

apex; medium to large species ≈18-23 mm TL; distribution: WC, Elandsberg and Tafelkop ..... *I. carbonaria* sp. nov.

- Male clypeus with basal invaginations narrow; white cretaceous markings fully developed; dorsal lobes of parameres narrow ellyptical in dorsal view; female W:E ratio = 0.89; female clypeus with lateral margins smoothly angled and deeply sinuate apex; medium species ≈16-20 mm TL; distribution: WC, Langeberg foothills (Little Karoo) .... *I. karoominoris* sp. nov.

***Ichnestoma carbonaria* sp. nov.** (Figs 7-8, 9-11)

Diagnosis. This species represents the transition between *I. karoominoris* and *I. coetzeri*, in that it exhibits a male clypeal shape intermediate between that of these two species. In particular, in *I. carbonaria* there is an elongation of the clypeal body and an enhancement of its apical furcation, in

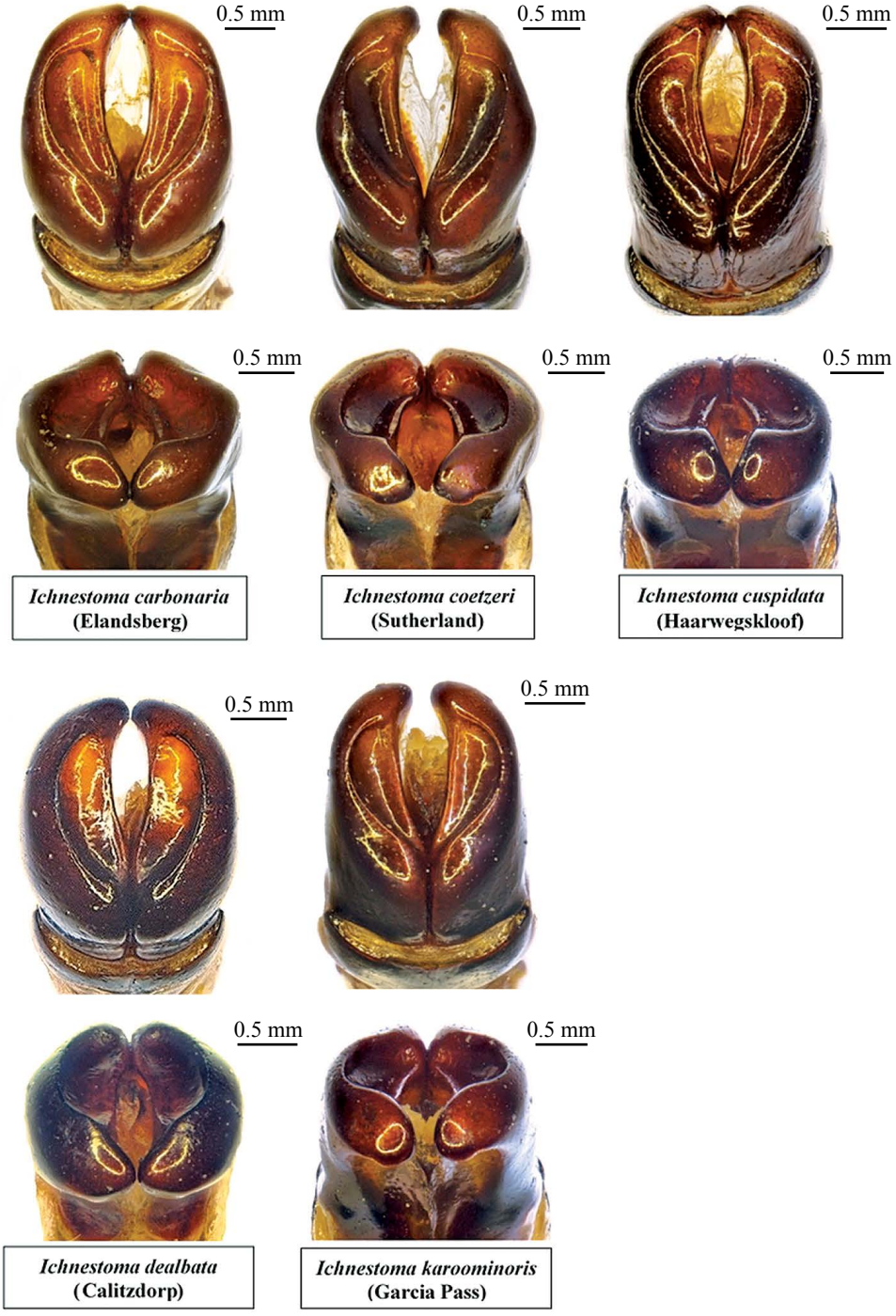

Fig. 8 – Comparative aedeagal shape of the species of the *Ichnestoma cuspidata* species-complex: dorsal (top row) and frontal (bottom row) views.

comparison with *I. karoominoris* (Fig. 7). This trend finds its extreme development in *I. coetzeri*, where the clypeus is further elongated and constricted at the apex just before the fork. Males of *I. carbonaria* can also be separated from those of the other two species by showing a drastic reduction in cretaceous markings, with about half specimens being actually completely black or nearly so (Fig. 9). The parameres of *I. carbonaria* are also quite distinctive, in that in dorsal view they are more widely elliptical, and in frontal view their lobes are also more raised at the base, than those of the other two closest species (Fig. 8).

Description of holotype male (Figs 9 A-E, 11 A-C)

Size. Length 20.6 mm; width 11.1 mm.

Body. Black to dark brown with velutinous elytra and no traces of white cretaceous markings (Fig. 9 A); head, pronotum and scutellum densely covered in round punctures and black setae, but elytra only on basal mid half, around scutellum and suture (Figs. 9 A, C, D).

Head. Black, with round punctures exhibiting long black setae at centre on vertex and frons, but sculpture becoming coarse and irregular on clypeus; clypeus asetose, markedly bilobate but moderately concave, with very

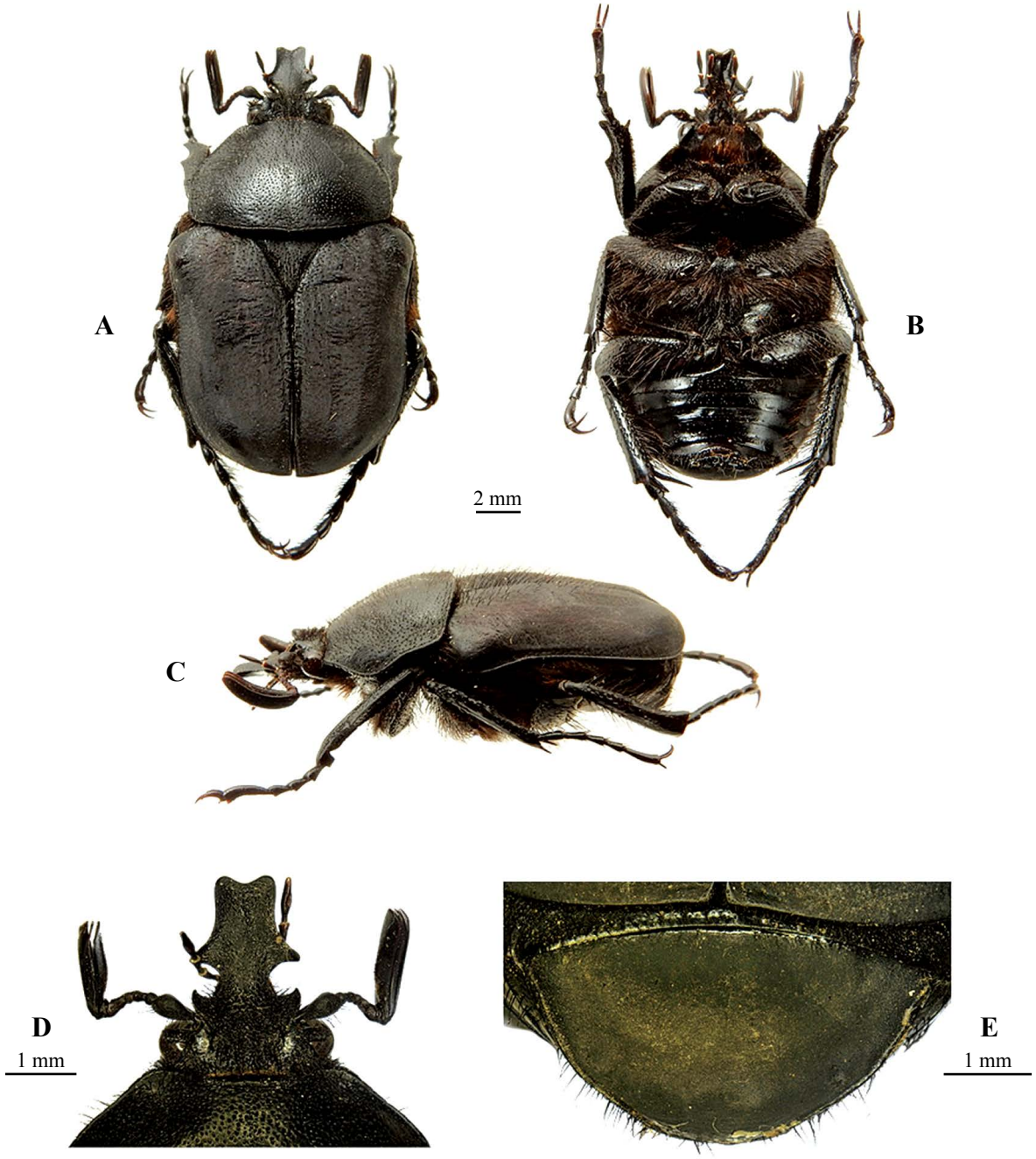

Fig. 9 – *Ichnestoma carbonaria* sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

large lateral invaginations and prominent spinal projections above (Fig. 9 D); antennal club, pedicel and flagellum black to dark brown; antennal club hypertrophic and of same length as pedicel and flagellum combined.

Pronotum. Completely black and roundly octagonal in shape (Fig. 9 A); without any protuberances but rebordered on all margins; posterior margin forming straight line in front of scutellum; small but dense round punctures throughout surface, with thin black, medium to long setae emerging at centre of punctures, becoming thicker and longer on lateral margins (Figs. 9 A, C).

Scutellum. Entirely black; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with regularly spaced round to horse-shoe punctures and long black setae across entire surface (Fig. 9 A).

Elytron. Dark brown to black and velutinous, with darkest infusions along margins and on umbones; with costae obsolete and without macrosculpture, but exhibiting dense, long black setae on basal half around scutellum and also along entire suture, albeit more scattered and shorter; apex forming blunt right angle, without any spinal projection (Fig. 9 A).

Pygidium. Black and matte; roundly triangular in shape, with narrow groove followed by ridge at margins; with scattered, shallow round punctures and few short black setae on disc but full lining of medium sized setae along apical and lateral margins (Fig. 9 E).

Legs. Completely black, with tarsal segments moderately hypertrophic; with black setae increasing in density and length from pro- to metalegs; tibiae with coarsely

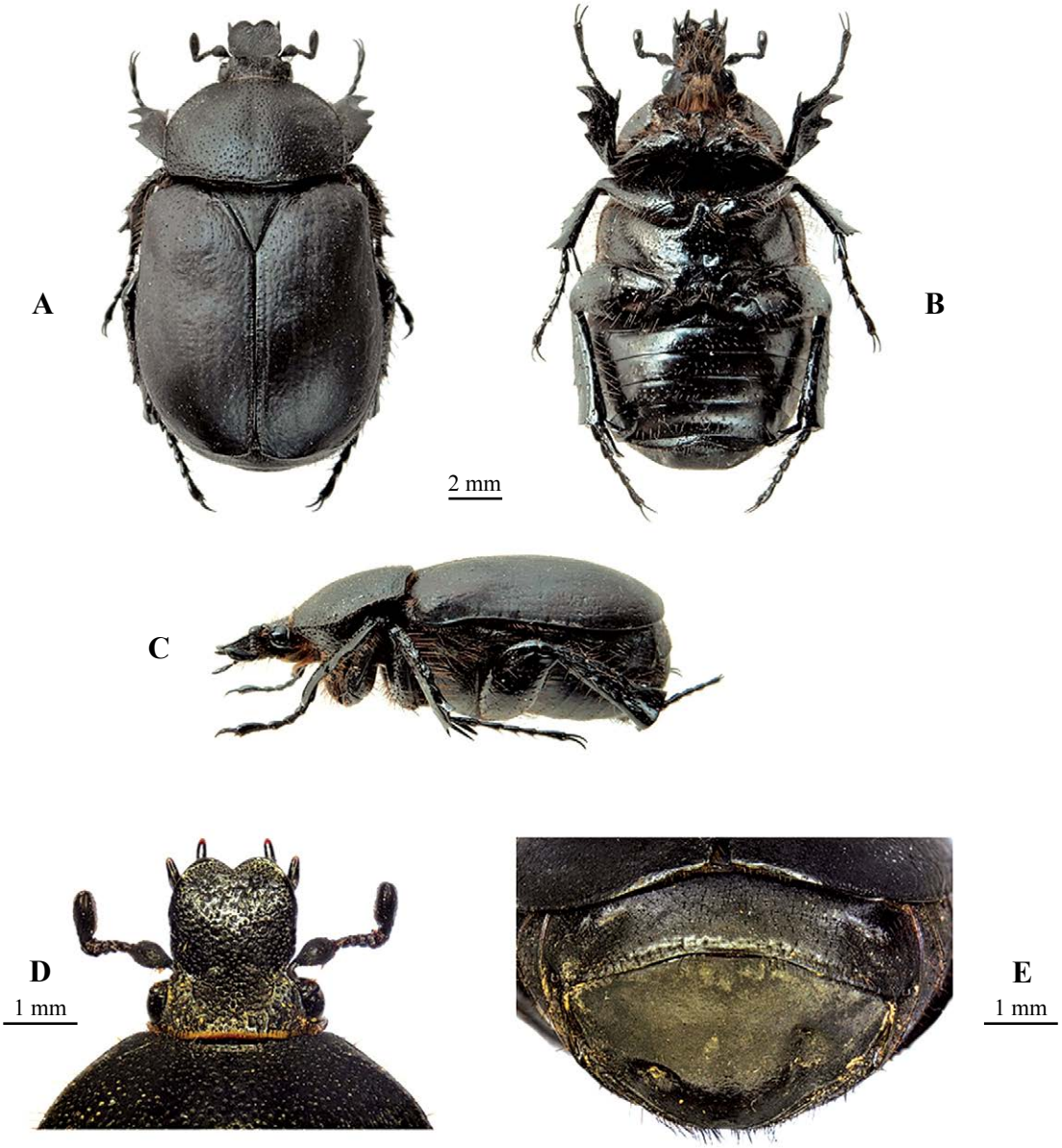

Fig. 10 – *Ichnestoma carbonaria* sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

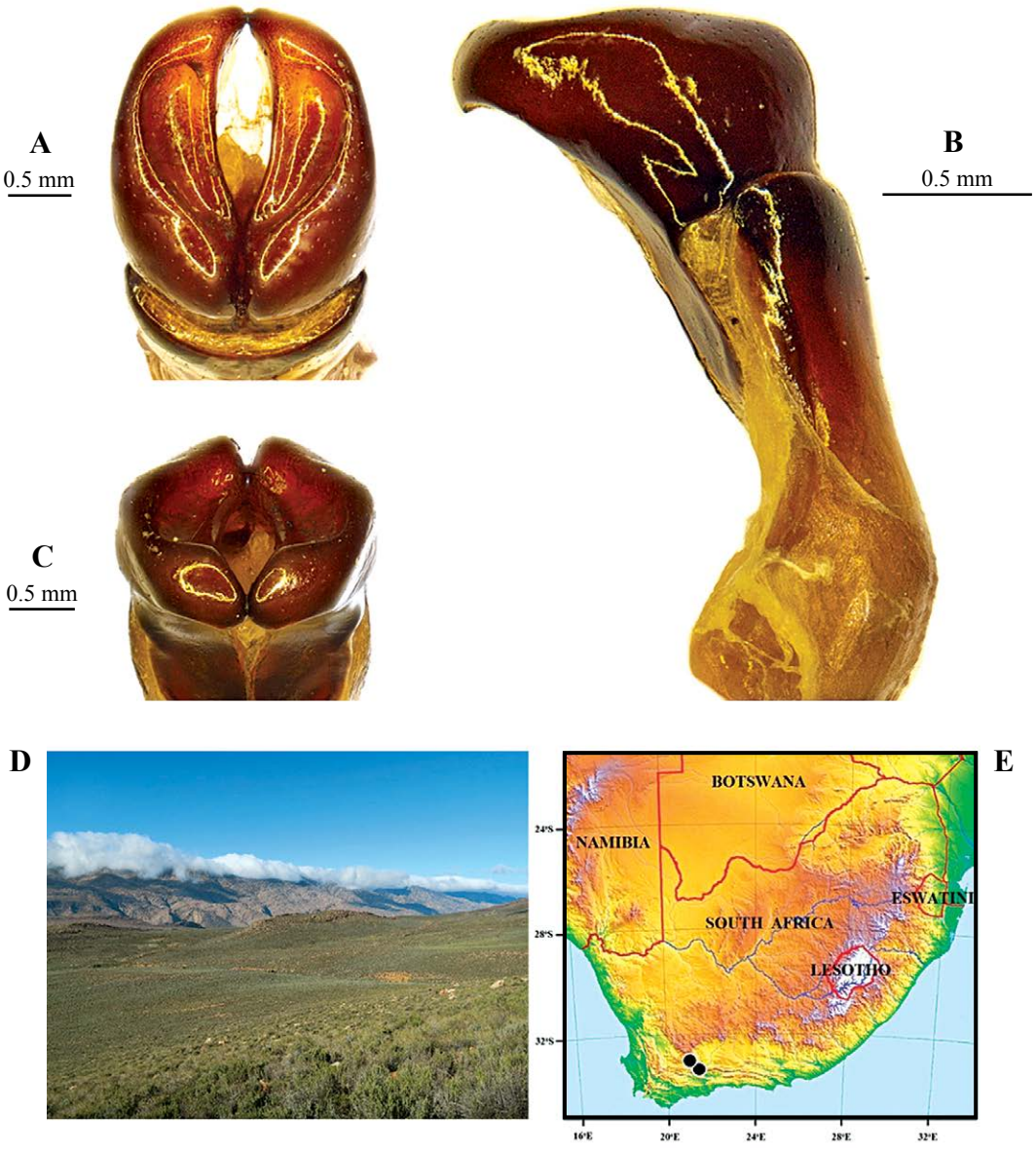

Fig. 11 – *Ichnestoma carbonaria* sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Elandsberg, Western Cape; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

round to irregular sculture across external surface; protibia bidentate, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 9 A-C).

Ventral surface. Entirely black and covered in dense and long black setae, except on most surface of abdominal sternites, femoral and coxal bases; mesosternal lobe slightly convex, with dense round punctures and long setae across entire surface; metasternal lobe with roundish concave expansion posteriad of median sulcus; abdominal sternites with marked concavity and scattered short setae at middle (Fig. 9 B).

Aedeagus. Parameres with lobes tapering gradually and smoothly towards apex, imparting a quasi-oval shape in dorsal view (Fig. 11 A); in frontal view exhibiting poorly developed dorsal and ventral projections on apical surface but substantially raised basal lobes (Fig. 11 C).

Derivatio nominis. From the Latin root of *carbo* = coal. This species is named after its remarkable dark colour, which often assumes a complete black matte character when the white cretaceous markings become obsolete.

Description of female (Figs. 7, 10). As expected, the female of *I. carbonaria* resembles most closely that of both *I. coetzeri* and *I. karoominoris*, and thus it may not be possible to separate them on the basis of external morphology alone. Even at the level of the clypeus, which is normally one of the key diagnostic character in all *Ichestoma* species,

these females actually all exibit approximately the same length and the same marked degree of apical sinuation. The most salient features of the female of *I. carbonaria* can be summarised as follows. a) Body black to dark brown and velutinous, with sparse short black setae only around margins and shallow coarse to round punctures on head and pronotal surfaces, becoming extremely small and scattered on scutellum and elytra; b) clypeus moderately elongate, gently rounded laterally, concave and with deep sinuation at apex; c) pronotum globose and covered in dense round, shallow punctures but glabrous; d) scutellum equilateral triangular, with few shallow punctures and wide lateral grooves, but no setae; e) elytra dark brown to black, with extremely small and scattered sculpture and weak costal markings; f) brachypterous, with wing size = 11.0 mm and W:E ratio = 0.88; g) pygidium black, with small, scattered horse-shoe puncutres and very short dark setae emerging at centre of some punctures; h) tarsal segments slim and moderately hypertrophic, protibiae tridentate, more robust and wider than in male, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with round punctures shallow but dense across entire surface except abdominal sternites, which are markedly convex.

Distribution. This species is so far only known from two localities both situated in the northern part of the Western Cape: the Elandsberg and Tafelkop, at altitudes ranging between approximately 1000 and 1300 m (Fig. 11 E).

Biology. Like its closest relatives, *I. carbonaria* is a typical renosterveld dweller, with preference for lower mountain slopes within the Fynbos Biome. Adult beetles emerge during the mid summer months, immediately after the first substantial rainfall event of the season. The specific bioregion that this species occupies is classified as Shale Renosterveld, of the Central Mountain and Matjiesfontain types (Mucina & Rutherford 2006). The climate is characterized by arid to semi-arid conditions and the landscape is dominated by low mountains and parallel hills, with regular escarpments and mid-altitude plateaus. Tall shublands dominate the vegetation, with an overwhelming presence of renosterbos (*Dicerothamnus rhinocerotis*) and pockets of non-succulent Karoo shrubs and geophitic flora in the undergrowth (Mucina & Rutherford 2006).

Remarks. The male of this species is characterized by a drastic reduction in the dorsal white markings, with extreme cases showing a complete black habitus (Fig. 9). Most specimens exhibit residual markings on external pronotal and elytral margins, but a small minority has an almost fully developed cretaceous lining, resembling that of *I. cuspidata.* Females are generally completely black, but on rare occasions their elytra may assume a more brownish colour. Together with *I. coetzeri,* the males of this species attain the largest body size observed within the entire genus. Within the type series analysed in this study, the size ranges as follows: male TL = 19.8-23.2 mm, MW = 10.9–12.2 mm (n = 20); female TL = 18.1-19.3 mm, MW = 11.2-12.1 mm (n = 6).

Data. Republic of South Africa: Holotype: ♂, WC, Elandsberg, 27 Mar 2015, found dead on ground, R. Perissinotto & L. Clennell (ISAM). Paratypes: 1♂, 2♀♀, *idem* (BMPC); 24♂♂, 6♀♀, *ibidem* 24 Jan 2016 (TMSA, SANC, BMPC, TGPC); 3♂♂, 1♀, South Africa, WC, Tafelkop 16 Feb 2000, CR Owen (COPC: http://www.beetlesofafrica.com/beetle_detail.asp?beetleid=573&page=1&count=y).

***Ichnestoma coetzeri* (Allard, 1986)** (Figs 7-8, 12-14)

Ischnostoma coetzeri Allard, 1986: 25; 1991: 44.

Ichnestoma cuspidata coetzeri (Allard). Holm 1992: 379; Holm & Marais 1992: 35.

Ichnestoma coetzeri (Allard). Holm & Perissinotto 2004: 76; Beinhundner 2017: 1147.

Remarks. The date of the original description of this species, i.e. 1986, has been erroneously reported as 1988 in Holm (1992), Holm & Marais (1992), Holm & Perissinotto (2004) and Beinhundner (2017). With *I. carbonaria*, this is the largest species of the genus attaining a total length generally in excess of 22 mm. Males exhibit a whole range of cretaceous patterns on their dorsal side, with the lateral bands on pronotum and elytra a consistent feature found in all specimens (Fig. 12 A, C). The sutural cretaceous band on the elytra can be extremely reduced to the apical portion, or can extend forward and obliquely over the elytral disc, either in the form of a continuous band or as an interrupted scatter of maculae (e.g. holotype specimen described by Allard, 1986). Smaller areas of cretaceous marking can also be found on clypeal base and scutellar sides; these however are rather occasional and can be completely obsolete in several specimens. The moderately brachypterous female exhibit a W:E length ratio = 1.04. Size: male TL = 21.6-24.2 mm, MW = 11.6-12.3 mm (n = 14); female TL = 21.7– 22.8 mm, MW = 12.5-13.3 mm (n = 3).

Distribution. Populations are currently known from the Swarweerberg and the northern slopes of the Komsberg range, to the immediate west and south of Sutherland, respectively (Fig. 14 E). It is likely that the species actually occurs through much of the Roggeveld region of the Northern Cape.

Biology. This species occurs in mountainous terrain, between 1500 and 1900 m of altitude. Adults can be active together with those of *Mzansica clarki* in the Komsberg after summer rainfall events. The vegetation type of this area is characterized as Roggeveld Shale Renosterveld and is part of the broader Fynbos Biome (Mucina & Rutherford 2006). Apart from renosterbos (*Dicerothamnus rhinocero-*

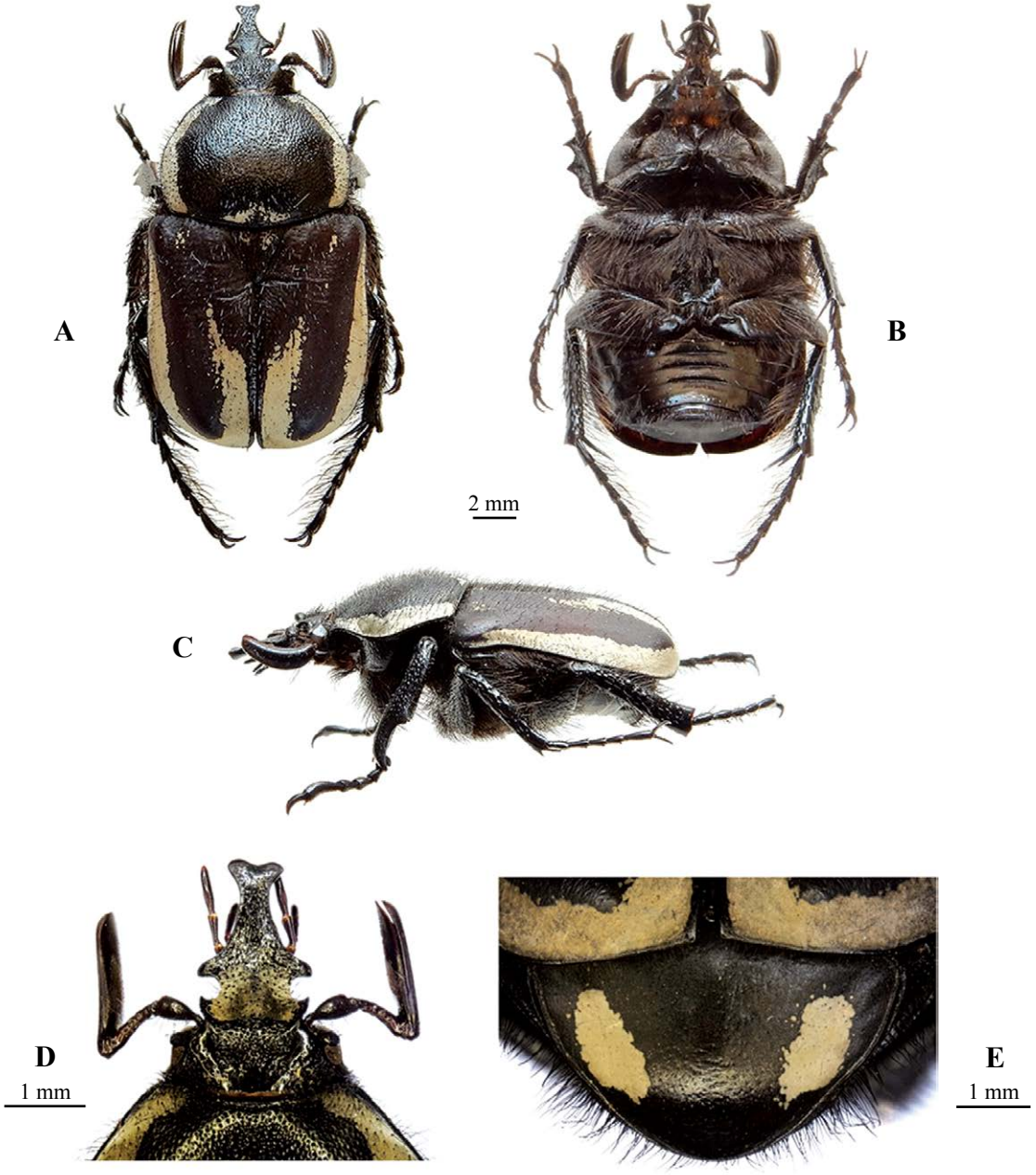

Fig. 12 – *Ichnestoma coetzeri* (Allard, 1986), male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

tis), this shrubland include dense but short clusters of *Helichrysum hamulosum* and a variety of other regionally endemic plants. Larvae have repeatedly been found together with those of *Odontorrhina hispida* (Olivier, 1789) under dense bushes of renosterbos and other Asteraceae at Sutherland and have been bred successfully in captivity, using only leaf litter of these plants as food source (pers. obs.). In captivity, the life cycle appears to involve two years of larval development.

Data. Republic of South Africa: Holotype: ♂, Cape Prov., Sutherland, Jan1986 (BMPC). Other material: 2♂♂, South Africa, Swaarweerberg, Sutherland, 8 Jan 2000, Dr J. Ball (BMPC); 1♂, *ibidem* A.K. Brinkman (BMPC); 2♂♂, *ibidem* 21 Jan 2000, Dr J. Ball (BMPC); 4♂♂, 2♀♀, *ibidem* 29 Jan 2000 (BMPC, TGPC, HMPC); 4♂♂, *ibidem* A.K. Brinkman (BMPC); 1♀, *ibidem* 18 Nov 2001, found dead, J. Ball & A.K. Brinkman (BMPC); 6♂♂, 1♀, *ibidem* 22 Feb 2004, AP Marais leg. (ISAM, BMNH{E} 2011-127, BMPC, PMPC, DMPC); 5♂♂, 1♀, *ibidem* Jonathan Ball leg. (GBPC, TGPC, MDPC); 1♂♂, 3♀♀, *ibidem* 28 Mar 2015, dead on ground, R Perissinotto & L Clennell (ISAM, TMSA); 2♂♂, South Africa, NC, Komsberg 28 Mar 2015, drowned in rain pool, D. Clark leg.

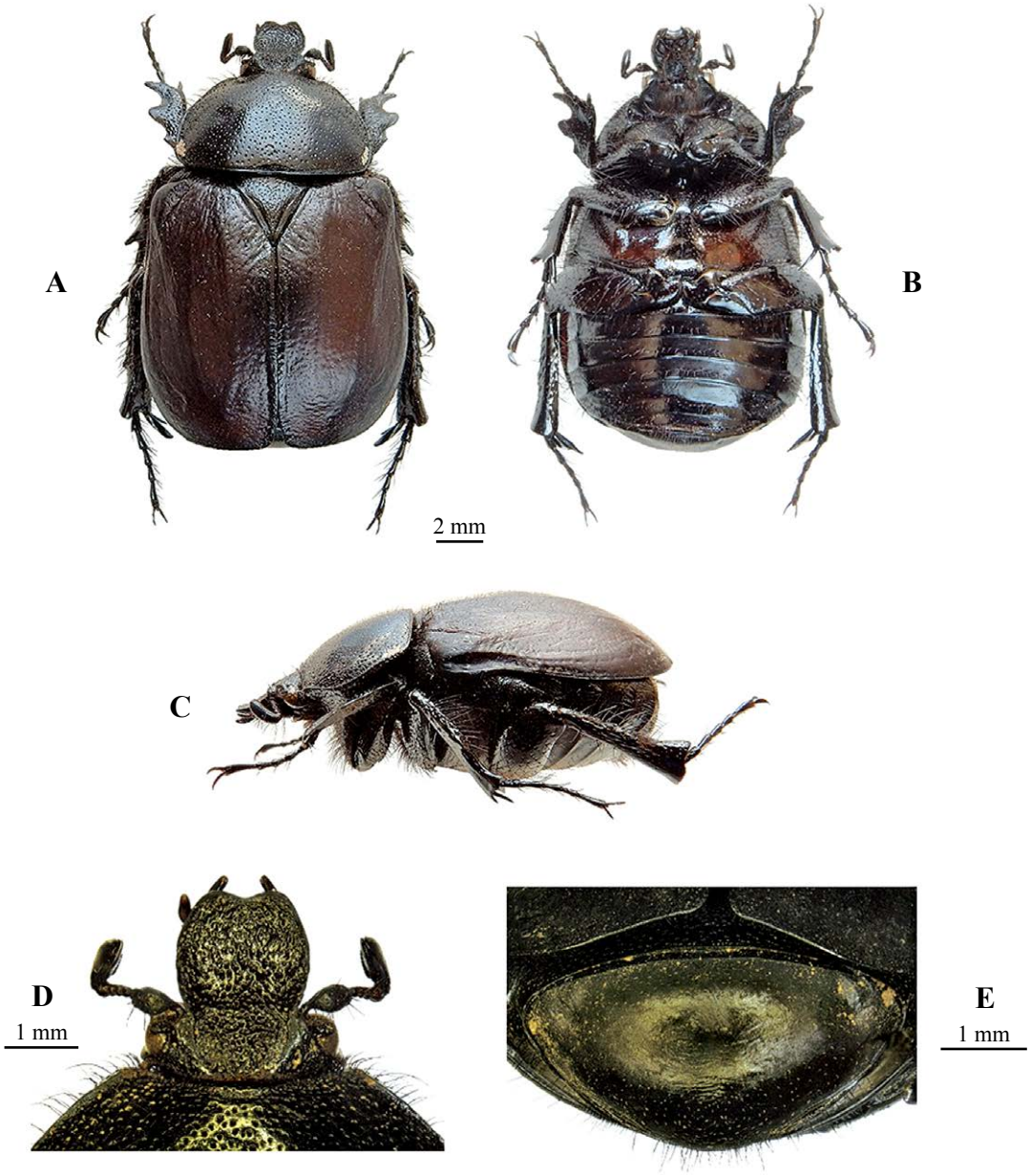

Fig. 13 – *Ichnestoma coetzeri* (Allard, 1986), female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

***Ichnestoma cuspidata* (Fabricius, 1787)** (Figs 7-8, 15-17)

Cetonia cuspidata Fabricius, 1787: 27; 1792: 129; 1801: 138; Herbst 1790: 262; Schönherr 1817: 124.

Ischnostoma cuspidata (Fabricius). Macleay 1838: 44; Burmeister 1842: 607; Schaum 1844: 391;

Schoch 1895: 24; Péringuey 1907: 375; Schenkling 1921: 79; Allard 1991: 44.

Melolontha albomarginata Herbst, 1790: 174.

Ichnostoma atbomarginata (Herbst). Castelnau 1840: 167; Schaum 1844: 391; Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (subsp. *cuspidata*).

Cetonia cordata Fabricius, 1792: 129; 1801: 139; Herbst 1790: 262; Schönherr 1817: 124.

Ischnostoma cordata (Fabricius). Schaum 1844: 392; Péringuey 1907: 374 (= *cuspidata*);

Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Ichnestoma heteroclyta Gory & Percheron, 1833: 303.

Ischnostoma heteroclyta Gory & Percheron. Macleay 1838: 44; Burmeister 1842: 608; Schaum 1844: 392; Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (subsp. *cuspidata*).

Cetonia rufipes Fabricius, 1787: 27.

Ischnostoma rufipes (Fabricius). Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Cetonia erythropus Gmelin (in Linnaeus), 1790: 1581.

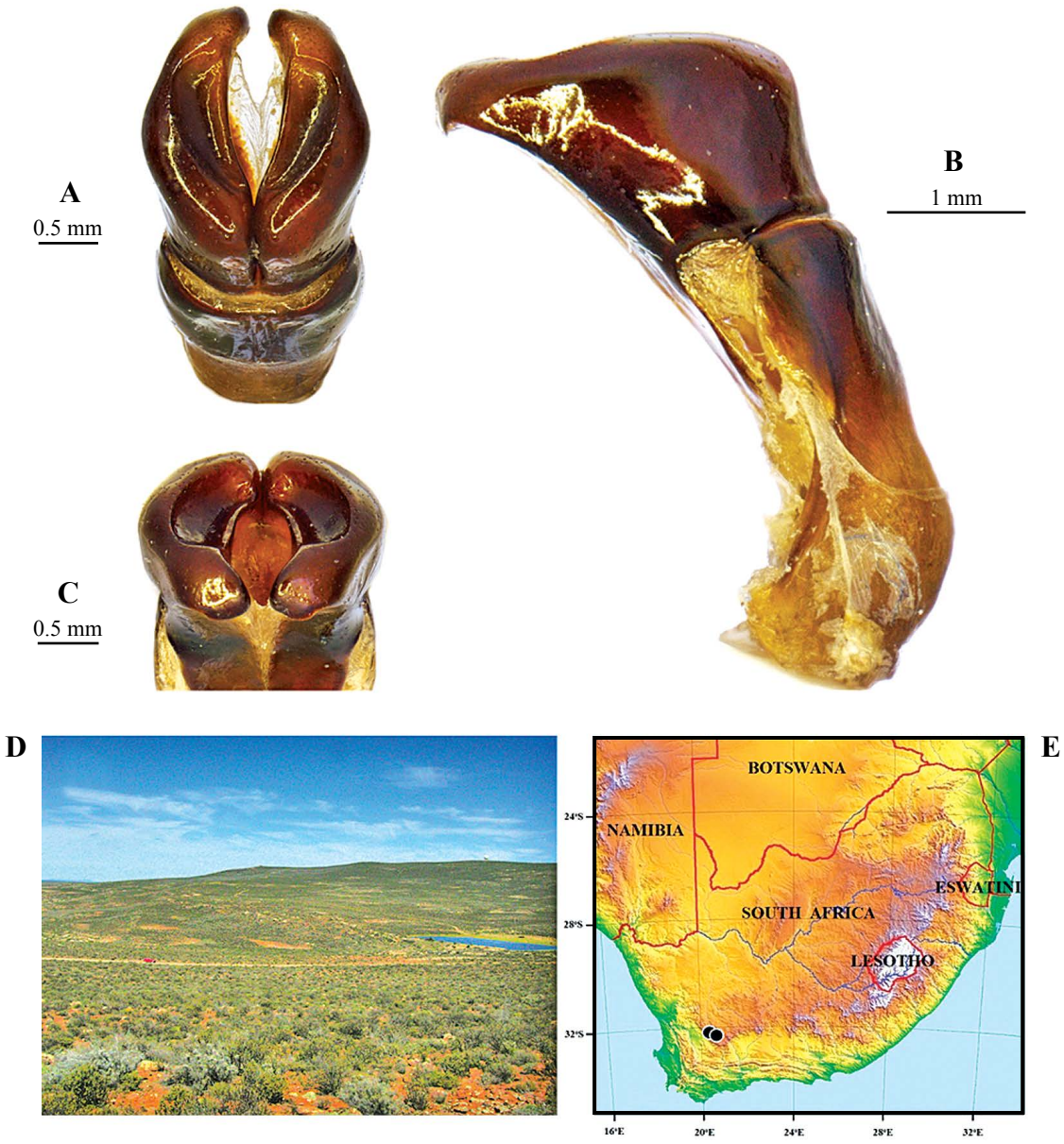

Fig. 14 – *Ichnestoma coetzeri* (Allard, 1986): **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Swarveerberg near Sutherland; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

Ischnostoma erythropus (Gmelin). Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Cetonia lundi Gmelin (in Linnaeus), 1790: 1582.

Ischnostoma lundi (Gmelin). Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Cetonia nobilis Fabricius, 1787: 27.

Ischnostoma nobilis (Fabricius). Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Ischnostoma pica Macleay, 1838: 44; Burmeister 1842: 607 (= *cuspidata*); Péringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Ischnostoma spatulipes Macleay, 1838: 44; Burmeister 1842: 697 (= *cuspidata*); Péringuey 1907: 79 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (= *cuspidata*).

Ichnestoma cuspidata cuspidata (Fabricius). Holm 1992: 377; Holm & Marais 1992: 33; Holm & Perissinotto 2011: 89; Beinhundner 2017: 1144

Remarks. This is the first species of *Ichnestoma* that was collected and described, already in the 18th century, from the immediate vicinities of the early settlement of Cape

Town. Indeed most records are currently available from old museum collections, while recent specimens appear to be extremely scarce. Males exhibit a stable presence of cretaceous markings along the elytral and pronotal margins, however these can vary substantially in extent from specimen to specimen and can even become virtually obsolete on rare occasions (cf, e.g. Beinhundner 2017, p. 1147). In some specimens, there may also be a residual presence of white markings on the clypeus and pygidium (Fig. 19 C, D). While most males exhibit black setation on their body surface, a significant minority shows dark-brown to testaceous setae across their entire body. The clypeal shape of the males is remarkably constant across the range of specimens analysed, with lateral margins tapering smoothly from base to apex, without any constriction or expansion beyond the bilateral invaginations (Fig. 19 A, D). The length of the clypeal armour, from the lateral expansion that follows the invagination to its apex, is always shorter than its maximum width. The anterior margin of the clypeus is invariably sinuate, even though the extent of the apical invagination is very variable. Females are brachypterous, with a W:E length ratio = 0.86. Size: male TL = 16.4-19.7 mm; MW = 8.5-10.2 mm (n =15); female TL = 15.7-19.6 mm, MW = 9.3-12.2 mm (n = 4).

Distribution. It is now evident that *I. cuspidata* is restricted to the lowland areas of the southern part of the Western Cape, just inland of the coastal belt (Fig 21E). It is current-

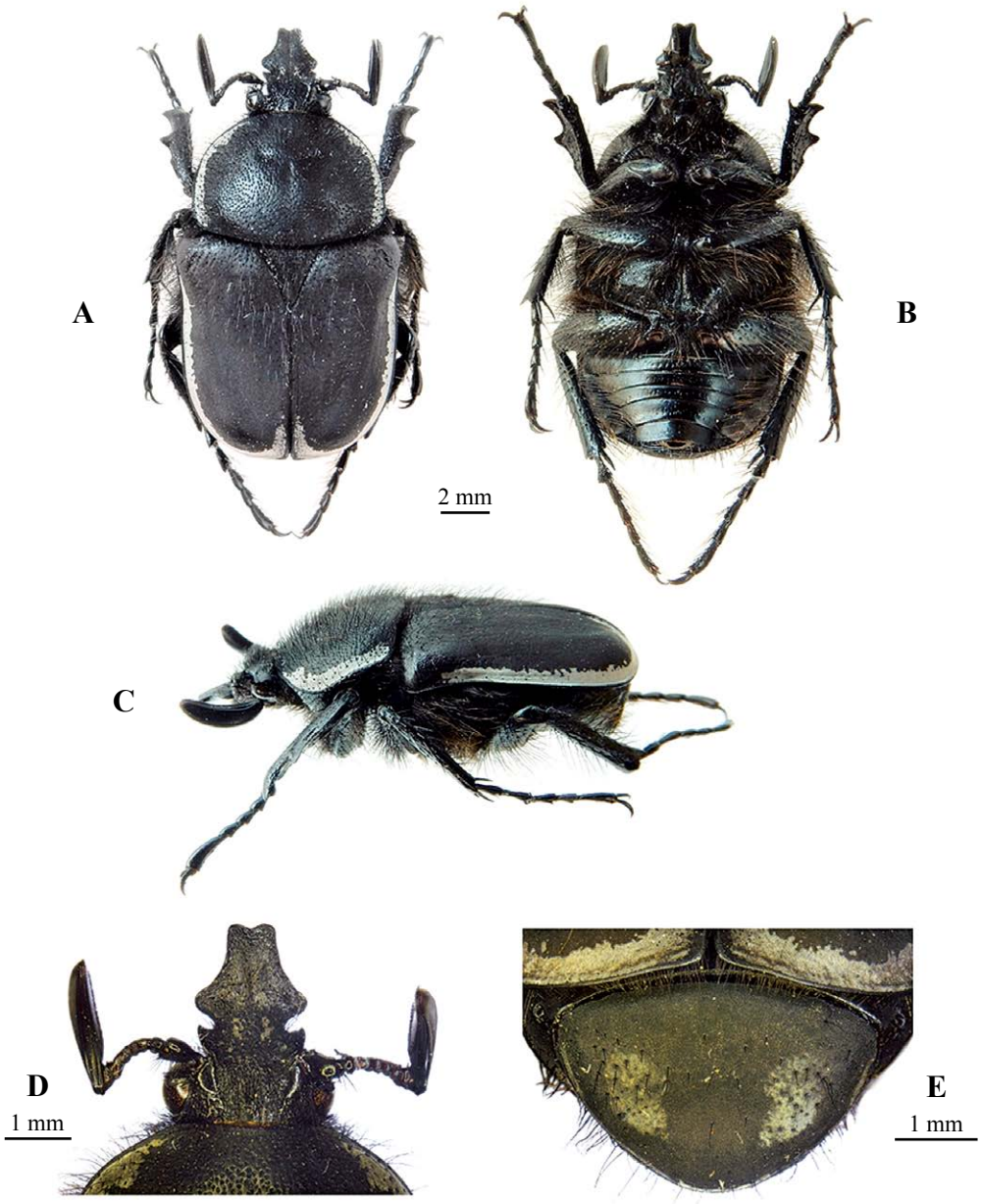

Fig. 15 – *Ichnestoma cuspidata* (Fabricius, 1787), male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

ly known from small populations occurring from the Haarwegskloof in the west to Riversdale in the east. As shown by the numerous historical records, the species was however much more abundant and widespread prior to the onset of commercial agriculture in the southern Cape, which resulted in the virtual elimination of its shale renosterveld vegetation. Inland, the Cape Fold Mountains have acted as an effective biological barrier that has led to the divergence of the northern populations into separate species. In the light of this review, previous records of this species extending to the Eastern Cape and to the Klein Karoo region of the Western Cape should be regarded as erroneous and most probably referred to different species described herein (cf. *I. furcata*, *I. spatulata* and *I. carbonaria*).

Biology. The habitat of *I. cuspidata* appears to be strictly limited to the Shale Renosterveld of the Eastern Rûens type, also known as coastal renosterveld. This vegetation is regarded as critically endangered, since about 90% of its total surface has already been transformed by cultivation (Mucina & Rutherford 2008). Both larvae, cocoons and adults of *I. cuspidata* have been observed under the surface around large bushes of renosterbos (*Dicerothamnus rhinocerotis*) or slangbos (*Stoebe plumosa*), where presumably larvae feed on the abundant leaf litter deposited by the vegetation (pers. obs.).

Data. Republic of South Africa: Holotypes: ♂ *albomarginata*, "Pr. b. sp." (ZMHB); ♂ *rufipes*, no data (HMUG)**.** Lectotypes: ♂ *cuspidata* (Holm, 1992), "Cap. b. spei." (SNMC); ♂ *heteroclyta* (Holm, 1992), no data (MNHN); ♂ *cordata* (Holm, 1992), "Cap" (SNMC). Paralectotypes: ♂ *cuspidata* (Holm, 1992), "Cap. b. spei." (UZIU); ♂ *cordata* (Holm, 1992), "Cap" (UZIU); ♀ *heteroclyta* (Holm,

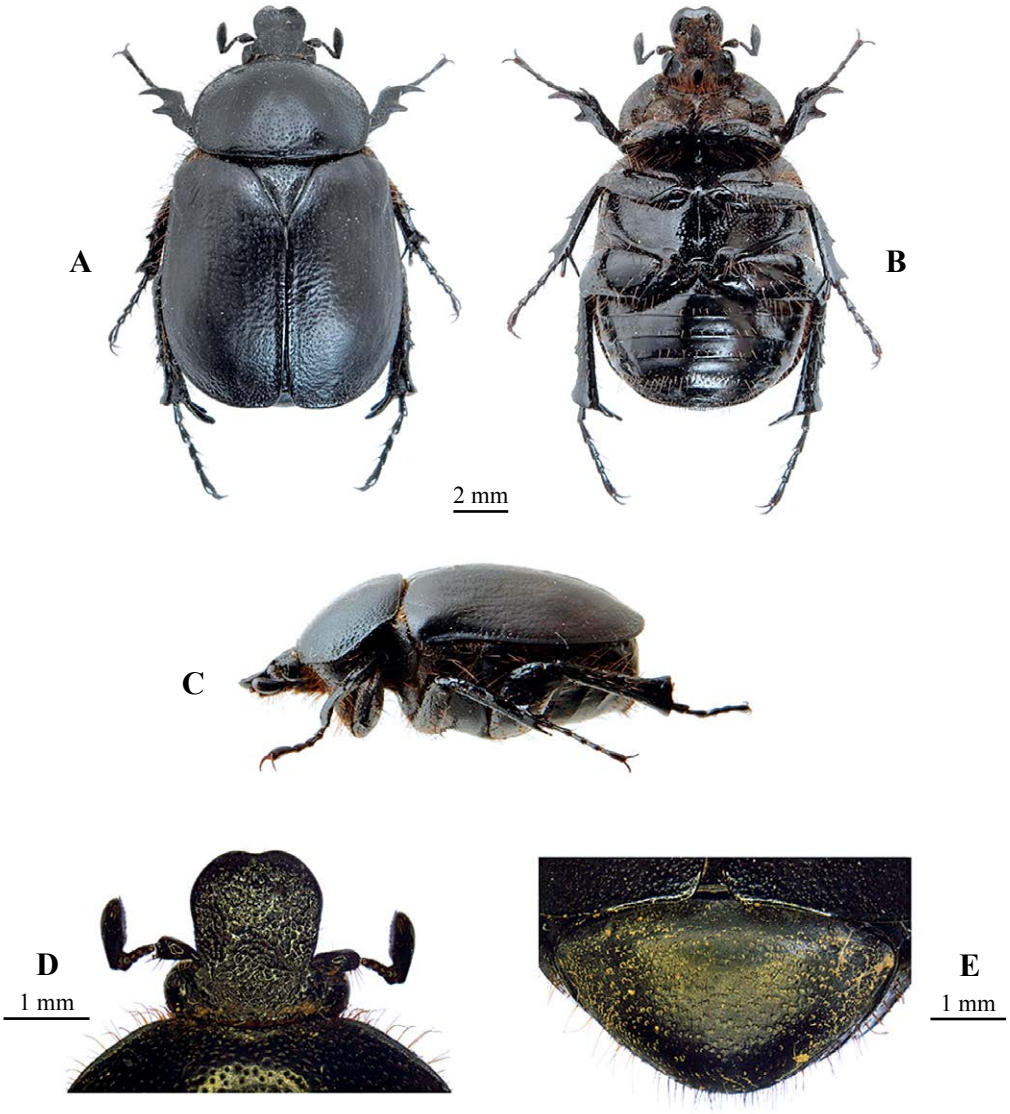

Fig. 16 – *Ichnestoma cuspidata* (Fabricius, 1787), female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

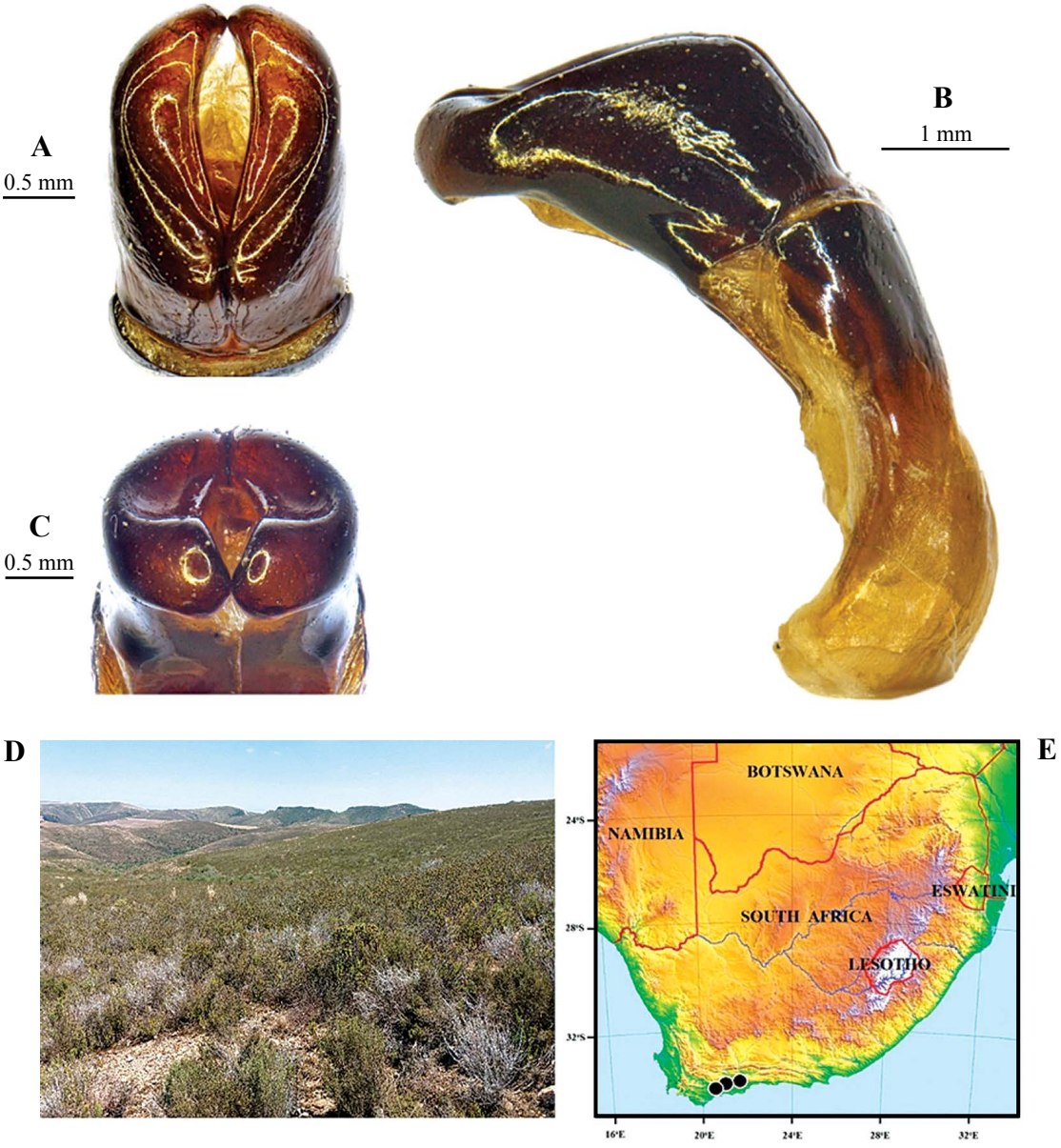

Fig. 17 – *Ichnestoma cuspidata* (Fabricius, 1787): **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Haarwegskloof Nature Reserve; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

1987), *Ichnestoma Heteroclyta*, "Appears to be typical" (BMNH-NHMUK014400040). Other material: 1♂, Riversdale, Feb 1891, R Lightfoot (ISAM COL-A026584); 1♂, Riversdale, Dr Melle, 1907 (ISAM COL-A026581); 1♂, Riversdale (DMSA 11615); 1♂, Zuurbrak Peak, Swellendam, Feb 1932, KH Barnard (ISAM COL-A026583); 2♂♂, no data (ISAM COL-A026581, COL-A026577); 2♂♂, 1♀, "Kapland" (MDPC); 1♂, South Africa, Riversdale (DMSA-11615); 1♂, Bourgoin Coll., B.M. 1938-252 (BMNH-NHMUK014400035); 1♂, C. Bon. Spei, Fry Coll., 1905-100, *cuspidata* Fabr., L.H. Duyrolle (BMNH-HMUK014400036); 1♂, Riversdale, Cap, Bourgoin Coll., B.M. 1938-252, *I. cuspidata* F., Afr. O. (BMNH-HMUK014400039); 1♂, Cape of Good Hope, C.E. Tottenham Collection, B.M. 1969-77, *Ischnostoma cuspidata* F. (BMNH-HMUK014400038); 1♂, Cap, Nevinson Coll., 1918-14 (BMNH-HMUK014007141); 1♀, S. Afric, ? *cuspidata* ♀, 85/28, *Ischnestoma* sp. ♀, J.Ph. Legrand det. Aug 2009 (BMNH-HMUK014007142); 1♂, No Data (NS)(Sakai & Nagai 1998-No. 474); 2♂♂, Cape, RSA, Prost leg (TGPC); 1♂, South Africa, WC, Haarwegskloof, 08 Mar 2016, H. Groenewald leg. (TGPC); 1♂, 3♀♀, *ibidem* 9 Feb 2018, dead on ground (pers. obs.); 3♂♂, 1♀, Haarwegskloof Renosterveld Reserve, 6 Feb 2015, J. Groenewald [2♂♂+1♀ dead on ground] (https://www.inaturalist.org/observations/11038578).

***Ichnestoma dealbata* sp. nov.** (Figs 7-8, 18-20)

Diagnosis. Within the *cuspidata* spp-complex, this species stands out for the unique features of its clypeus, which is constricted laterally in the middle, then anteriorly expanded in the male but contracted in the female (Figs 7, 18, 19). Along with *I. coetzeri, I. dealbata* is also the only species of the group to exhibit a substantial infusion of white cretaceous markings on the clypeus, and residual markings on the lateral margins of the scutellum. Its aedeagal shape is also unique within this group, showing the most extensive incavations in dorsal view (Fig. 8). On the other hand, superficially males of *I. dealbata* resemble remarkably those of *I. cochleata* from the *albomaculata* spp-complex. This is particularly evident at the level of the clypeus, which is similarly constricted at middle and covered in extensive white markings on frons and vertex in both species (Fig. 7). The apical sinuation, however, is only moderately de-

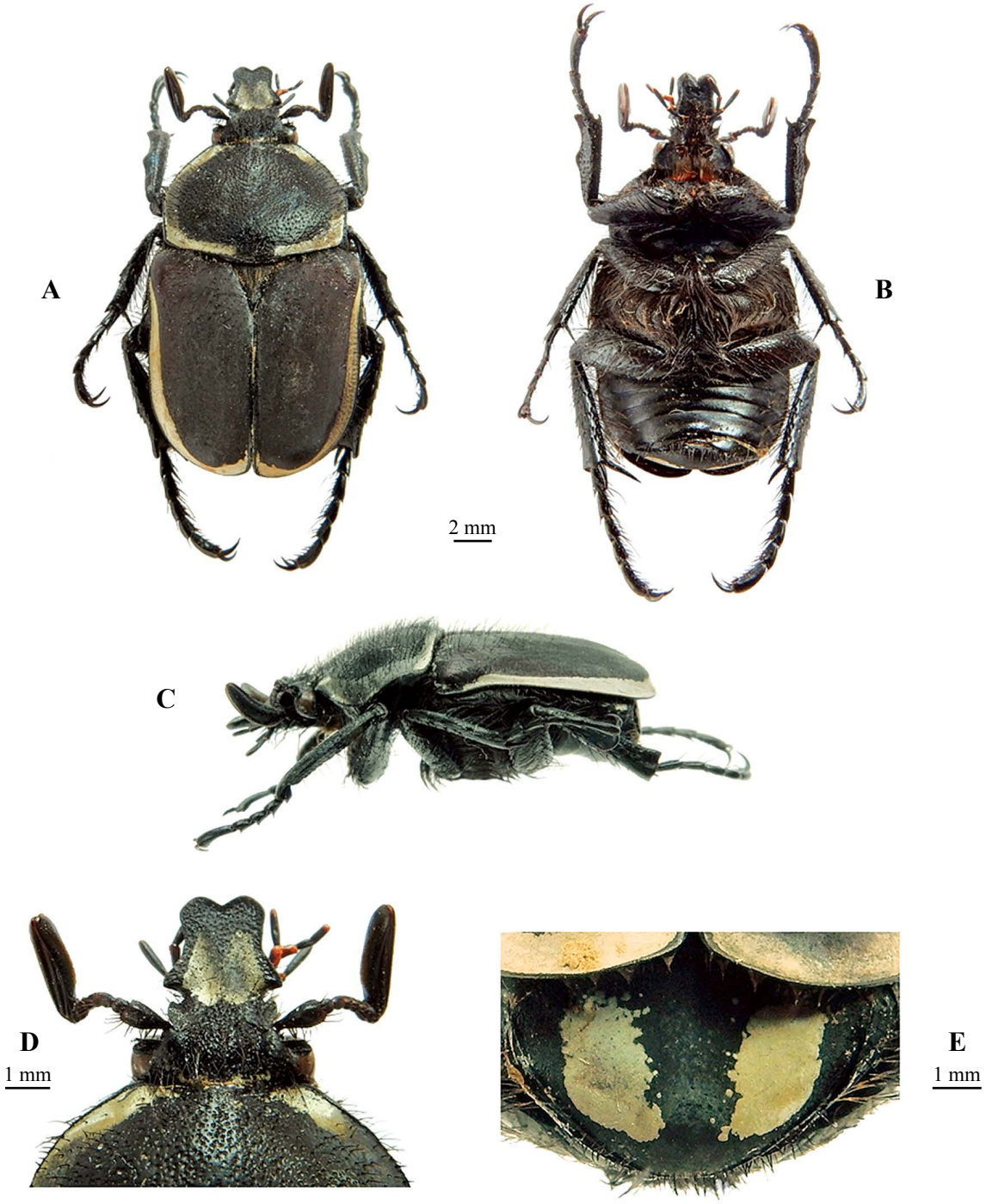

Fig. 18 – *Ichnestoma dealbata* sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

veloped in *I. cochleata*, but very pronounced in *I. dealbata*. Their parameres also differ significantly, as despite having similar incisions on their dorsal lobes, those of *I. dealbata* lack the dark ridge with spinal projection on their inner margin (Fig. 8). This, is on the other hand, a defining character of the *albomaculata* spp-complex, to which *I. cochleata* belongs.

Description of holotype male (Figs 18 A-E, 20 A-C)

Size. Length 20.9 mm; width 10.2 mm.

Body. Black to dark brown, with wide cretaceous markings on pronotal and elytral margins, clypeus, scutellum and pygidium (Fig. 18 A); round punctures and black setae dense on head and pronotum, but scattered on elytra and present only on basal mid half, around scutellum and along entire suture (Fig. 18 A, C, D).

Head. Black, with dense round sculpture and long black setae on vertex and frons; clypeus moderately elongate and asetose, with deep sinuation at apex and slightly raised margins, laterally constricted at middle and then expanding again towards apex, exhibiting slight convexity at centre with infusion of cretaceous markings reaching base of frons, moderately developed lateral invaginations and spinal projections (Fig. 18 D); antennal club, pedicel and flagellum black to dark brown; antennal club hypertrophic and as long as pedicel and flagellum combined.

Pronotum. Black with wide cretaceous lining on all margins, except central area of anterior and posterior mar-

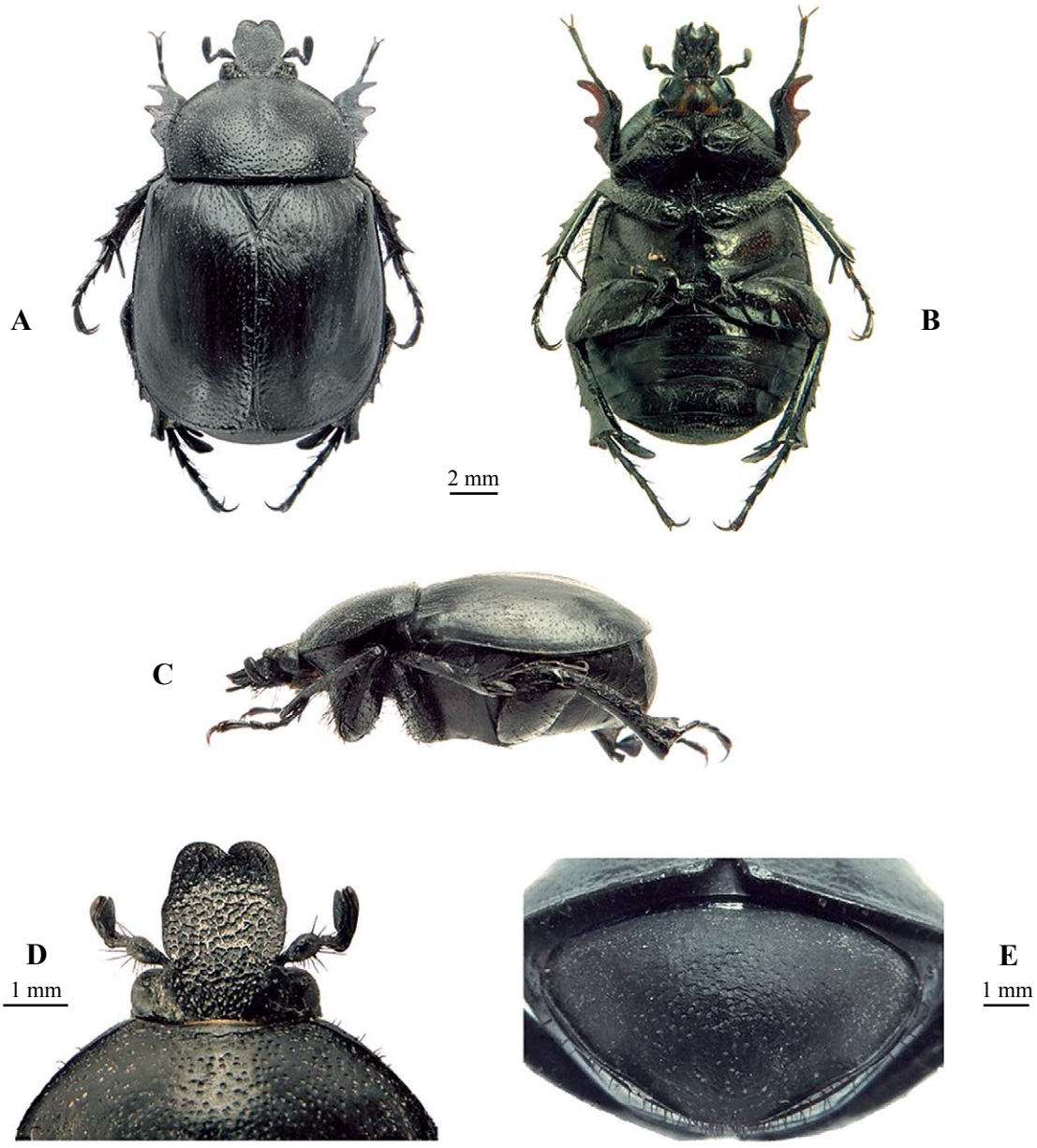

Fig. 19 – *Ichnestoma dealbata* sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

gins; smoothly heptagonal in shape (Fig. 18 A); without any protuberances but reborded on all margins; small but dense round punctures throughout surface except over cretaceous margins, with thin black, medium to long setae emerging at centre of each puncture (Fig. 18 A, C).

Scutellum. Black but with disk and base covered in white cretaceous markings and long setae; isoscelic triangular with sharply pointed apex and wide lateral grooves (Fig. 18 A).

Elytron. Very dark brown to black and velutinous, with white cretaceous lining along all external margins, widest around apical callus and narrowing gradually towards humeral callus; with costae obsolete and without macrosculpture, but long black setae scattered on basal half around scutellum and along entire suture; apex smoothly rounded and without any spinal projection (Fig. 18 A).

Pygidium. Black and matte, with two symmetric mid-lateral white maculae covering about half of the total surface; roundly triangular in shape and with lining of long black setae around apical margins (Fig. 18 E).

Legs. Black, with tarsal segments hypertrophic; with black setae increasing in density and length from pro- to metalegs; tibiae with coarsely round to irregular sculture across external surfaces; protibia bidentate, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 18 A-C).

Ventral surface. Black and shiny, covered in dense and

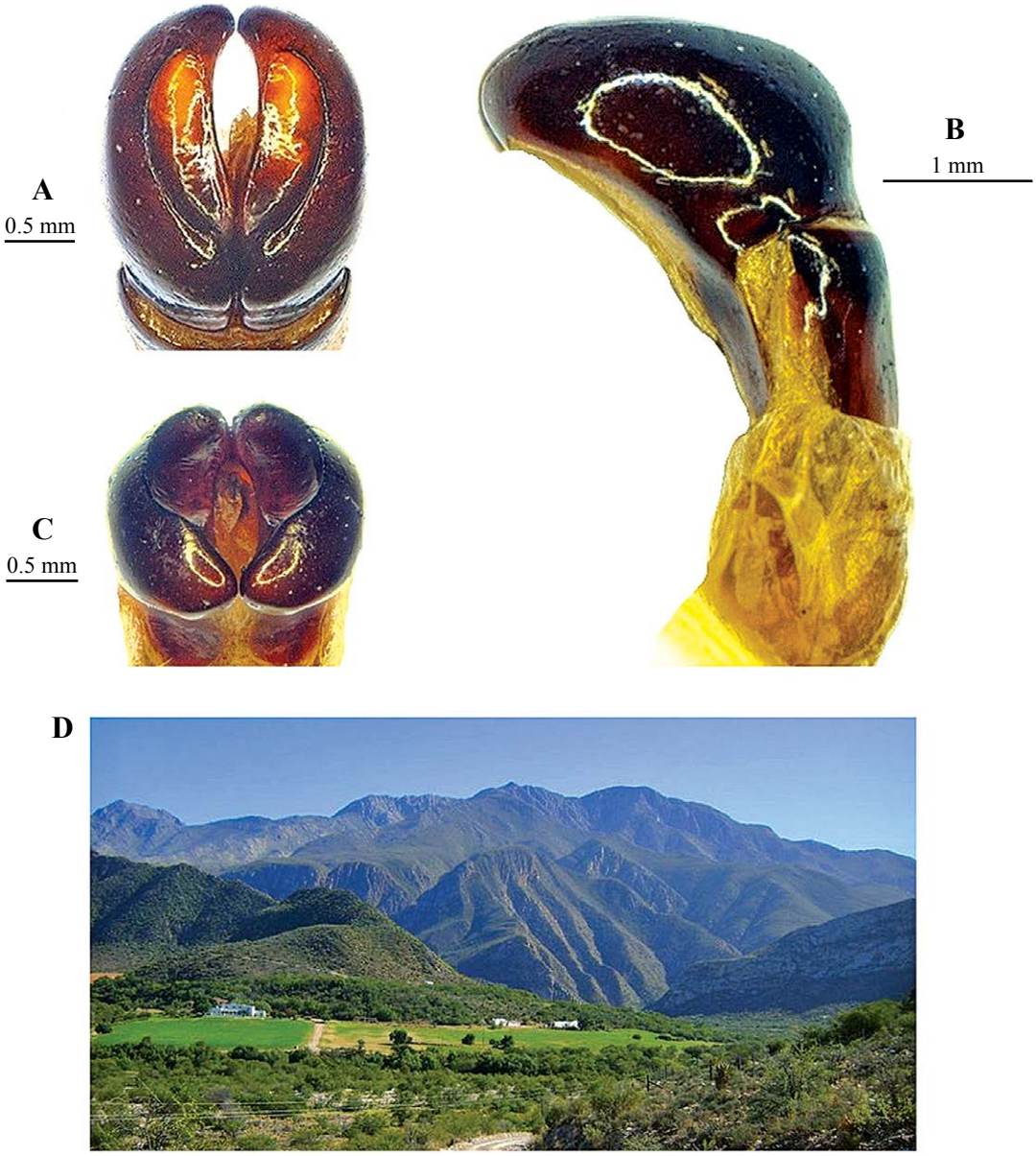

Fig. 20 – *Ichnestoma dealbata* sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, habitat area at the base of the Swartberg range, near Calitzdorp. Photographs: A-C by Lynette Clennell; D from lovecamping.co.za.

long black to brown setae, except on abdominal sternites, metasternum, femoral and coxal bases; mesosternal lobe small and not protruding, with central groove continuing into median sulcus of metasternum, with dense sculpture and long setae across entire surface; metasternal lobe with scattered round punctures and long black setae; abdominal sternites markedly concave and with scattered short setae only on 1-3 (Fig 18 B).

Aedeagus. In dorsal view, the parameres of *I. dealbata* are regularly elliptical in shape, and exhibit sausage-shaped incavavation on each lobe (Fig. 20 A). In frontal view, the lobes are rather smoothly rounded at apex, with both dorsal and ventral protuberances virtually obsolete (Fig. 20 C).

Derivatio nominis. This species is named after the extensive infusion of white cretaceous markings that its males exhibit across the dorsal surface and on the pygidium (Fig 18 A, C-E). This includes large patches on the clypeal frons, full marginal contours around pronotum and elytra, as well as large spots on pygidium and occasionally even residual marking on the scutellum.

Description of female (Figs 7, 19). The only female specimen currently known for this species exhibits a relatively short and markedly sinuate clypeus. Also, the lateral margins of this clypeus are constrained in the apical half, imparting an unique disjunct shape to this body part. It is not known, however, if this is a consistent feature among specimens, and therefore of diagnostic value, or rather an individual anomaly. The most salient features of the female of *I. dealbata* can be summarised as follows. a) Body black and shiny, with sparse short black setae only around margins and shallow coarse to round punctures on head, pronotum and scutellum, becoming smaller and more scattered on elytra; b) clypeus moderately elongate, concave and with marked sinuation at apex, with margins wider in basal than in apical half due to constriction; c) pronotum globose, covered in dense but small round punctures and exhibiting sparce black setae on lateral margins; d) scutellum equilateral triangular, with round to oblong punctures but no setae; e) elytra black, with irregular sculpture and weak costal markings; f) brachypterous, with wing size = 8.9 mm and W:E ratio = 0.85; g) pygidium black and asetose, with shallow round to rugose sculpture; h) tarsal segments slim and moderately hypertrophic, protibiae tridentate, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with small round to irregular punctures across entire surface, becoming very sparse on abdominal sternites, which are markedly convex.

Distribution. *Ichnestoma dealbata* is so far only known from one locality a few kilometres South of the base of the Swartberg range, near the Western Cape town of Calitzdorp. There are several river gullies in the area, but only one of these appear to host the species. It is thus the species with the easternmost range among all those included in the *cuspidata* species-complex.

Biology. This species appears to be ecotonal, associated with elements of both the Succulent Karoo and the Fynbos biomes, and possibly even the Albany Thicket (JB Ball, pers. comm.). The bioregions involved in this area are the Rainshadow Valley Karoo, the Kango Limestone Renosterveld and the Gamka Thicket (Mucina & Rutherford 2006). The phytogeography is characterized by 'incisions' into the landscape caused by river gullies and the curvilinear nature of the Cape Fold Mountains. While there are patches of renosterbos (*Dicerothamnus rhinocerotis*), growing slightly upslope, succulents are most prominent and represented mainly by spekboom (*Portulacaria afra*), *Aloe* spp., *Crassula orbicularis, Gasteria* spp. and *Haworthia* spp. (JB Ball, pers. comm.). Trees of *Rhus* spp. and thickets of *Carissa bispinosa* are also common in the gullies. This clearly separates ecologically *I. dealbata* from all the other species of the *cuspidata* complex, which are strictly linked to renosterveld habitats.

Remarks. The small series collected so far exhibits a remarkable stability in the shape of the clypeus and extent of white cretaceous infusions on the dorsal part of the male body. Within the type series analysed in this study, the size ranges as follows: male TL = 19.4-21.1 mm, MW = 9.3-10.1 mm (n = 5); female TL = 18.3 mm, MW = 10.7 mm (n = 1).

Data. Republic of South Africa: Holotype: ♂, W. Cape Prov., Calitzdorp Dist., Paardekloof 391 m, 1 Jan 2016, J.B. Ball leg (ISAM). Paratypes: 2♂, 1♀, *idem* (BMPC); 2♂, *ibidem* 6 Jan 2014 (BMPC).

***Ichnestoma karoominoris* sp. nov.** (Figs 7-8, 21-23)

Diagnosis. This species obviously forms part of a shared lineage with *I. cuspidata,* with the two species being physically separated by the Langeberg range of the Cape Fold Belt. The key differences between them lie in the structure and shape of the parameres and the male clypeus.

In dorsal view, the lobes of the parameres of *I. karoominoris* are less elliptical and more widened at base, compared to those of *I. cuspidata*. The incavations on the lobes of the former species are also shorter and generally more constrained than in the latter (Fig. 8). In frontal view, the lobes of *I. karoominoris* are substantially narrower and lack in dorsal protuberance, by comparison with those of *I. cuspidata*. Concerning clypeal differences, in both sexes the total length of the clypeus is significantly greater in *I. karoominoris* than in *I. cuspidata,* with the tapering from base to apex and apical sinuations of the male being more marked in the latter than in the former species (Fig. 7).

Description of holotype male (Figs 21 A-E, 23 A-C)

Size. Length 19.9 mm; width 10.0 mm.

Body. Black to very dark brown, with well-developed white cretaceous markings on pronotal and elytral margins as well as pygidium, but only residual markings on clypeal base and scutellar lateral margins (Fig. 21 A); head, pronotum and scutellum densely covered in round punctures and black setae, but elytra only on basal mid half, around scutellum and suture (Fig. 21 A, C, D).

Head. Black, with round punctures exhibiting long black setae at centre on vertex and frons, but sculpture becoming coarse and irregular on clypeus; clypeus elongate and asetose, with weak sinuation at apex and slightly raised margins, but not exhibiting concavity at centre, with moderate lateral invaginations and spinal projections as well as residual cretaceous markings at base of invaginations (Fig. 21 D); antennal club, pedicel and flagellum black to dark brown; antennal club hypertrophic and slightly longer than pedicel and flagellum combined.

Pronotum. Black with wide cretaceous lining on all margins, except central area of apical margin; smoothly octagonal in shape (Fig. 21 A); without any protuberances but reborded on all margins; posterior margin forming slightly arcuate line in front of scutellum; small but dense round punctures throughout surface, with thin black, medium to long setae emerging at centre of each puncture (Fig. 21 A, C).

Scutellum. Entirely black; isoscelic triangular with

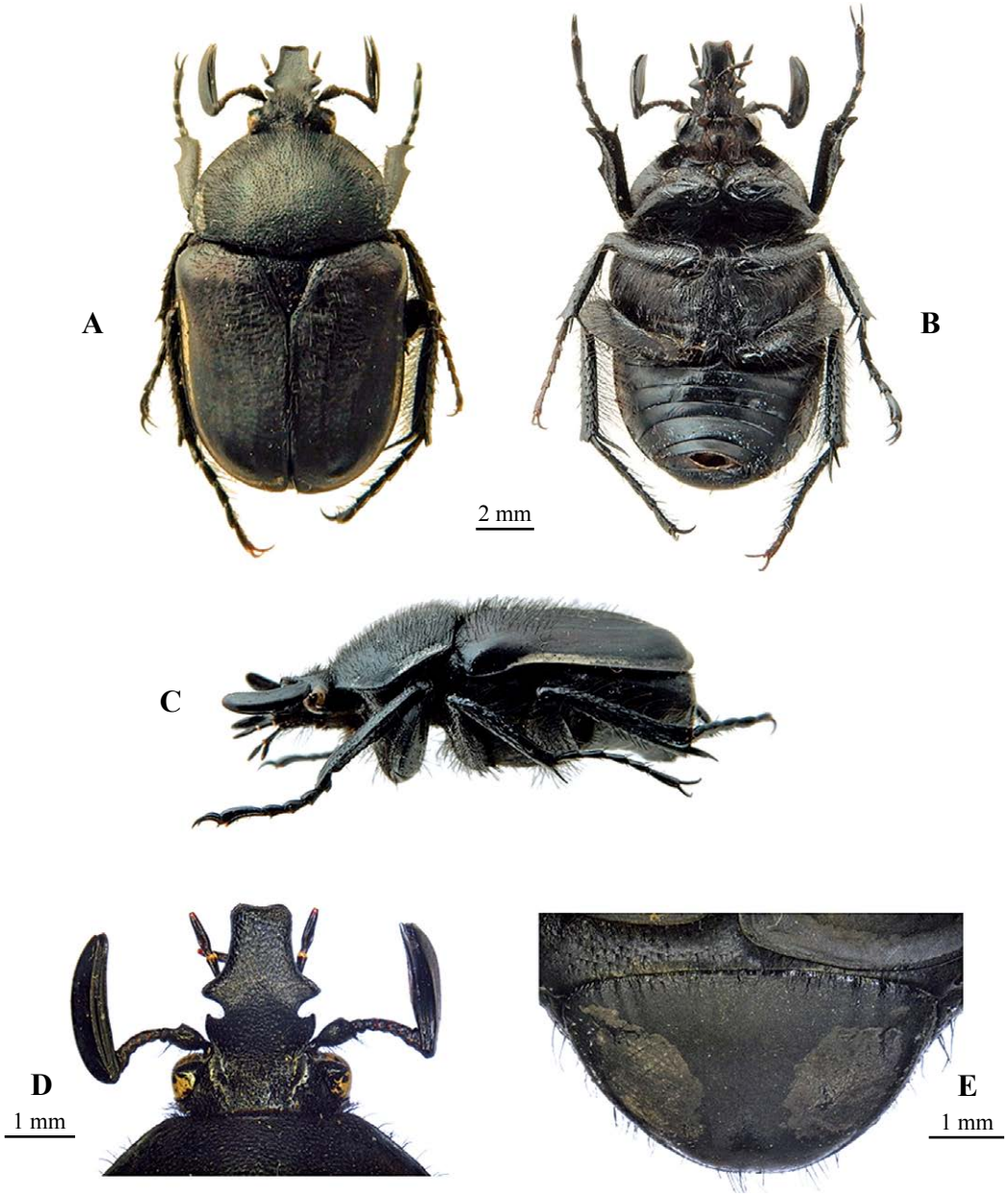

Fig. 21 – *Ichnestoma karoominoris* sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

sharply pointed apex and wide but shallow lateral grooves; with residual cretaceous markings on lateral margins and long black setae across entire surface (Fig. 21A).

Elytron. Very dark brown to black and velutinous, with white cretaceous lining along all external margins, except around humeral callus; with costae obsolete and without macrosculpture, but exhibiting dense, long black setae on basal half around scutellum and also along entire suture, albeit more scattered and shorter; apex forming blunt right angle, without any spinal projection (Fig. 21 A).

Pygidium. Black and matte, with two symmetric mid-lateral white maculae; roundly triangular in shape, with narrow groove followed by ridge at margins; with cluster of thick and long setae around apical margins (Fig. 21 E).

Legs. Completely black, with tarsal segments hypertrophic; with black setae increasing in density and length from pro- to metalegs; tibiae with coarsely round to irregular sculture across external surfaces; protibia bidentate, meso- and metatibia with obsolete mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 21 A-C).

Ventral surface. Black, shiny and covered in dense and long black to dark brown setae, except on most surface of abdominal sternites, metasternum, femoral and coxal bases; mesosternal lobe with concavity at centre continuing into median sulcus of metasternum, with dense round punctures and long setae across entire surface; metasternal lobe with roundish concave expansion posteriad of medi-

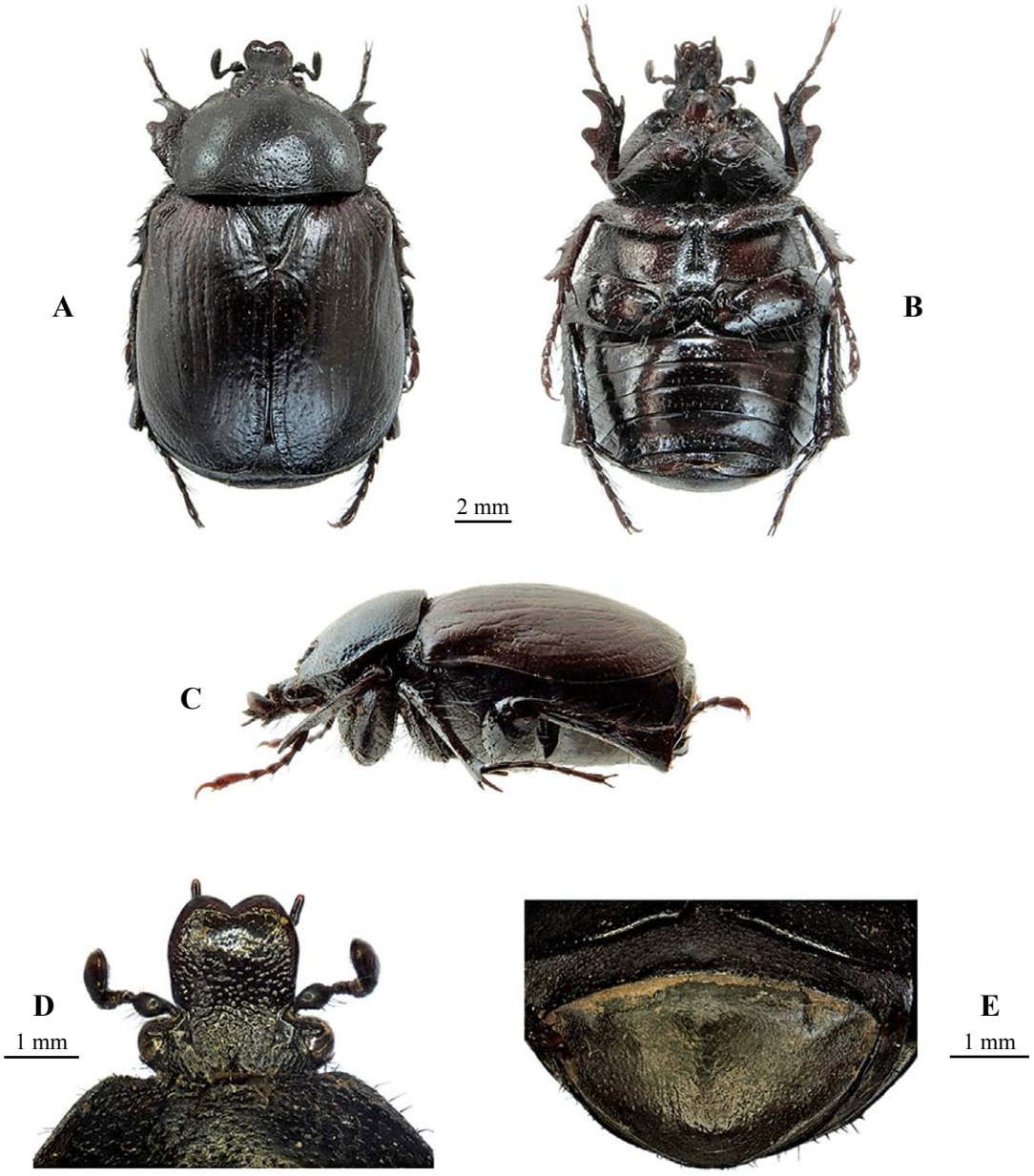

Fig. 22 – *Ichnestoma karoominoris* sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

an sulcus; abdominal sternites with marked concavity and scattered short setae at middle (Fig. 21 B).

Aedeagus. In dorsal view, the lobes of the parameres of *I. karoominoris* are roughly elliptical in shape, but rather widened at base. The incavations on the dorsal lobes are relatively short and extremely narrow at base, almost forming a sharp point (Fig. 23 A). In frontal view, the lobes are rather narrow at apex and exhibit only a ventral protuberance (Fig. 23 C).

Derivatio nominis. This species seems to be restricted to the marginal areas of the Little Karoo region of the Western Cape, hence the tentative Latinization of its name as "*karoominoris*".

Description of female (Figs 7, 22). As already mentioned above, the female of *I. karoominoris* is remarkably similar to that of the other species of the same group and thus not diagnosable using external morphology alone. The most salient features of the female of *I. karoominoris* can be summarised as follows. a) Body black to dark brown and shiny, with sparse short black setae only around margins and shallow coarse to round punctures on head, pronotum and scutellum, becoming smaller and more scattered on elytra; b) clypeus elongate, straight to gently rounded laterally, concave and with sinuation at apex; c) pronotum globose, covered in dense round punctures and short black setae on lateral margins; d) scutellum equilateral tri-

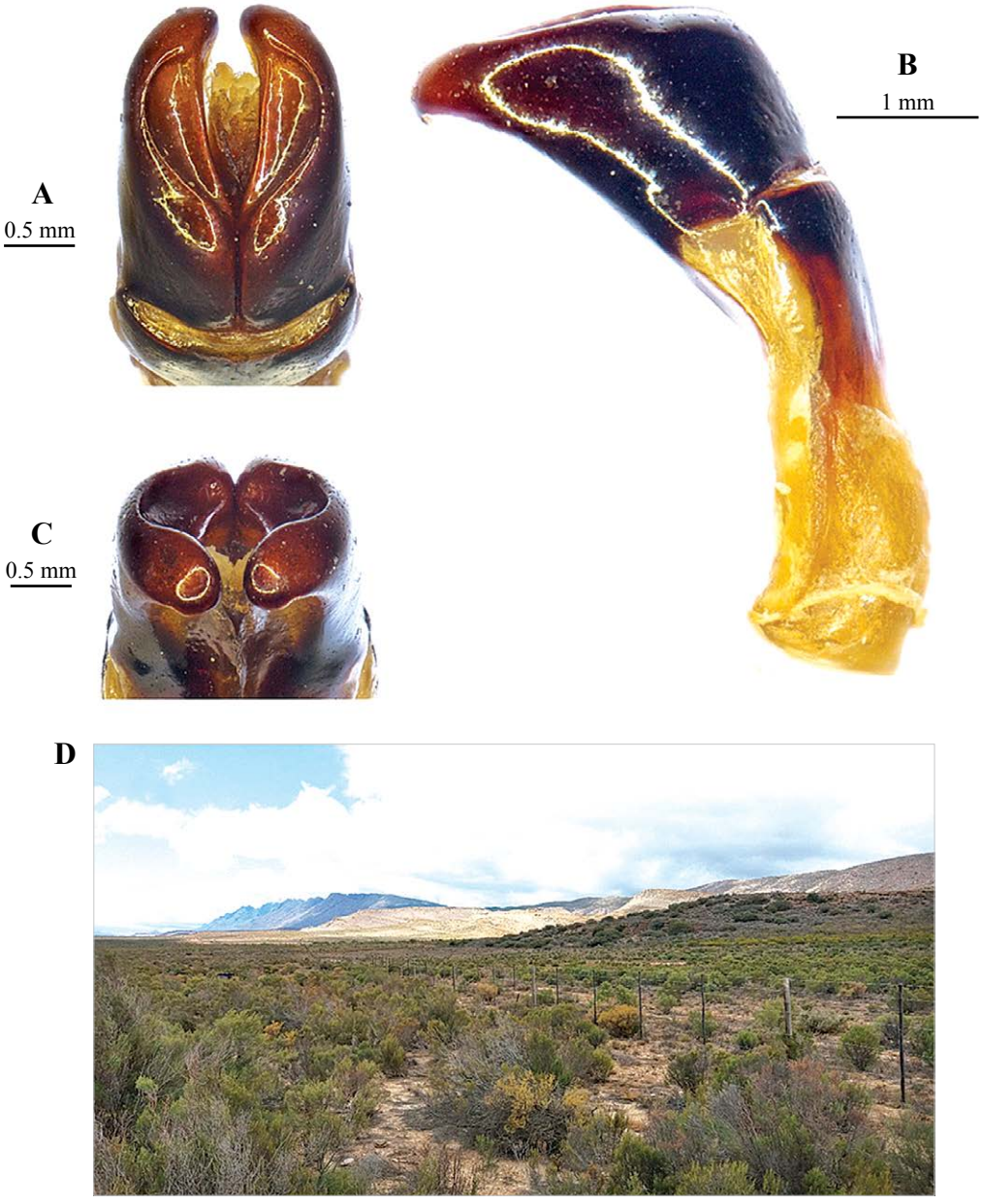

Fig. 23 – *Ichnestoma karoominoris* sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the renosterveld valley below the Garcia Pass. Photographs by Lynette Clennell.

angular, with numerous round punctures but no setae; e) elytra dark brown to black, with irregular sculpture and weak costal markings; f) brachypterous, with wing size = 9.8 mm and W:E ratio = 0.89; g) pygidium black and asetose, with shallow but dense round puncutres; h) tarsal segments slim and moderately hypertrophic, protibiae tridentate, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with small round punctures across entire surface except abdominal sternites, which are slightly convex.

Distribution. *I. karoominoris* is currently known from the ronosterveld valley just to the north of the Garcia Pass in the Western Cape (Fig. 23 E). The area is isolated from the coastal lowlands between Swellendam and George to the south, by the long and uninterrupted Langeberg mountain range. The region between the Langeberg and the Swartberg is semiarid in nature and constitutes the Little Karoo. It is thus very likely that the species may also occur in other parts of this relatively vast region.

Biology. *Ichnestoma karoominoris* inhabits the Montagu Shale Renosterveld bioregion (Mucina & Rutherford

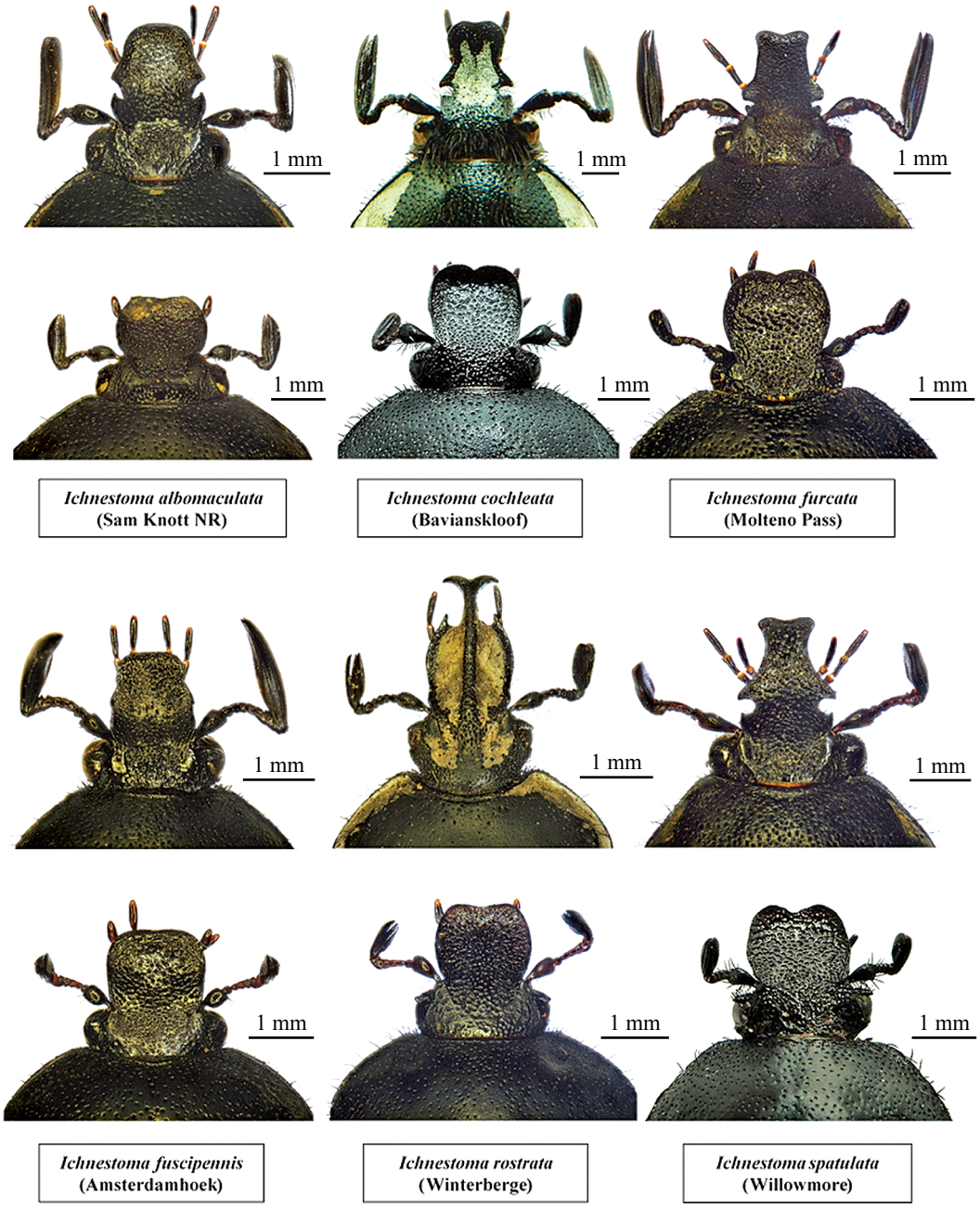

Fig. 24 – Comparative clypei of the *Ichnestoma albomaculata* species-complex.

2006) at the margins of the Little Karoo. This is significantly different to the Coastal Renosterveld inhabited by *I. cuspidata,* in that it exhibits a climate characterized by hotter but drier summer conditions and the vegetation is dominated by tall shrubland where renosterbos (*Dicerothamnus rhinocerotis*) clearly prevails, but transitions with Succulent Karoo units also occur (Mucina & Rutherford 2006). The typical landscape is dominated by undulating hills alternated with broad valleys.

Remarks. Although the type locality of this species lies just about 15 km to the north of Riversdale, which is a well known place of occurrence of the closely related species *I. cuspidata*, the two species are remarkably different in their aedeagal shape (Fig. 8) and other morphological characters. This is obviouisly due to the Langeberg range, characterized by sandstone fynbos vegetation which acts as an effective divide between their respective habitats, situated to the north and to the south of it. There is very little varia-

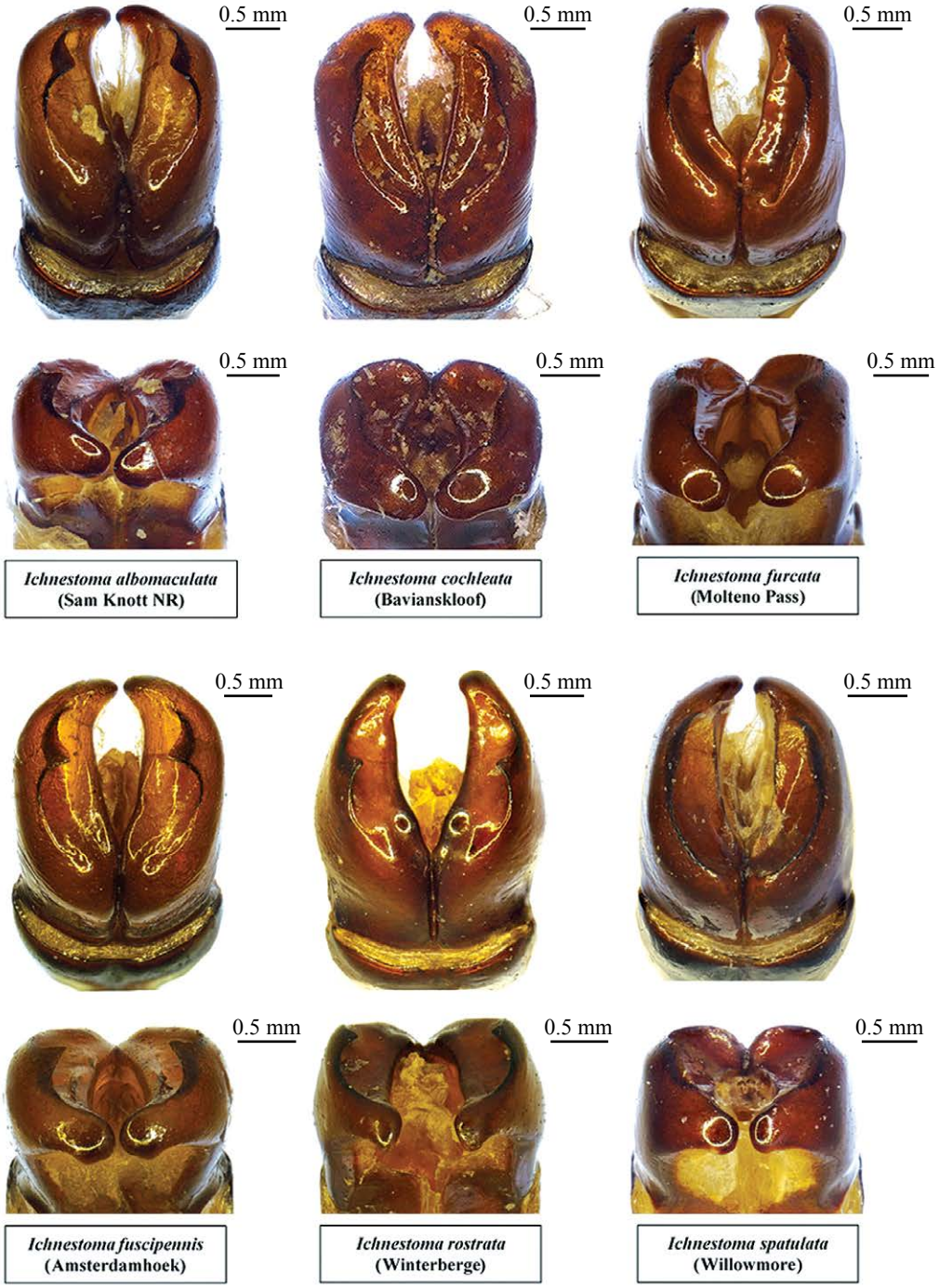

Fig. 25 – Comparative aedeagi of the *Ichnestoma albomaculata* species-complex.

tion in the extent of the dorsal white markings in the male specimens of *I. karoominoris*, with extreme cases showing only partial fading on elytra margins and pygidium (Fig. 21 A, C, D). Within the type series analysed in this study, the size ranges as follows: male TL = 16.9–19.6 mm, MW = 8.7–10.4 mm (n = 7); female TL = 16.4–19.8 mm, MW = 9.8–10.7 mm (n = 4).

Data. Republic of South Africa: Holotype: ♂, WC, Garcia Pass, 12 Jan 2014, found dead on ground, R. Perissinotto & L. Clennell (ISAM). Paratypes: 5♂♂, 1♀, *idem* (BMPC, TGPC); 1♂, *ibidem*, 13 Jan 2014 (BMPC); 2♂♂, 3♀♀, *ibidem* 24 Jan 2015 (ex larva, emerged in Port Elizabeth) (TMSA, TGPC); 1♀, *ibidem*, 16 Mar 2016; S. Afr. 44-6, Dr. Smith, *Ichnestoma pica*, Cape Smith (BMNH-NHMUK014400060)

Ichnestoma albomaculata species-complex

Key characteristics

1) Dorsal lobes of aedeagus with deep incavations and dark ridge with spinal projection on inner margin;
2) both male and female clypeus progressively elongating form lowland species (*I. fuscipennis*) to high altitude dwellers (*I. furcata*, *I. rostrata*);
3) pygidium velutinous with only ultrafine sculpture in both sexes;
4) widely distributed in Eastern, Western and Northern Cape, across a south-north gradient from near-coastal lowland to high mountain habitats above the Great Escarpment;
5) six species are known so far in this complex: *I. albomaculata, I. cochleata, I. furcata, I. fuscipennis*, *I. rostrata, I. spatulata*;
6) species-complex named after *I. albomaculata*, the first species to be historically recognised and described within this group.

Key to species

1. Male clypeus hypertrophic, with apex furcate and with extensive cretaceous markings on frons; dorsal lobes of parameres wide oval in dorsal view; female W:E ratio = 0.70; female clypeus with smoothly rounded lateral margins and mildly sinuate apex; medium to large species ≈17-23 mm TL; distribution: EC, WC, NC (above Great Escarpment) ..... *I. rostrata* (Janson, 1878)
- Male clypeus moderately elongate, apex furcate, sinuate or straight, with or whithout white cretaceous markings on frons 2
2. Male clypeus with apex wide and straight to slightly sinuate, without white markings on frons 3
- Male and female clypeus both sinuate at apex, male with white markings on frons; dorsal lobes of parameres rounded exagonal in dorsal view; female W:E ratio = 0.81; female clypeus elongate with slightly rounded lateral margins; medium to large species ≈19-22 mm TL; distribution: EC (Baviaanskloof) ..... *I. cochleata* Holm & Perissinotto, 2011 stat. nov.
- Male clypeus with apex furcate, deeply sinuate in female, without white markings on frons 4
3. Male clypeus with basolateral invaginations narrow but fully developed; dorsal lobes of parameres round hexagonal in dorsal view; female W:E ratio = 0.80; female clypeus with smoothly rounded lateral margins and slightly sinuate apex; medium to large species ≈17-23 mm TL; distribution: EC, WC (Cape Fold Mountains) ..... *I. albomaculata* Gory & Percheron, 1833
- Male clypeus with basolateral invaginations absent or obsolete, dorsal lobes of parameres wide ellyptical in dorsal view; female W:E ratio = 0.84; female clypeus with lateral margins parallell and slightly sinuate apex; medium species ≈16-20 mm TL; distribution: EC (Swartkops River to Addo Heights) ..... *I. fuscipennis* Holm, 1992 stat. nov.
4. Male clypeus short and wide, slightly concave at apex; pronotal white lining generally extending from lateral to postero-lateral margins; dorsal lobes of parameres rounded rectangular in dorsal view; female W:E ratio = 0.94; female clypeus with lateral margins smoothly rounded and lightly sinuate apex; medium to large species ≈19-22 mm TL; distribution: WC (Molteno Pass) ..... *I. furcata* sp. nov.
- Male clypeus elongate and constricted anteriourly, flat across whole surface; pronotal white lining restricted to lateral margins; dorsal lobes of parameres oval in dorsal view; female W:E ratio = 0. 91; female clypeus with lateral margins smoothly angled and deeply sinuate apex; medium species ≈18-20 mm TL; distribution: EC (Boesmanspoortberg) ..... *I. spatulata* sp. nov.

Ichnestoma albomaculata Gory & Percheron, 1833

(Figs 24-25, 26-28)

Ichnestoma albomaculata Gory & Percheron, 1833: 302.

Ischnostoma albomaculata Gory & Percheron: Peringuey 1907: 374 (= *cuspidata*); Schenkling 1921: 79 (= *cuspidata*); Allard 1991: 100 (subsp. *cuspidata*).

Ischnostoma tristis Schaum, 1844: 393; Peringuey, 1907: 374 (= *cuspidata*); Schenkling, 1921: 79 (= *cuspidata*); Allard, 1991: 100 (= *cuspidata albomaculata*).

Ichnestoma albomaculata albomaculata Gory & Percheron; Holm 1992: 376; Holm & Marais 1992: 30; Beinhundner 2017: 1143.

Remarks. While the general external morphology and aedeagal shape of this species remain constant across its relatively large distribution range, the colour pattern in males ranges substantially in terms of the extent of its cretaceous markings. This can vary from full marking along the lateral and posterior margins of pronotum, intercostal stripes along the elytral surface and symmetric spots on pygidium, to completely black forms. The latter are rather scarce though and generally restricted to the western (e.g. Antoniesberg, Baviaanskloof) margins of its distribution range. The brachypterous female exhibits a W:E length ratio = 0.82. Size: male TL = 16.8-23.2 mm, MW = 9.2-11.4 mm (n = 32); female TL = 17.4-20.8 mm, MW= 11.1 – 12.8 mm (n = 12).

Distribution. The species occurs in the valleys and lower slopes of the Cape Fold Mountains. It is virtually restricted to the Eastern Cape Province, from Graaf-Reinet to Gra-

hamstown, but has also been recorded at Uniondale and Antoniesberg in the Western Cape (Fig. 28E). The two records from the northwestern Drakensberg area (i.e. Witteberg, EC and Mamathes, LES) are included here for completeness, but should be taken with great caution as they have not been confirmed and there are concerns about the interpretation of the writing on the specimens' labels.

Biology. Both larvae and cocoons (often with adult specimens ready to emerge inside) have been unearthed from under relatively large bushes, generally of renosterbos (*Dicerothamnus rhinocerotis*). Larvae utilize mostly the abundant leaf litter accumulated there, but on occasion they have also been observed consuming dry cow dung, at the interface with the soil (pers. obs.). The species occurs sympatrically with *I. rostrata* in the Driekoppe area of the Camdeboo National Park (Graaff-Reinet) and with *I. spatulata* in the Boesmanspoortberg near Willowmore.

Data. Republic of South Africa: Holotypes: ♂ *albomaculata*, no data (MHNG); ♂ *tristis*, **'**Caffria' (MHNG). Other material: 1♂, Brakkloof, Feb 1896, Mrs White (ZSMC); 5♂♂, 2♀♀, Capland, Willowmore, 21 Dec 1921, Dr Brauns (DMSA-11616, DMNH-CPH7915); 4♂♂, 3♀♀, Resolution, Albany Distr, Jun 1928, A. Walton (DMSA-11617, DMNH-CPH7919); 1♂, *ibidem,* Jan 1929 (DMNH-CPH7920); 1♂, no data (DMNH-CPH7916); 1♂, C. Good Hope (DMNH-CPH7917); 1♂, Zuurbergen, E Cape (MNHN); 1♂, 2♀♀, South Africa EC, Somerset East, 7 Jan 1947, D.A. Jackson (SANC-COLS-17008);

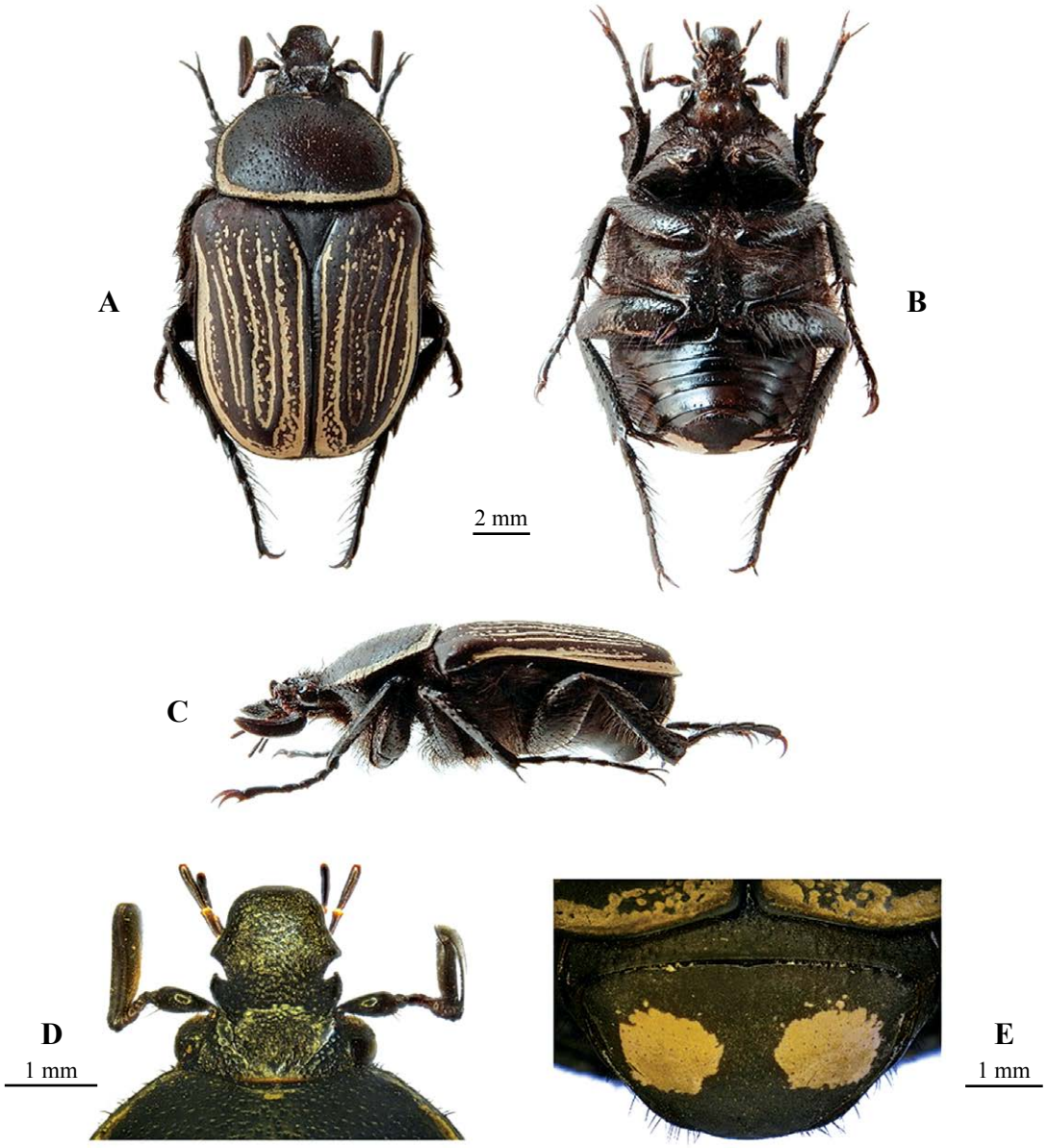

Fig. 26 – *Ichnestoma albomaculata* Gory & Percheron, 1833, male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

1♂, C. Bon. Spei., Fry Coll., 1905-100, Ex Mus Murray, 17639 TYPE, *Ischnostoma tristis* Schaum, *albomarginata* G. & P., Pro B. Spei (BMNH-NHMUK014400044); 1♂, C. Good Hope, 5512, *albo-marginata* Herbst? (BMNH-NHMUK014400045); 1♂, S Africa, 85/28, *Ichnestoma albomarginata* Gory Percheron, *tristis* Schaum (BMNH-NHMUK014400043); 1♂, Ent. Club, 44-12, I. TRISTIS Schaum (BMNH-NHMUK014400042); 1♀, South Africa, E Cape, A. Vosloo Kudu R, 10 Mar 1994, M. Burger (BMPC); 19♂♂, 4♀♀, South Africa, E Cape, Sam Knott NR, 21 Jan 1996, R. Perissinotto & L. Clennell (BMPC, EPPC); 1♂, 1♀, South Africa EC, Koonap Neck 17 Feb 1998, R. Perissinotto (EPPC); 1♂, 1♀, RSA, Fort Brown, EC, 19 Feb 2000, ex coll. A Chaminade (HMPC); 1♂, 1♀, South Africa, WC, Uniondale, Jan 2004 (ex larva) (BMPC); 2♂♂, South Africa, EC, Antoniesberg, 25 Dec1997, D. Clark (BMPC); 1♂, South Africa, EC, Baviaanskloof Nr Couga, 11 Jan 1998, D. Clark (BMPC); 1♂, 1♀, RSA, Witteberg E. Cape, 13 Mar 1999, leg. R.C. Owen (BMNH{E}-2015-37, Milan Kraicik); 3♂♂, South Africa, EC, Graaff Reinet 1068 m, 1 Jan 2007, drowned in farm dam (BMPC); 1♂, 1♀, South Africa, EC, Nr Uitenhage, 5 Apr 2014, found dead on ground (BMPC); 29 ♂♂, 5♀♀, South Africa, Bedford 9 Jan 2006, E.L. Pringle (EPPC); 4♂♂, South Africa, Willowmore, 22 Jan 2005, E.L. Pringle (EPPC); **Lesotho**: 1♂, Mamathes, C. Jacot Guillarmod? [locality probably erroneous](DMNH-CPH7918).

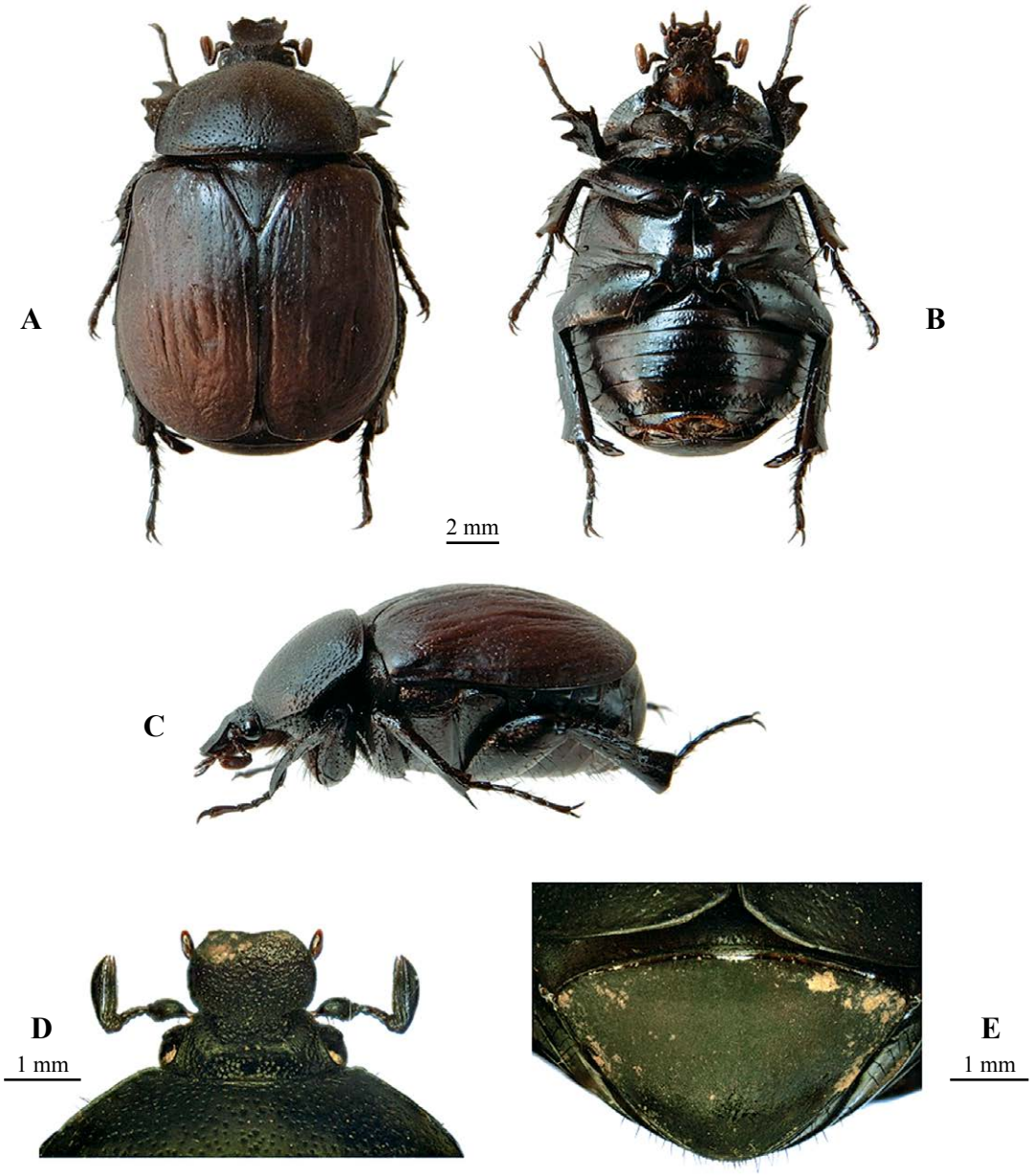

Fig. 27 – *Ichnestoma albomaculata* Gory & Percheron, 1833, female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

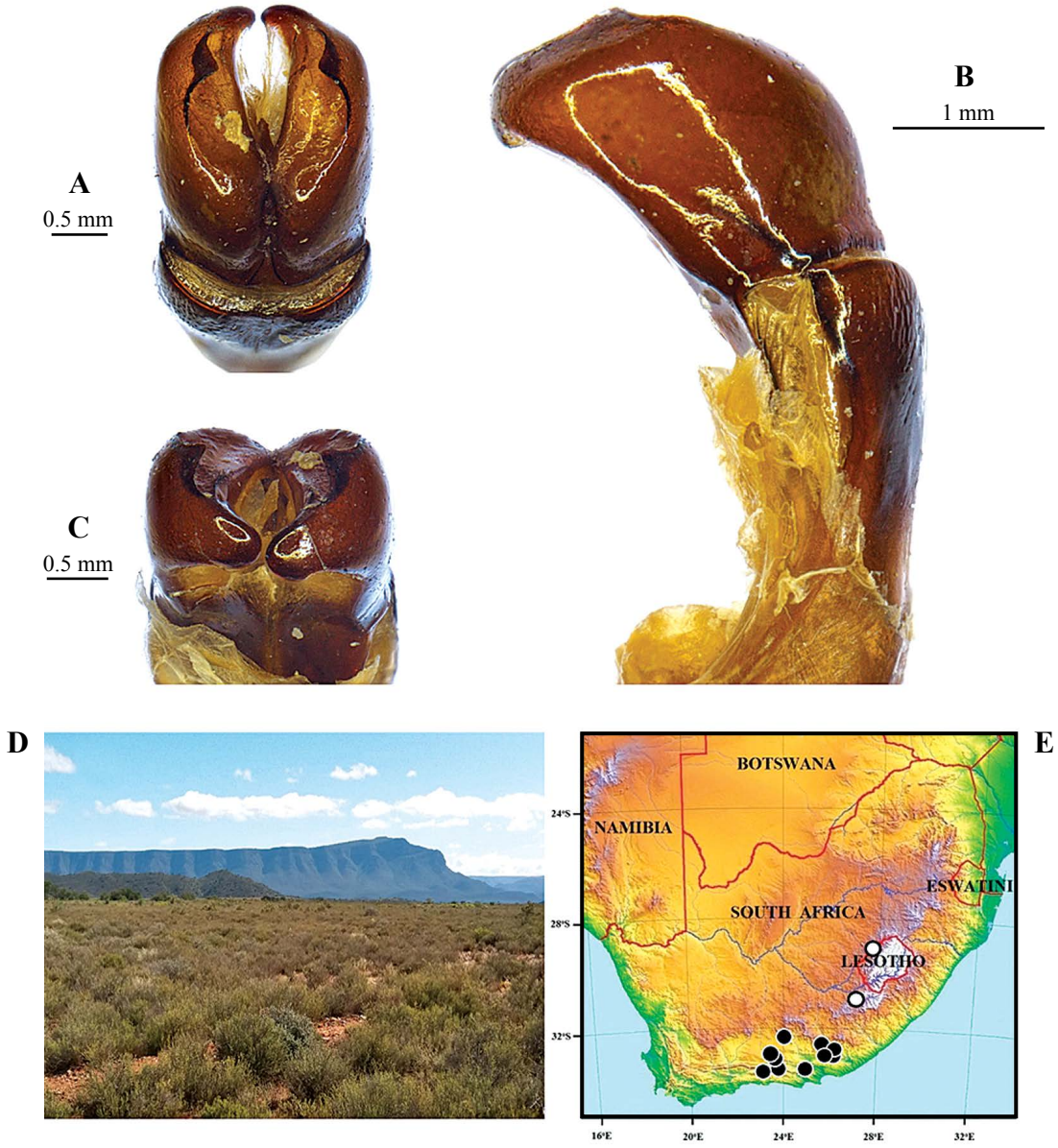

Fig. 28 – *Ichnestoma albomaculata* Gory & Percheron, 1833: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Willowmore area of the eastern Cape; **E**, known distribution range, with white circles representing unverified records. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

***Ichnestoma cochleata* Holm & Perissinotto, 2011 stat. nov.** (Figs 24-25, 29-31)

Ichnestoma cuspidata cochleata Holm & Perissinotto, 2011: 89; Beinhundner 2017: 1147.

Remarks. In the light of the review of the identity and distribution of *I. cuspidata* reported above, the status of subspecies proposed originally by Holm & Perissinotto (2011) for this taxon is untenable. *Ichnestoma cochleata* differs markedly in many aspects from *I. cuspidata*, especially at the level of clypeal armour and aedeagal parameres. Despite the superficial similarity between the male habitus of *I. cochleata* and that of *I. cuspidata*, the aedeagal characteristics of the former are actually much closer to those of *I. albomaculata* than to those of *I. cuspidata* (Fig 15A-C). The known populations of these two species are, furthermore, separated by more than 300 km, making it virtually impossible for them to exchange any genetic pool, given the inability of their females to fly and the conservative dispersal behaviour of their males (cf. also Introduction section). The female is brachypterous, with a W:E ratio = 0.81. Size: male TL =18.8 – 21.2 mm, MW = 8.1–10.5 mm (n = 12); female TL = 19.7– 22.4 mm, MW = 10.4 – 12.2 mm (n = 3).

Distribution. The only known population of this species

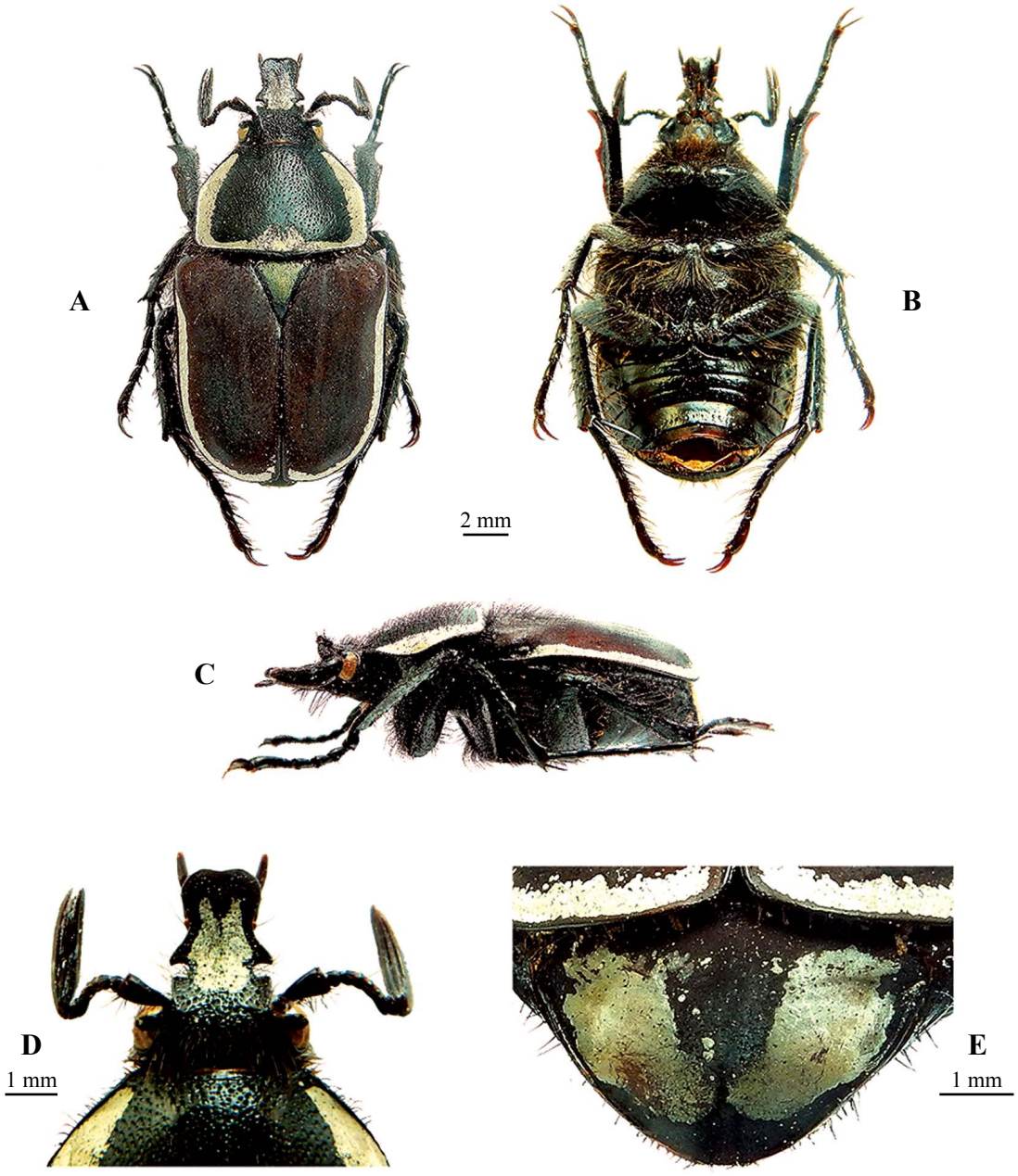

Fig. 29 – *Ichnestoma cochleata* Holm & Perissinotto, 2011 stat. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

is restricted to a few hundred square metres on the northern slopes of the Kouga mountain range, in the Baviaanskloof Wilderness Area, now part of the Cape Floral Region World Heritage Site (https://whc.unesco.org/en/list/1007).

Biology. This species appears to be an isolated specialist at the transition between the Fynbos Biome and the Albany Thicket Biome, in the Cape Fold Belt of the Eastern Cape. The vegetation type in which it occurs lays in fact at the interface between the Shale Renosterveld and the Groot Thicket (Mucina & Rutherford, 2006). The elevation of the area is in the range of 500-600 m asl and plant cover is relatively scattered, with dominance of spekboom (*Portulacaria afra*) and renosterbos (*Dicerothamnus rhinocerotis*) (Fig 15D). This part of the Baviaanskloof Reserve has recently been re-stocked with key animals of its original wildlife, which includes rhinos and buffalos.

Data. Republic of South Africa: Holotype: ♂, EC, Baviaanskloof [S33°38' E24°08'], 23 Dec 2002, R. Perissinotto & L. Clennell (TMSA). Allotype: ♀, *ibidem* 25 Dec1999 (TMSA). Paratypes: 9♂♂, 2♀♀, *idem* (BMPC, EPPC). Other material: 7♂, 2♀♀, *ibidem* 14 Feb 2003 D. Clark.

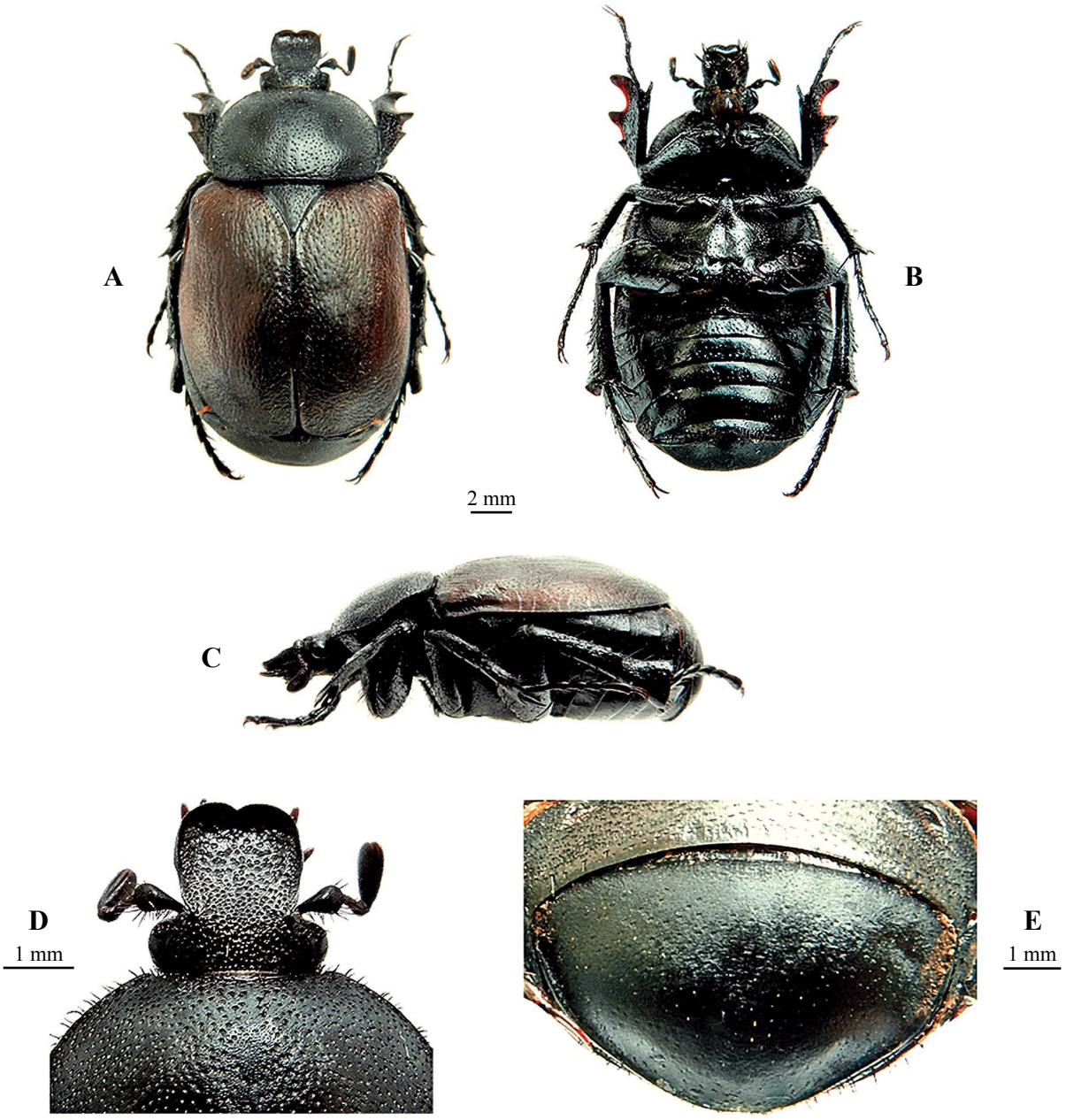

Fig. 30 – *Ichnestoma cochleata* Holm & Perissinotto, 2011 stat. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

***Ichnestoma furcata* sp. nov.** (Figs 24-25, 32-34)

Diagnosis. The male of this species is superficially very distinct from those of all the other species of the *albomaculata* complex, except that of *I. spatulata* sp. nov., from which it differs mainly in its aedeagal and clypeal shapes. In particular, the parameres of *I. furcata* are squarely rounded in dorsal view, particularly towards their apical part, while those of *I. spatulata* are smoothly oval all around (Fig. 25). Also, the dark ridge on the external margin of each incavation of the dorsal lobes exhibits a pronounced spinal projection in *I. furcata*, which is completely lacking in *I. spatulata*. In frontal view, the lobes of *I. furcata* are wider and substantially more geniculate than those of *I. spatulata*. The two species also occur on two different mountain ranges, separated by a distance of about 150 km. Finally, in terms of habitat characteristics, while *I. furcata* is a high altitude dweller linked to renosterveld vegetation, *I. spatulata* seems restricted to the banks of dry river valleys in karooid plain areas.

Description of holotype male (Figs 32 A-E, 34 A-C)

Size. Length 20.4 mm; width 10.3 mm.

Body. Black to dark brown with velutinous elytra and

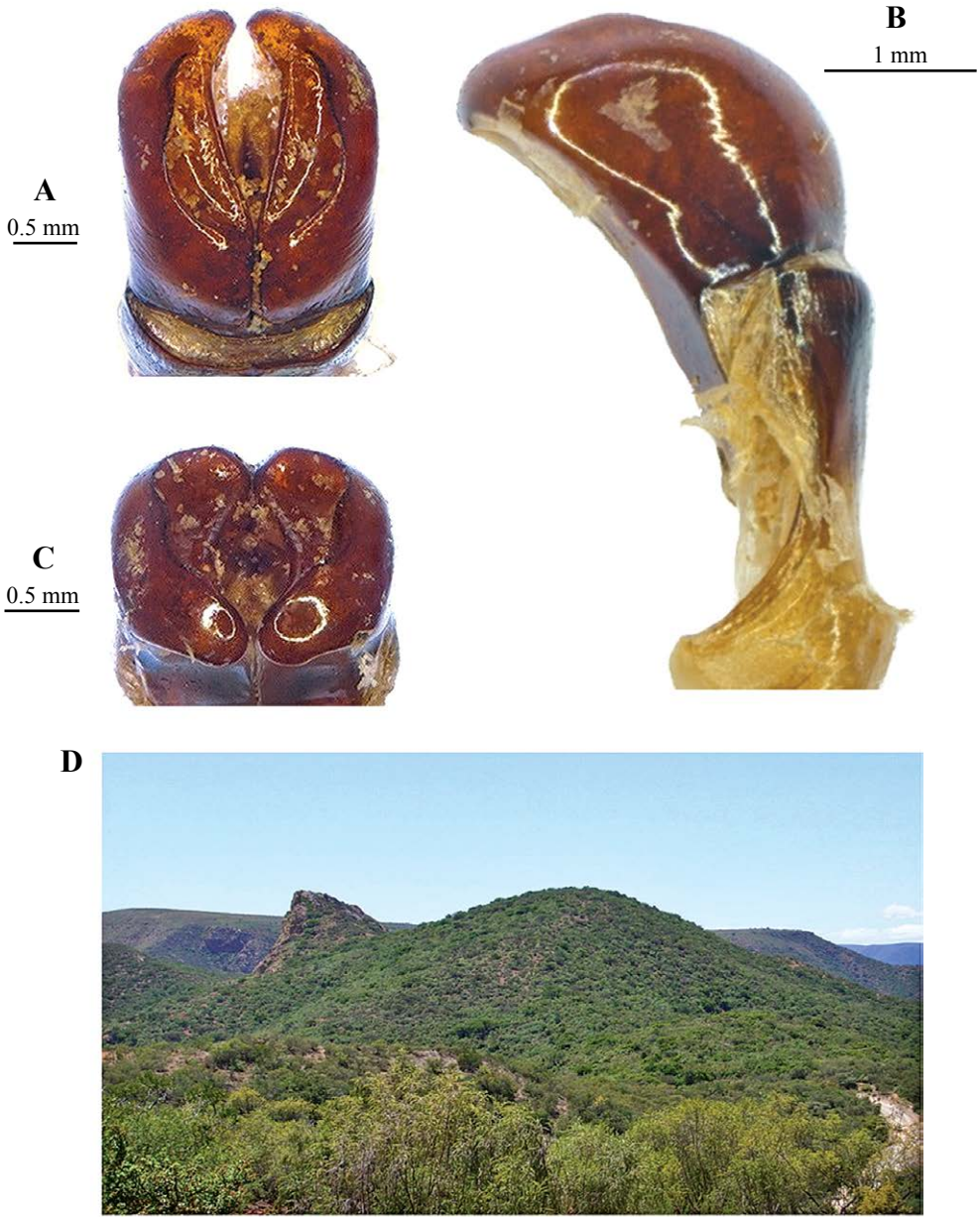

Fig. 31 – *Ichnestoma cochleata* Holm & Perissinotto, 2011 stat. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Baviaanskloof Wilderness Area; **E**, known distribution range. Photographs by Lynette Clennell.

white cretaceous markings on pronotal and elytral margins as well as pygidium (Fig. 32 A); head, pronotum and parts of scutellum and elytra densely covered in round punctures and black setae (Fig. 32 A, C, D).

Head. Black, with round punctures and long black setae on vertex and frons, but clypeus glabrous and rugose; clypeus with sinuation and sharply upturned and laterally expanded lobes at apex, flat to slightly convex at centre, with small lateral invaginations and prominent but rounded spinal projections above (Fig. 32 D); antennal club, pedicel and flagellum black to dark brown; antennal club hypertrophic and of same length as pedicel and flagellum combined.

Pronotum. Black with white cretaceous lining on lateral and posterior margins, except anteriad of scutellum; smoothly hexagonal in shape, with posterior margin straight to slightly curved; small but dense round punctures throughout surface, with thin black, short to medium setae emerging at centre of each puncture (Fig. 32 A, C).

Scutellum. Entirely black; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with scattered round to horse-shoe punctures across entire surface, but short black setae restricted to basal half (Fig. 32 A).

Elytron. Dark brown to black and velutinous, with white cretaceous lining along lateral (except next to humeral cal-

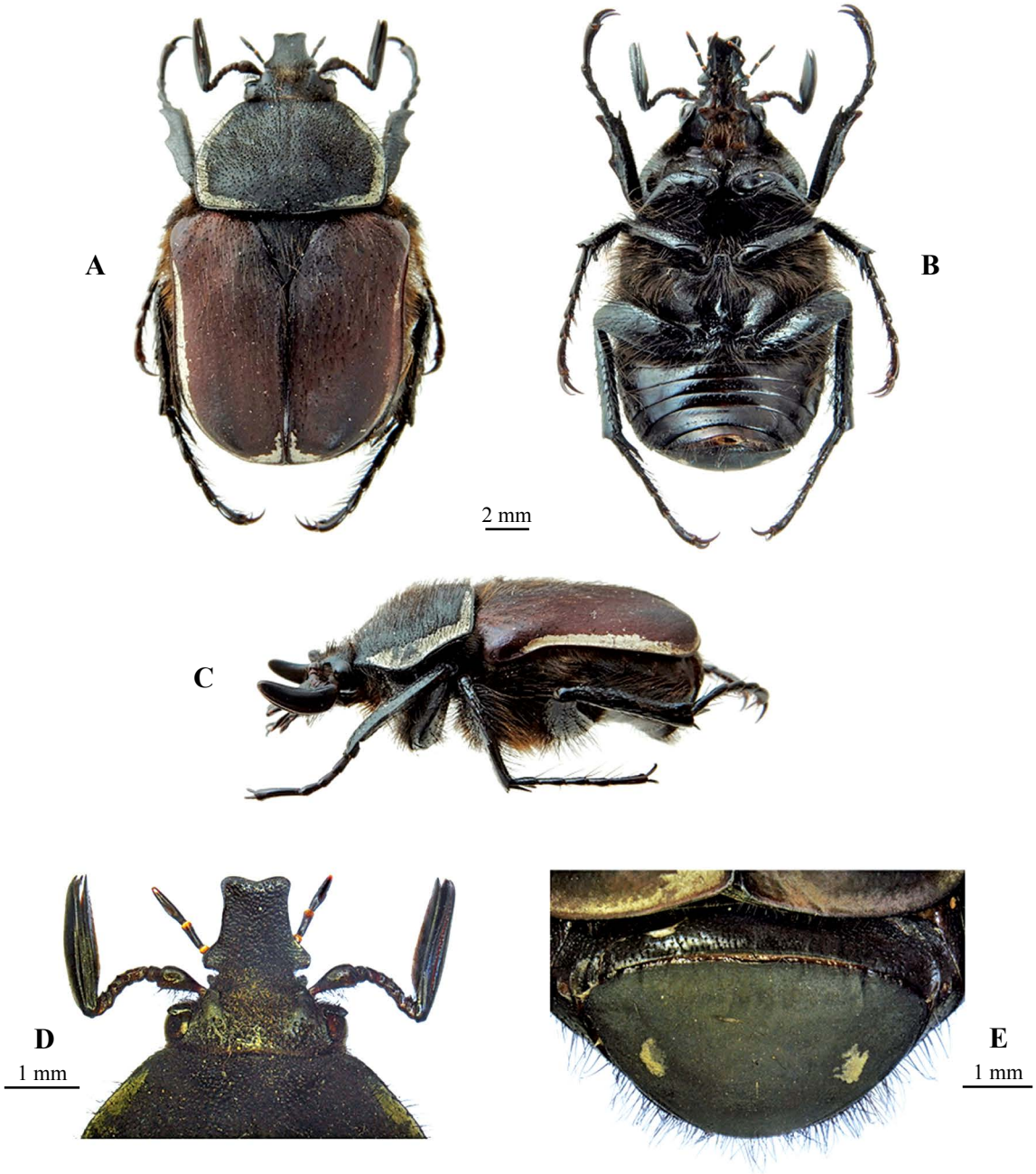

Fig. 32 – *Ichnestoma furcata* sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

lus) and apical margins, extending a few mm along suture; with short to medium dark setae on basal half, around scutellum and along entire suture; apex forming blunt right angle, without any spinal projection (Fig. 32 A).

Pygidium. Black and matte with symmetric white mid-lateral cretaceous spots; roundly triangular in shape, with very scattered and shallow round to horse-shoe punctures, full lining of medium to long setae along apical and lateral margins (Fig. 32 E).

Legs. Completely black, with tarsal segments hypertrophic; with black setae increasing in density and length from pro- to metalegs; protibia tridentate with proximal tooth drastically reduced, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 32 A-C).

Ventral surface. Black and shiny, covered in dense and long black setae except on abdominal sternites, femoral and coxal bases; mesosternal lobe atrophic and flat, glabrous at centre but exhibiting setae along lateral and posterior margins; metasternal lobe with wide groove along median sulcus; abdominal sternites with marked concavity and small round punctures at middle (Fig. 32 B).

Aedeagus. Parameres with lobes roundedly squared at apex in dorsal view (Fig. 34 A); outer ridge of incavations

exhibiting prominent dark spinal projections; apical end of lobes smoothly rounded and without projections in frontal view (Fig. 34 C).

Derivatio nominis. The species is named after the distinctly forked clypeal apex of its male (Fig. 32 D).

Description of female (Figs 24, 33). The female of *I. furcata* is superficially very similar to those of the other species of this group, particularly *I. cochleata, I. rostrata* and *I. spatulata*, which all exhibit a relatively elongate and sinuate clypeus. Particularly problematic may be distinguishing this female from that of *I. rostrata*, as the two appear to be partially sympatric. However, in *I. furcata* the clypeus is slightly wider than in *I. rostrata* and its lateral margins are also more convex than in the latter species. Also, the round punctures of the pronotal surface are substantially denser and deeper in *I. furcata* than in *I. rostrata*. The key features of the female of *I. furcata* can be summarised as follows. a) Body black to dark brown and velutinous, with sparse short black setae only around pronotal margins and basal part of elytra, dense round punctures on head, pronotum and basal half of scutellum; b) clypeus moderately elongate, smoothly rounded laterally, concave and with deep sinuation at apex; c) pronotum globose and covered in dense round punctures but glabrous, except for few short setae anteriad of posterior margin; d) scutellum equilateral triangular, with round punctures on basal part and wide lateral grooves, but no setae; e) elytra

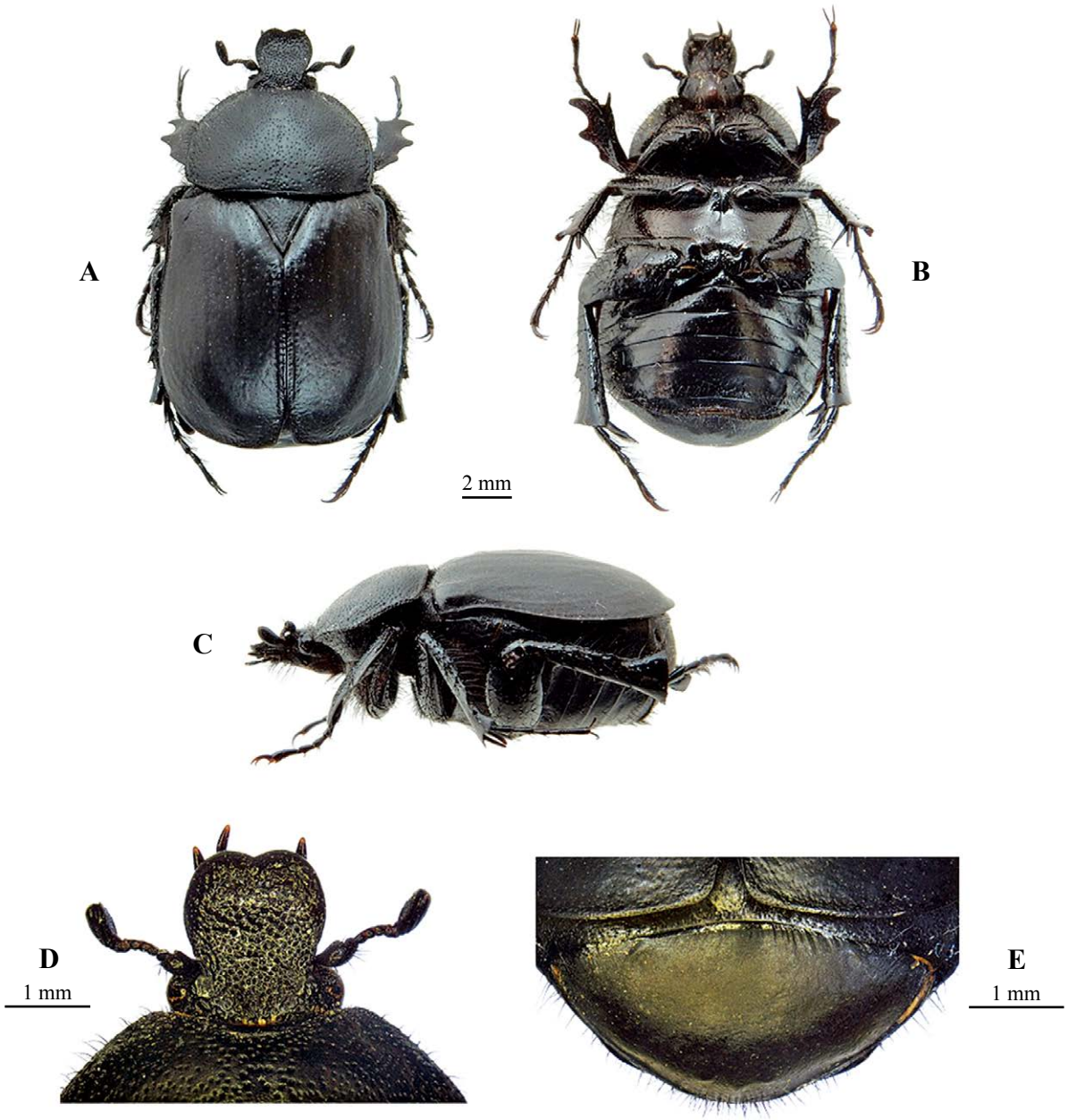

Fig. 33 – *Ichnestoma furcata* sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

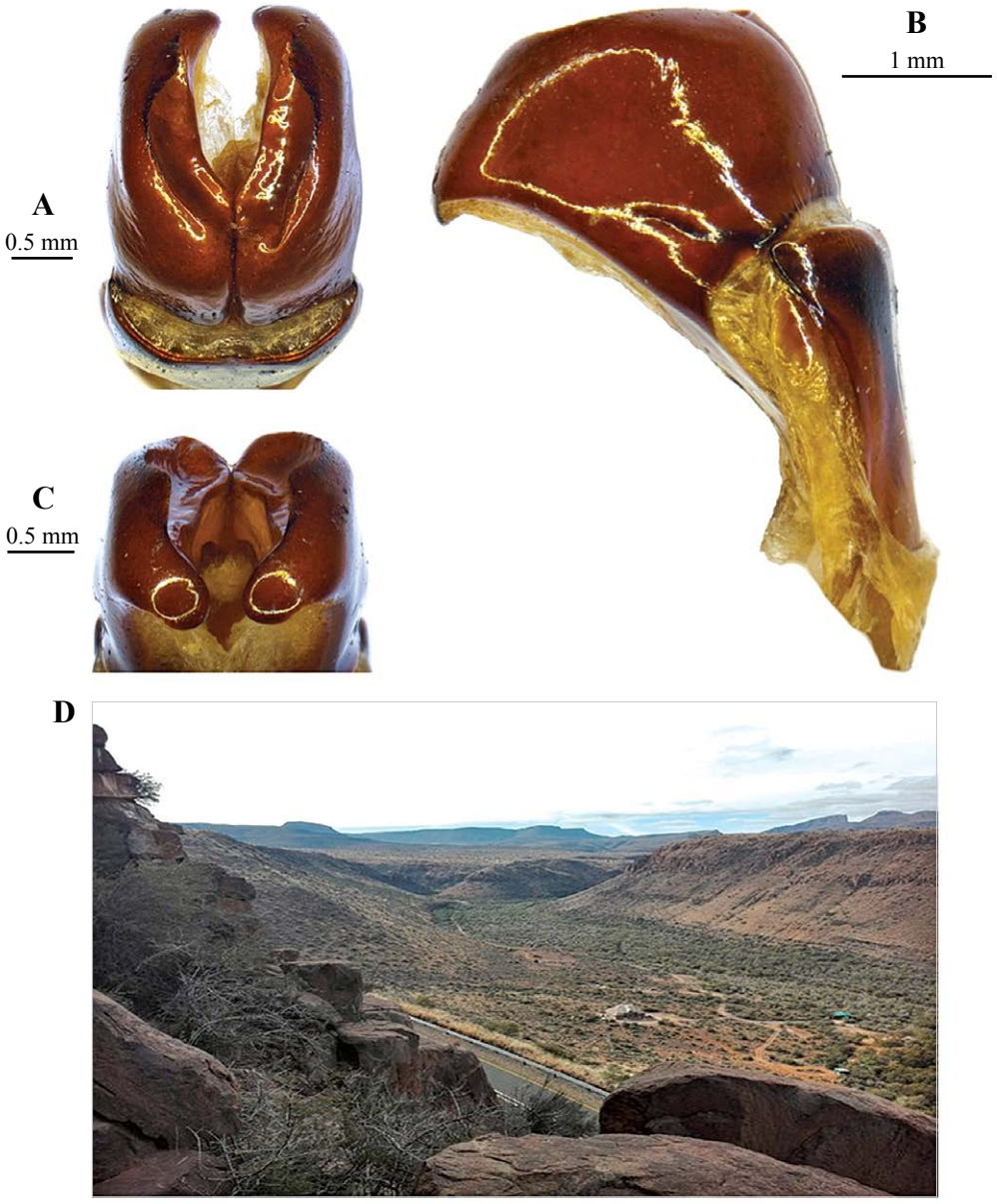

Fig. 34 – *Ichnestoma furcata* sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Molteno Pass area; **E**, known distribution range. Photographs A-C by Lynette Clennell; photo D from Geocaching.com©.

dark brown to black, with extremely small and scattered sculpture and short setae around sutural and scutellar margins; f) brachypterous, with wing size = 8.9 mm and W:E ratio = 0.85; g) pygidium black, with isolated and shallow round punctures; h) tarsal segments slim and moderately hypertrophic, protibiae tridentate, more robust and wider than in male, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with round punctures shallow but dense across entire surface except abdominal sternites 3-5, which are markedly convex.

Distribution. *Ichnestoma furcata* is currently only known from the Molteno Pass area, above the Great Escarpment of the Western Cape, where it occurs both inside and outside the borders of the Karoo National Park, at an altitude of approximately 1500-1600 m (Fig. 34 E).

Biology. This species appears to be a high altitude grassland dweller, associated with pockets of renosterbos (*Dicerothamnus rhinocerotis*) occurring on gentle slopes within the Dry Highveld Grassland Bioregion (Karoo Escarpment Grassland) (Mucina & Rutherford 2006). Here, the landscape is characterized by mountain summits and escarpment plateaus. The vegetation consists of tussock grassland, dominated by *Merxmuellera disticha* and other dry grassland species, as well as low shrub plants in-

cluding renosterbos (Mucina & Rutherford 2006). A partial overlap with the distribution of *I. rostrata* has been observed in the lower range of its occurrence and males of both species have been collected together, after drawning in pools in the aftermath of heavy rains (pers. obs.).

Remarks. The limited number of specimens available so far, shows that this species is remarkably stable in its morphological appearance. The white cretaceous markings on the elytral margins can however vary from ending at the apex to extending a few millimeters upwards along the sutural margins. The clypeal shape can also range from highly sinuate to moderately sinuate at the apex, although it is quite consistent in its lateral contriction at centre with outward expansion towards the apex, thereby imparting to the overall structure its typical furcate shape. The two females currently known both exhibit a very sinuate clypeal apex and dark brown elytra. The third protibial tooth, is virtually obsolete in both sexes, and hardly visible in a few specimens. Within the type series analysed in this study, the size ranges as follows: male TL = 19.1-21.2 mm, MW = 9.8-11.2 mm (n = 11); female TL = 19.6-19.8 mm, MW = 11.1-11.3 mm (n = 2).

Data. Republic of South Africa: Holotype: ♂, Western Cape, Beaufort West (Karoo National Park), 29 Jan 2002,

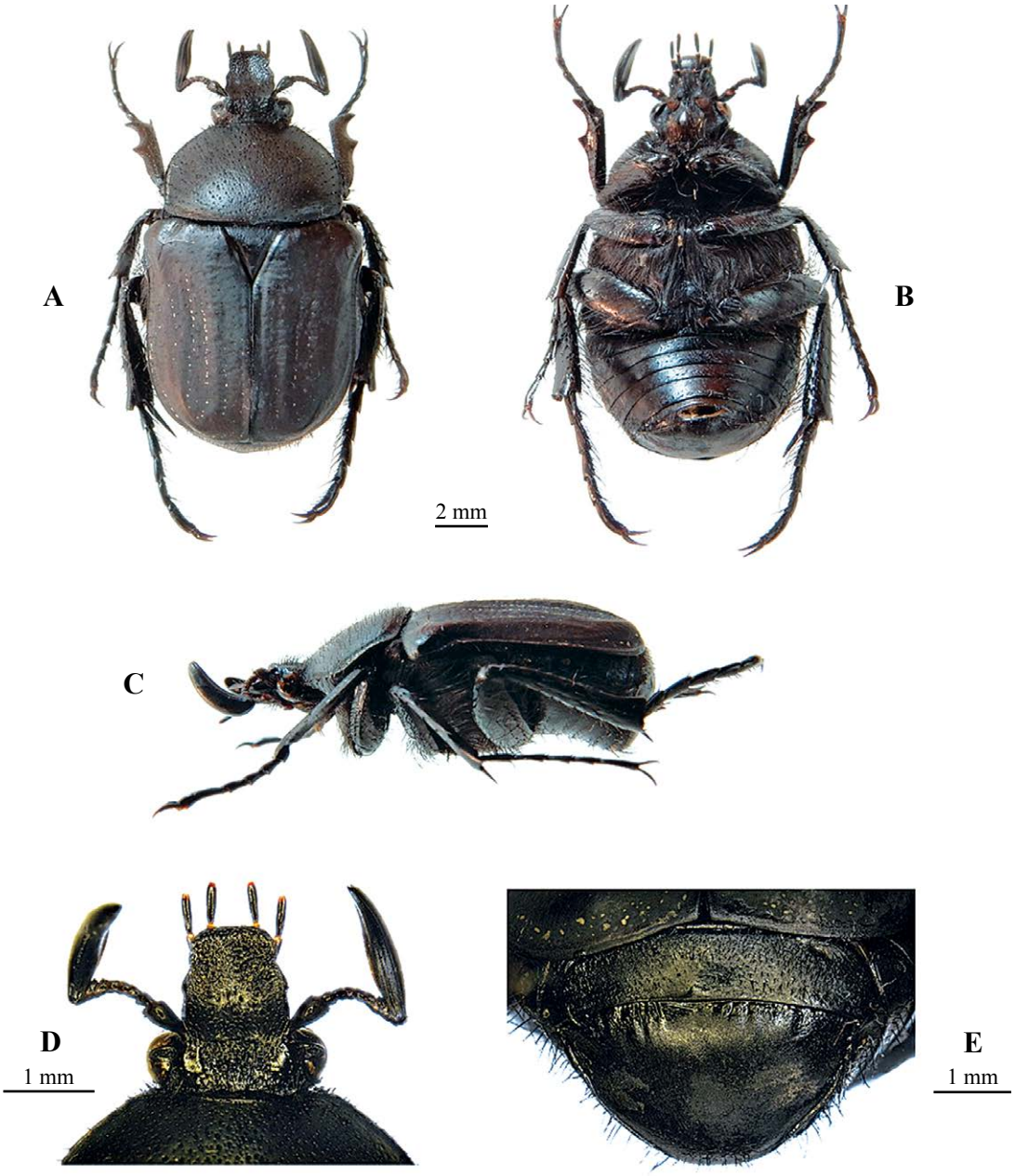

Fig. 35 – *Ichnestoma fuscipennis* Holm, 1992 stat. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

E.L.Pringle (ISAM). Paratypes: 5♂♂, *idem* (EPPC); 1♂, 2♀, South Africa, WC, Molteno Pass, 2 Jan 2016, drowned in rain pools, R. Perissinotto & L. Clennell (BMPC, ISAM); 4♂♂, *ibidem* 3 Jan 2016 (BMPC).

***Ichnestoma fuscipennis* Holm, 1992 stat. nov.**
(Figs 24-25, 35-37)

Ichnestoma albomaculata fuscipennis Holm, 1992: 377; Holm & Marais 1992: 31; Beinhundner 2017: 1144.

Remarks. Its original designation as a subspecies of *I. albomaculata* by Holm (1992) seems unlikely, given the number of consistent features that separate it from that species. These include male clypeus without mid-lateral invaginations, male antennal clubs longer than flagellum and pedicel combined (same length in *I. albomaculata,* Fig. 24) and elytra with cretaceous lines drastically reduced or completely absent in most males (Fig. 35 A). The aedeagus of *I. fuscipennis* is also more elongate and rounded apically, and the ventro-apical projection is more pointed than in that of *I. albomaculata* (Fig. 25). The habitat of the two species also differs, as *I. fuscipennis* is restricted to coastal Albany Thicket while *I. albomaculata* is more widespread on dry grassy slopes of the interior. The female, unknown in Holm (1992), exhibits the typical *Ichnestoma* features, with W:E length ratio of 0.84. By comparison with *I. albomaculata*, its clypeal lateral margins are straighter and its metafemora and tibiae wider and thicker. Size: male TL =15.7-19.6 mm, MW = 8.7-9.8 mm (n = 24); female TL = 16.0-18.9 mm, MW = 10.4-11.3 mm (n = 3).

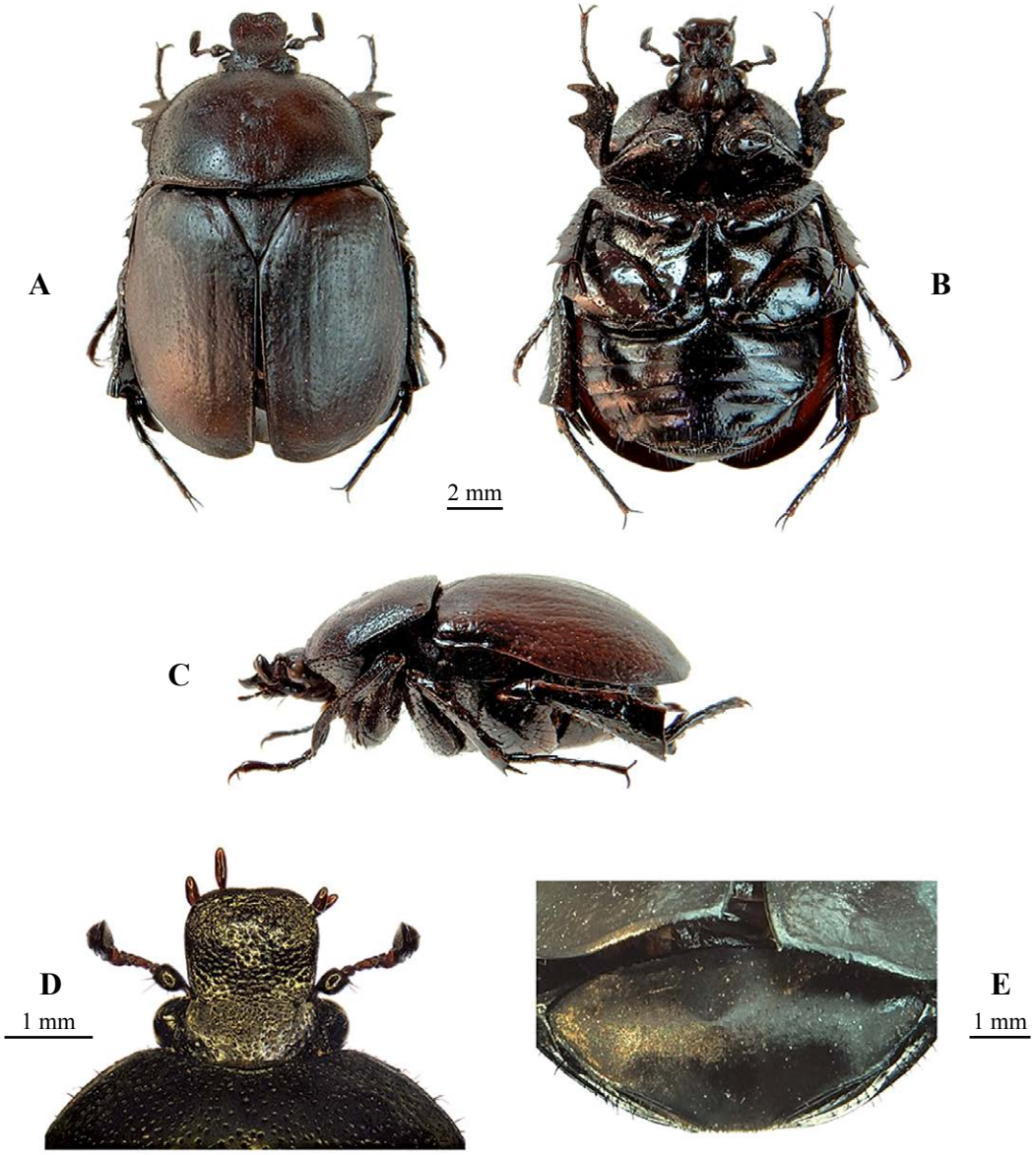

Fig. 36 – *Ichnestoma fuscipennis* Holm, 1992 stat. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

Distribution. The species is only known from the eastern part of Algoa Bay, in a small area ranging from the northern banks of the Swartkops River in Port Elizabeth to the Ngqura (formerly Coega) Industrial Zone and the Addo Heights in the Addo Elephant National Park (Fig. 37 E).

Biology. This species is a near-coastal inhabitant and occurs in the Coega Bontfeld and Sundays Thicket vegetation types of the Albany Thicket Biome (Mucina & Rutherford 2006). Adults become active only during the late morning hours after a substantial rainfall event, disappearing already from the surface in the early afternoon of the same day (pers. obs., EL Pringle pers. comm.). This is among the shortest periods of adult activity ever observed for any species of this genus. Males fly with remarkable dexterity among the dense bushes of the thicket, mainly composed of spekboom (*Portulacaria afra*), *Schotia afra* and a variety of *Euphorbia* and *Aloe* species. Mating takes place generally at the base of dense bushes of spekboom, where females presumably lay eggs into the soil, under the dense layer of leaf litter.

Data. Republic of South Africa: Holotype: ♂, Port Elizabeth, Feb 1884 (SANC-TYPH-02090, SANC-COLS-17216). Paratypes: 1♂, Port Elizabeth, Feb 1884 (SANC-COLS-16935); 2♂♂, P. Elizab., Feb 1884, *Ichnestoma fuscipennis* Krikken 1985, Paratype (TMSA-CPH7922); 1♂, (label data not recorded), *Ichnestoma fuscipennis* Krikken, 1985, "Holotype" (NBCN). Other material: 1♂, P. Elizabeth, 1888, Brady (TMSA-CPH7922); 1♂,

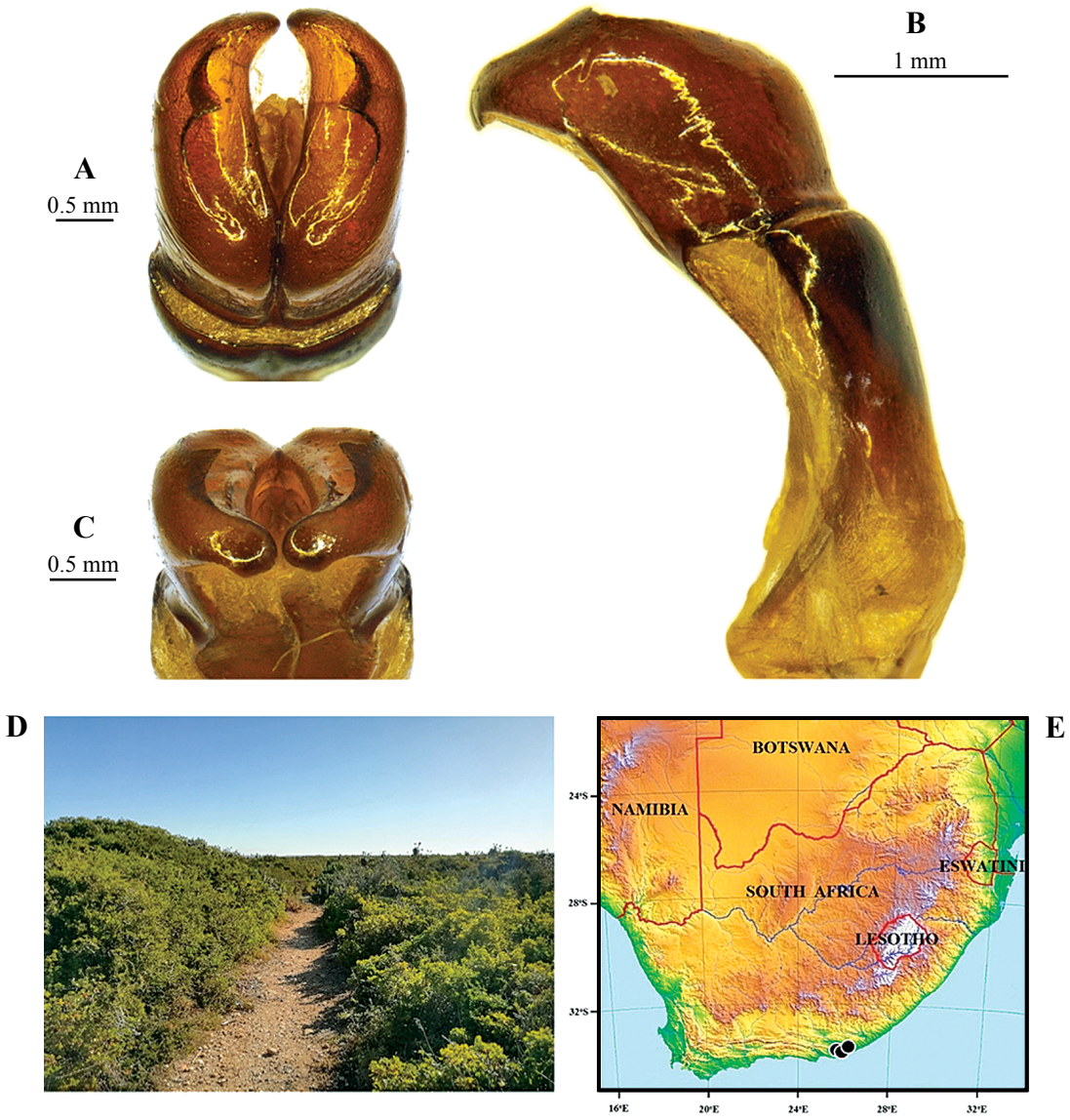

Fig. 37 – *Ichnestoma fuscipennis* Holm, 1992 stat. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical spekboomveld habitat in the Aloes Reserve at Amsterdamhoek; **E**, known distribution range. Photographs A-C by Lynette Clennell, D by Gavin Rishworth; map adapted from Mapsland (Copyright© 2019 Mapsland).

Port Elizabeth, C.E. Tottenham Collection B.M. 1969-77 (BMNH-NHMUK014400049); 6♂♂, 1♀, Pt. Eliz., 80-66 (BMNH-NHMUK014400046-48, 50-53); 1♂, Port Elizabeth, 77·15 (BMNH-NHMUK014400055); 1♂, Bowring, 63·47*(BMNH-NHMUK014400054); 1♀, Capland, Algoa-Bay, 10 Jan1897, Dr H. Brauns (TMSA-CPH7911); 1♂, *ibidem* 28 Feb 1896 (TMSA-CPH7921; 5♂♂, South Africa, EC, Addo Heights, 3 Jan 2000, R. Perissinotto & L. Clennell (BMPC); 4♂♂, South Africa EC, Coega 4 Jan 2000, E.L. Pringle (EPPC); 6♂♂, 1♀, *ibidem* 4 Feb 2002 (EPPC); 2♀♀, *ibidem* 5 Feb 2002 (EPPC); 2♂♂, Addo, 29 Dec 1999 E.L. Pringle (EPPC); 2♂, *ibidem* 3 Jan 2000 (EPPC). 6♂♂, 2♀♀, South Africa EC, Amsterdamhoek (Aloes Reserve), 15 Feb 2014, dead on ground (pers. obs.).

***Ichnestoma rostrata* (Janson, 1878)** (Figs 24-25, 38-40)

Ischnostoma rostrata Janson, 1878: 299; Peringuey 1907: 373-375; Schenkling 1921: 80; Allard 1991: 45.

Ichnestoma rostrata Janson. Holm 1992: 375; Holm & Marais 1992: 29; Beinhundner 2017: 1151.

Remarks. Within the nominal subgenus and the *albomaculata* complex, *I. rostrata* represents a distinct taxon, clearly separated from the other species by the unique shape of its clypeus and aedeagal parameres, as well as the ratio of female wing to elytron length, which is lower than the values measured in all other species of the subgenus (i.e. 0.7 versus ≥ 0.80). It is therefore the most brachypterous species within the genus. Male specimens vary substan-

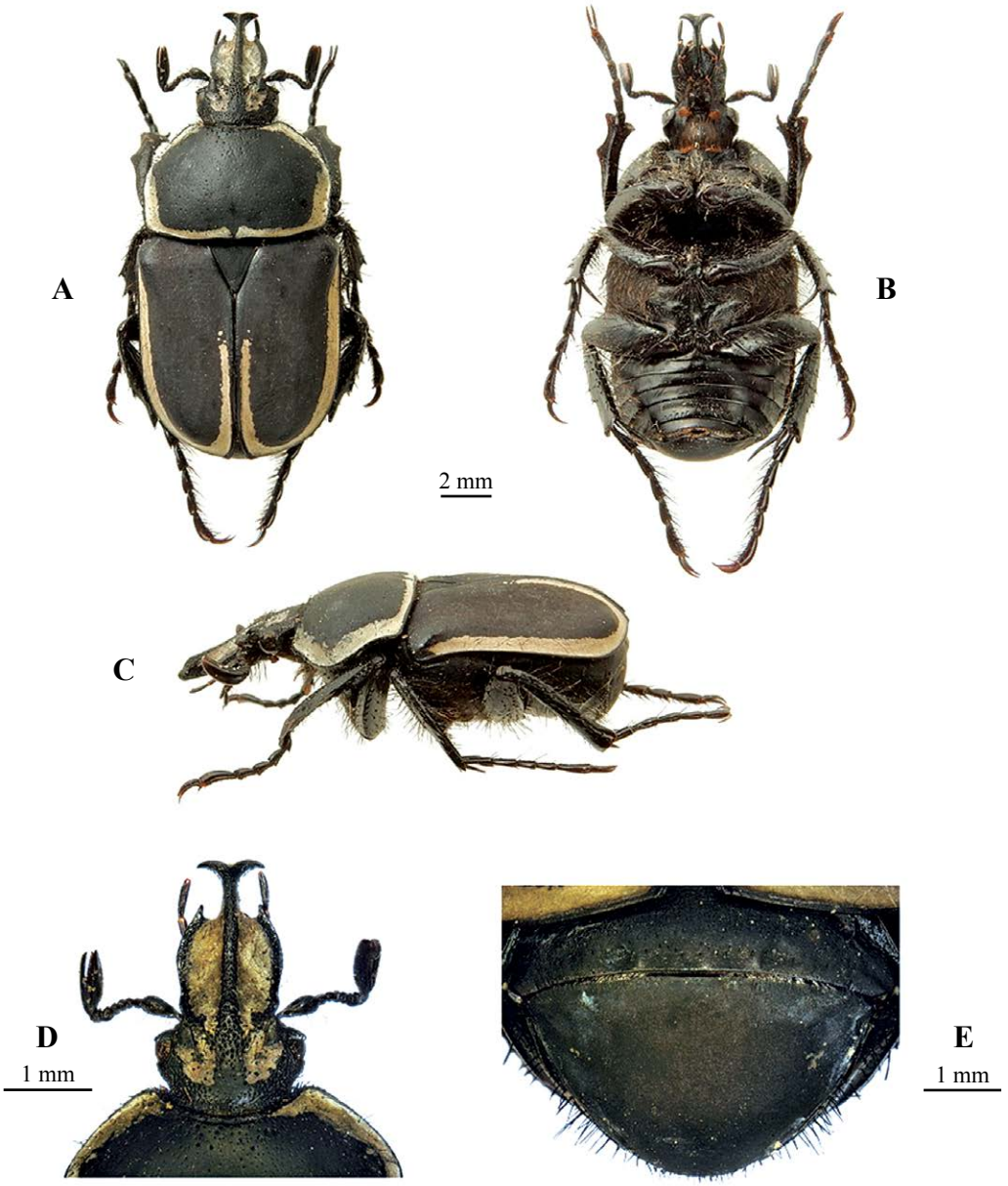

Fig. 38 – *Ichnestoma rostrata* (Janson, 1878), male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

tially in the extent of the cretaceous markings on the dorsal surface, which range from fully expanded to drastically reduced or even obsolete, particularly on the pronotal and elytral (both lateral and sutural) margins, as well as on each side of the clypeal ridge (cf. Beinhundner 2017: 1152). Size: male TL = 17.0-23.5 mm; MW = 9.3-10.8 mm (n = 28); female TL = 16.4-22.1 mm, MW = 9.8-12.3 mm (n = 11).

Distribution. This is apparently the most widespread among all *Ichnestoma* species, occurring throughout the Eastern Cape Karoo region, extending into the Western and Northern Cape provinces as far as Fraserburg in the west and Kuruman to the north (Fig. 40 E).

Biology. The species inhabits a variety of habitats in the Nama-Karoo Biome, mainly in the Upper Karoo Bioregion (Mucina & Rutherford, 2006). This region is positioned above the South African Great Escarpment, is characteristically arid and includes several mountain ranges interspersed with extensive plains. In terms of vegetation, it consists of a mosaic of low shrubs, grasses, succulents, geophytes and annual forbs, with small trees found along drainage lines. *Ichnestoma rostrata* often emerges in large numbers immediately after a mid-summer rainfall event and spent individuals of both sexes can be found a few days later drowning in pools, rivers, dams and irrigation troughs (pers. obs.), presumably as they seek moisture when the soil starts drying out. The species occurs sym-

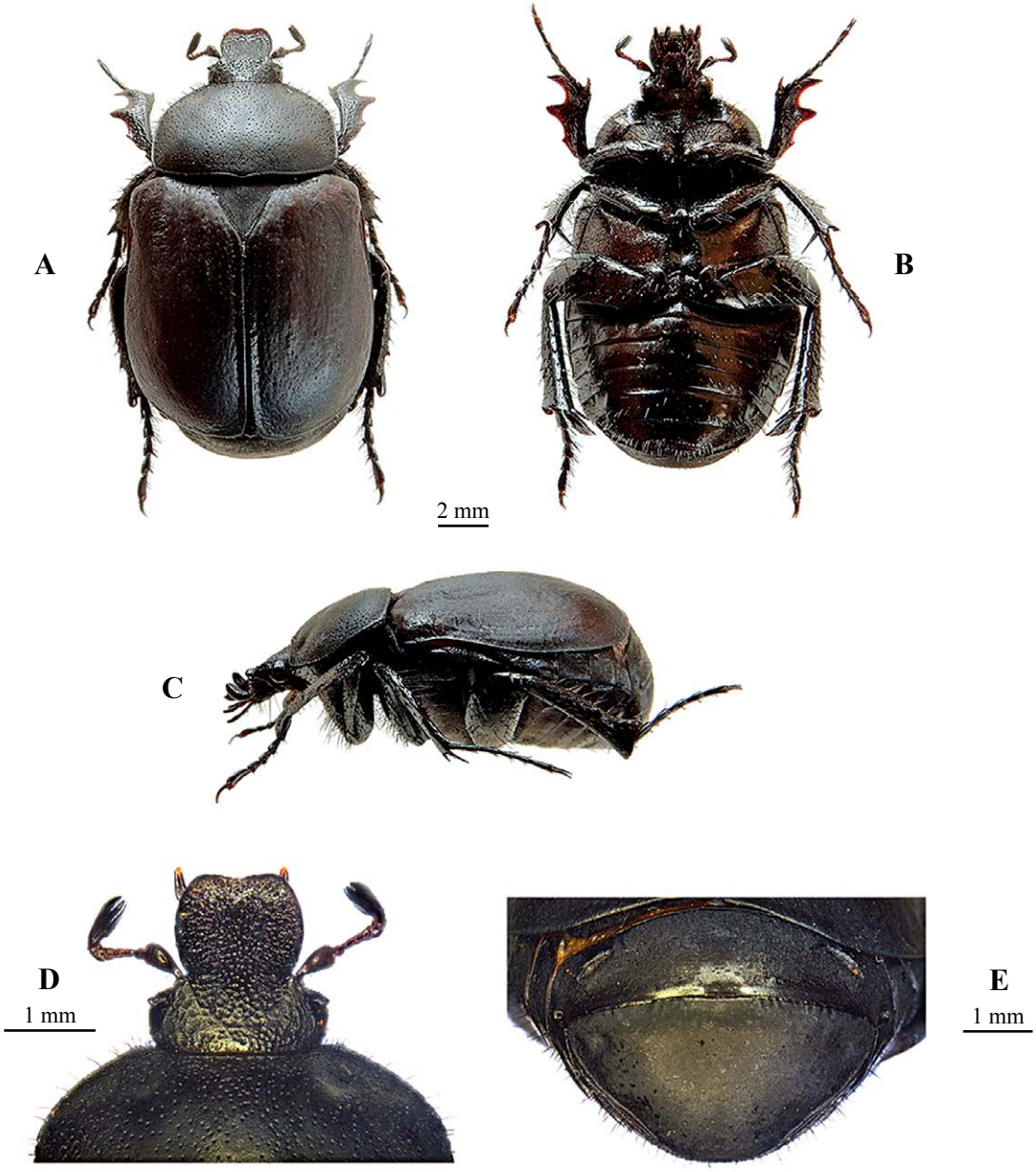

Fig. 39 – *Ichnestoma rostrata* (Janson, 1878), female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

patrically with *I. albomaculata* in the Driekoppe area of the Camdeboo National Park (near Graaff-Reinet), with *I. furcata* in the Molteno Pass (near Beaufort West), with *Mzansica falcipata* in the Sneeuberge (near Nieu Bethesda), with *Karooida struempheri* in the Bamboesberg (near Hofmeyr), with *K. pringlei* in the Winterberge (near Bedford), with *K. krikkeni* in the Lootsberg Pass (near Graaff-Reinet) and with *Gariep patera* in the Fraserburg area of the Northern Cape.

Data. Republic of South Africa: Holotype: ♂, 'Cape' (RMNH). Other material: 1♂, Cape Province, Middelburg, 30 Jan 1990 (ISAM COL-A069771); 2♂♂, 1♀, South Africa, EC, Nrth of Middelburg, 8 Dec 1996, R. Perissinotto & L.Clennell (TMSA-CPH7897); 1♂, South Africa, NC, Teekloof, Fraserburg, L. Péringuey (ISAM, COL-A027359); 2♂♂,1♀, South Africa, EC, Huntly Glen, 26 Jan 1997, drowned in stream, R. Perissinotto & L. Clennell (TMSA-CPH7898,); 2♂♂, South Africa, EC, Winterberg, 16 Feb 1997, R Perissinotto & L Clennell (TMSA-CPH7899, SANC-COLS-17007); 1♂, *ibidem* 25 Jan 1997, BMNH{E}, 2011-127 (BMNH-NHMUK014400037); 1♂, No data (ISAM COL-A026579); 1♂, South Africa, NC, Teekloof, Fraserburg, 1883 (ISAM COL-A026578); 1♀, *ibidem* Jan 1884 (ISAM, COL-A069783); 1♂, 1♀, RSA, Eastern Cape, Asanta Sana Game Reserve, 1140 m, 17 Jan 2011, S. Van Noort (ISAM COL-A069770); 2♂♂, South Africa, NC,

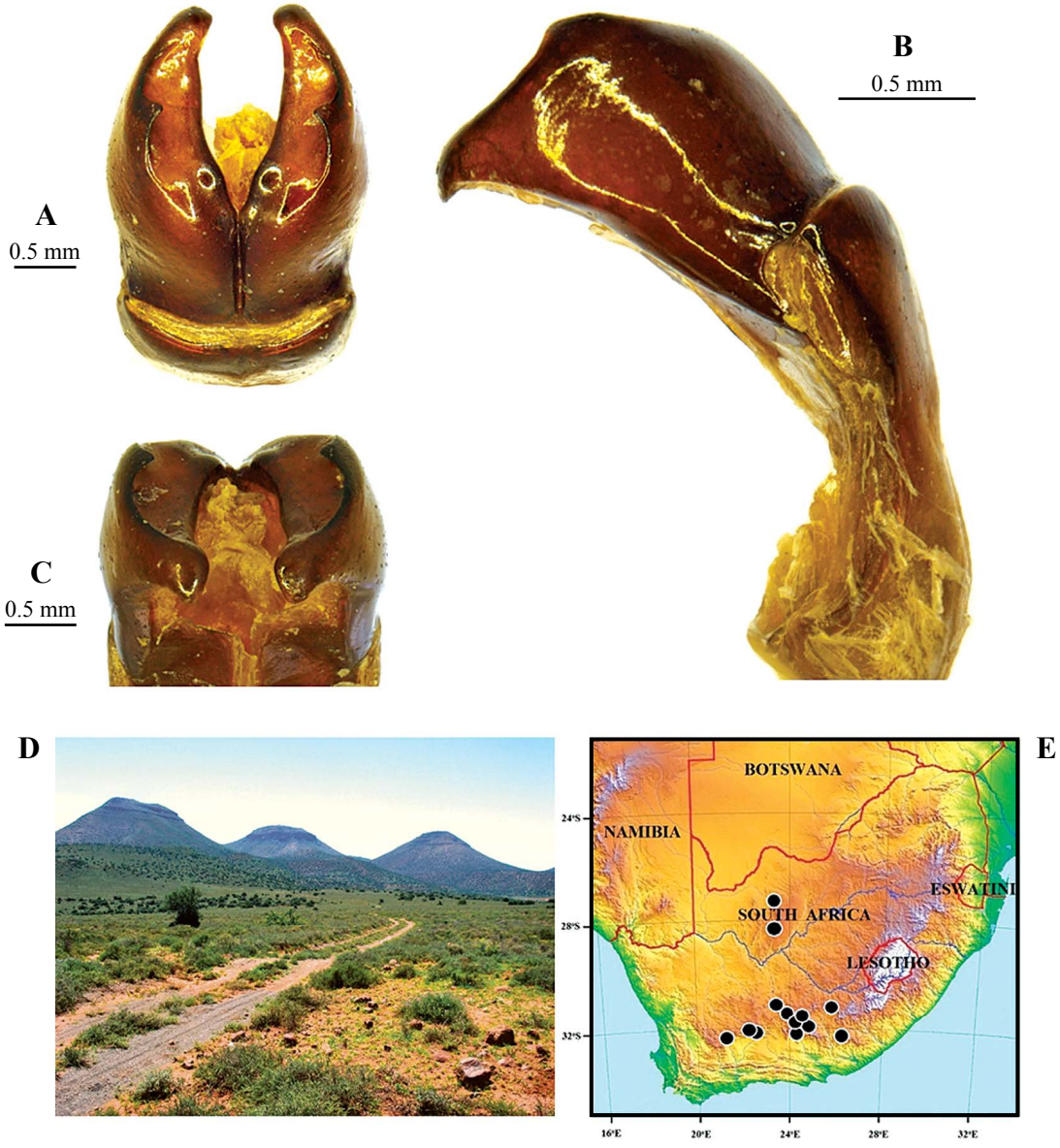

Fig. 40 – *Ichnestoma rostrata* (Janson, 1878): **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Driekoppe area near Graaf-Reinet; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

Kurumanheuwels, 11 Dec 2000, dead on ground, R Perissinotto & L Clennell (BMPC); 1♂, 1♀, South Africa, EC, Graaff Reinet, Driekoppe 1068 m, 1 Jan 2007, drowned in farm dam (BMPC); 2♂♂, South Africa, EC, Hofmeyr, 8 Dec 2004, drowned in rain pool, E.L Pringle (EPPC); 1♂, *ibidem* 17 Jan 2007 (BMPC); 1♂, South Africa, NC, Asbesberg, 6 Jan 2006, dead on ground (BMPC); 2♂♂, 3♀♀, South Africa, EC, Toorberg S 1700 m, 29 Dec 2007, drowned in farm dam (BMNH-NHMUK14400041, BMPC); 2♂♂, South Africa, EC, Compassberg, 26 Jan 1996, R Perissinotto & L Clennell (BMPC); 1♀, *ibidem* 23 Mar 1997 (BMPC); 3♂♂, Cape Prov., Bedford, 30 Dec 1996, E.L. Pringle (BMPC, PMPC); 1♂, South Africa, EC, Graaff Reinet, 16 Dec 2004, drowned in stream (BMPC); 1♂, South Africa, EC, Lootsberg Pass, 17 Dec 2004 (BMPC); 1♂, South Africa, NC, Gr Tafelberg, 2 Jan 2006 (BMPC); 1♂, South Africa, NC, W of New Bethesda, 21 Feb 1997, M. Burger Leg. (BMPC); 1♂, 1♀, South Africa, WC, Molteno Pass, 3 Jan 2016, drowned in rain pools (BMPC); 3♂♂, 1♀, South Africa, WC, Dejagerspas (Beaufort West), 26 Dec 2016, D. Clark (BMPC, ISAM); 1♂,1♀, South Africa, EC, Sneeuberge, Dec 1999 (DMPC); 1♂,1♀, South Africa, EC, Winterberg, Dec 1998 (DMPC); 1♂, *ibidem* 19 Dec 2005, ex coll. A. Chaminade (HMPC); 2♂♂, 2♀♀, *ibidem* 10 Jan 1998, P. Stobbia Leg. (TGPC); 1♂,1♀, *ibidem* 11 Jan 1998, ex coll. K. Werner (HMPC); 2♂♂, 1♀, *ibidem* 11 Jan 1998 (MDPC); 1♂, RSA EC, Huntley Glen (Bedford), Jan 1997 (MDPC); 1♂, *ibidem* 26 Jan 1997, P. Stobbia Leg. (TGPC); 5♂♂, 1♀, *ibidem* 17 Dec 1998, E.L.Pringle (EPPC); 5♂♂, *ibidem* 17 Jan 2001 (EPPC); 1♀, *ibidem* 16 Feb 2002 (EPPC); 2♂♂, 1♀, *ibidem* 25 Feb 2004 (EPPC); 1♂, 1♀, *ibidem* 15 Jan 2005 (EPPC); 1♂, 1♀, *ibidem* 15 Jan 2005 (EPPC); 1♂, 1♀, ZA-NC, Lemoenfontein Farm, 35 km SE of Britstown, 20-29 Jan 2006, Pitfall-and-funnel trap, M. Burger M. Carstens & K. Jacobs (SANC-COLS-16023); 4♂♂, 2♀♀, RSA, Eastern Cape, Nieu Bethesda env., 7 Jan 2017, P. Malec & P. Šípek lgt. (PMPC); 1♂, 2♀♀, RSA/Eastern Cape, Naudésberg Pass 1446, 18 Km N from Graaf Reinet, 2 Jan 2017 P. Malec & P. Šípek lgt. (PMPC); 2♂♂, 1♀, South Africa, Asante Sana Game Reserve, 11 Dec 2011, J. Orozco (https://www.ispotnature.org/communities/southern-africa/view/observation/381756/); 1♂, Nieu Bethesda, Weltevreden Farm, 21 Dec 2011, N. Van Berkel [drowned in water pool] (https://www.inaturalist.org/observations/11081009).

***Ichnestoma spatulata* sp. nov.** (Figs 24-25, 41-43)

Diagnosis. Within the *albomaculata* complex, the male of this species shares close similarities only with that of *I. furcata*. As already mentioned under the latter species description, the two however can be separated on the basis of their aedeagal and clypeal shapes. In summary, in dorsal view the parameres of *I. spatulata* are smoothly oval all around, while those of *I. furcata* are squarely rounded towards their apical part (Fig. 25). The dark ridge on the external margin of each incavation of the dorsal lobes of *I. spatulata* lacks the spinal projection, which on the other hand is very pronounced in *I. furcata*. At the clypeal level, the apical sinuation is generally shallower, and the lateral furcation less pronounced in *I. spatulata* than in *I. furcata* (Fig. 24). The two species also occur on different mountain ranges, separated by a distance of about 150 km, and their habitat is restricted to karooid river valleys and high altitude renosterveld, respectively.

Description of holotype male (Figs 41 A-E, 43 A-C)

Size. Length 19.5 mm; width 9.9 mm.

Body. Black to dark chocolate-brown with velutinous elytra and white cretaceous markings on pronotal and elytral margins (Fig. 41 A); head, pronotum, scutellum and peri-scutellar and sutural areas of elytra exhibiting round punctures and black setae of variable size (Fig. 41 A, C, D).

Head. Black, with round punctures and long black setae on vertex and frons; clypeus glabrous and densely sculptured, with moderate sinuation and slightly upturned at apex, flat to slightly convex at centre, with moderately large lateral invaginations and sharp spinal projections above (Fig. 41 D); antennal club, pedicel and flagellum black to dark brown; antennal club slightly hypertrophic but shorter than pedicel and flagellum combined.

Pronotum. Black with white cretaceous lining on lateral margins, except anterior portion; globose, with well-rounded lateral margins, with anterior and posterior margins curved downwards; with small but dense round punctures throughout surface and black, short setae emerging at centre of each puncture (Fig. 41 A, C).

Scutellum. Black, isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with scattered round to horse-shoe punctures and short black setae across entire surface (Fig. 41 A).

Elytron. Dark chocolate-brown to black and velutinous, with white cretaceous lining along lateral and apical margins, except next to humeral callus; with scattered and short dark setae on basal half, around scutellum and along suture; apex forming blunt right angle, without any spinal projection (Fig. 41 A).

Pygidium. Black, matte and without white cretaceous spots; roundly triangular in shape, lacking any macrosculpture and setation, apart from lining of medium to long setae along apical and lateral margins (Fig. 41 E).

Legs. Completely black, with tarsal segments hypertrophic; with black setae increasing in length from pro- to metalegs; protibia bidentate with internal margin covered in dense setation; meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 41 A-C).

Ventral surface. Black and shiny, covered in dense and long black setae except on abdominal sternites, femoral and coxal bases; mesosternal lobe protruding poorly ventrally, glabrous at centre but exhibiting long setae along

lateral and posterior margins; metasternal lobe with narrow groove along median sulcus, with widening short tract along central portion; abdominal sternites markedly concave and exhibiting small round punctures in horizontal middle band (Fig. 41 B).

Aedeagus. Parameres with lobes smoothly oval all around in dorsal view (Fig. 43 A); outer ridge of incavations without any dark spinal projection; apical end of lobes smoothly rounded and with only hint of ventral projections in frontal view (Fig. 43 C).

Derivatio nominis. The species is named after the remarkably flat and broad shape of it male clypeus, which is reminiscent of a spatula.

Description of female (Figs 24, 42). Although the female of *I. spatulata* is superficially very similar to those of other species of this group, particularly *I. cochleata, I. rostrata* and *I. furcata*, it does not occur sympatrically with any of these. The only other species that occurs near its distribution range is *I. albomaculata*, from which the female can easily be separated by the length and shape of its clypeus. The most salient features of the female of *I. spatulata* can be summarised as follows. a) Body black to dark chocolate-brown and velutinous, with sparse short black setae only around lateral margins of pronotum, dense round punctures on head, pronotum and scutellum; b) clypeus moderately elongate, smoothly rounded laterally, concave

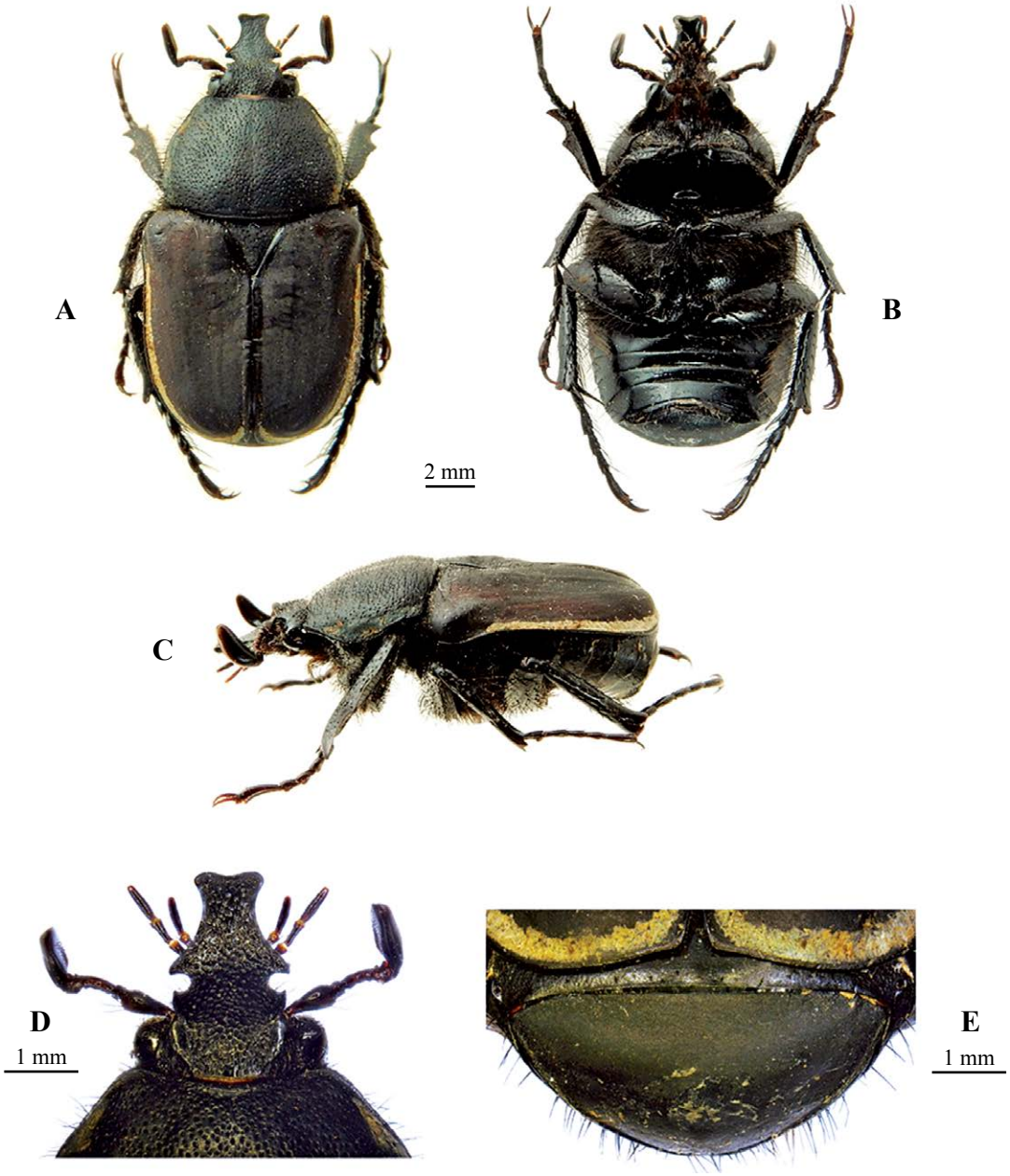

Fig. 41 – *Ichnestoma spatulata* sp. nov, male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

and with deep sinuation at apex; c) pronotum globose and covered in dense round punctures but glabrous, except for few short setae along lateral margins; d) scutellum equilateral triangular, with round punctures throughout except apical portion and well-defined lateral grooves, but no setae; e) elytra dark chocolate-brown to black, with extremely small and scattered sculpture; f) brachypterous, with wing size = 10.0 mm and W:E ratio = 0.91; g) pygidium black, with relatively dense but shallow round punctures; h) tarsal segments slim and moderately hypertrophic, protibiae tridentate, more robust and wider than in male, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with round punctures shallow and dense across general surface but becoming sparse on abdominal sternites, which are markedly convex.

Distribution. *Ichnestoma spatulata* occurs along dry riverbeds in the Boesmanspoortberg area to the west of Willowmore, Eastern Cape Province (Fig. 43 E). A record of "Addo" from the Department of Entomology of the University of Pretoria and reposited in the TMSA (see also Holm 1992) is possibly erroneous, as the area has been extensively surveyed during the current study.

Biology. This species occurs in the Rainshadow Valley Karro Bioregion (Prince Alfred Succulent Karoo unit) of

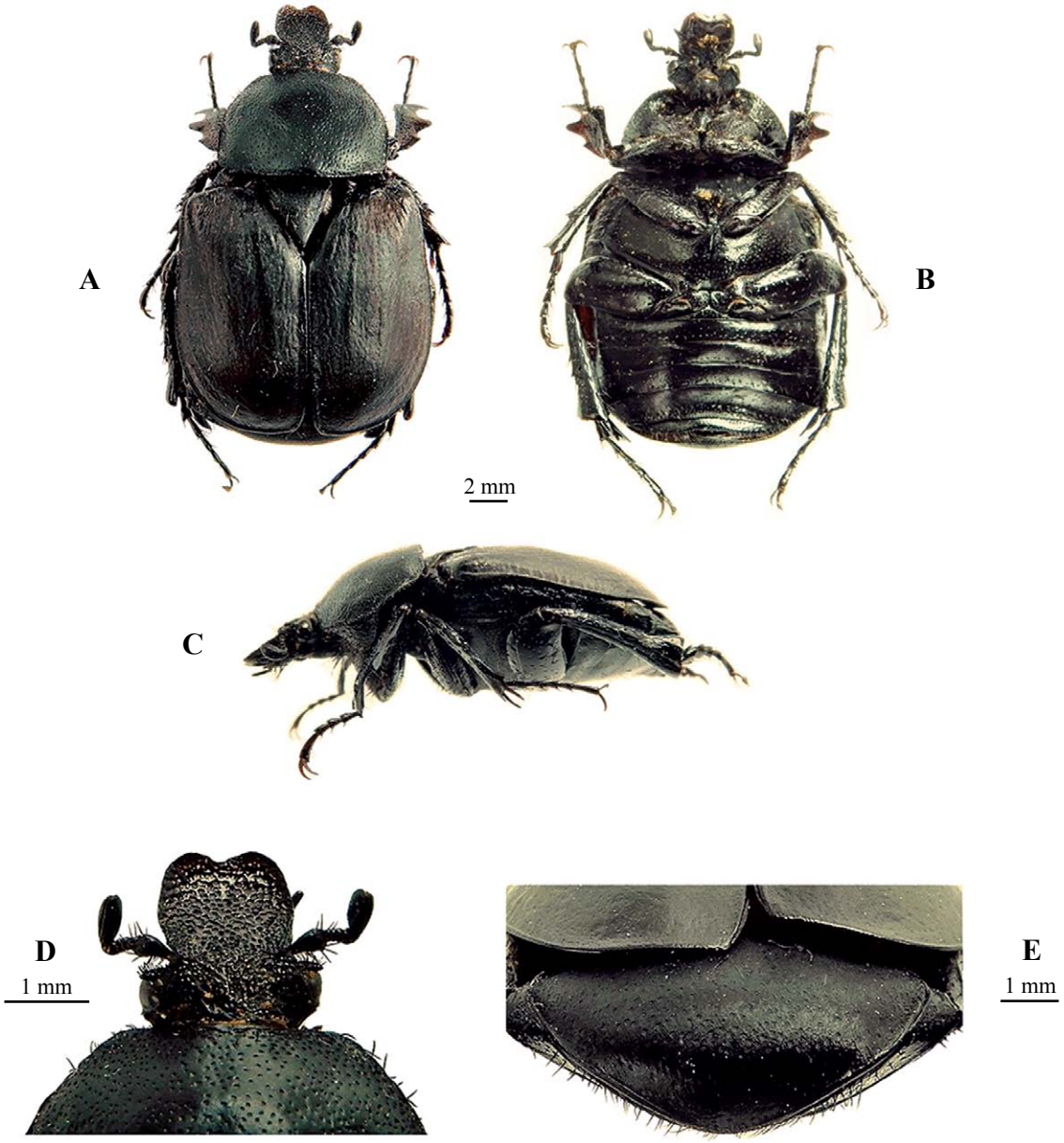

Fig. 42 – *Ichnestoma spatulata* sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

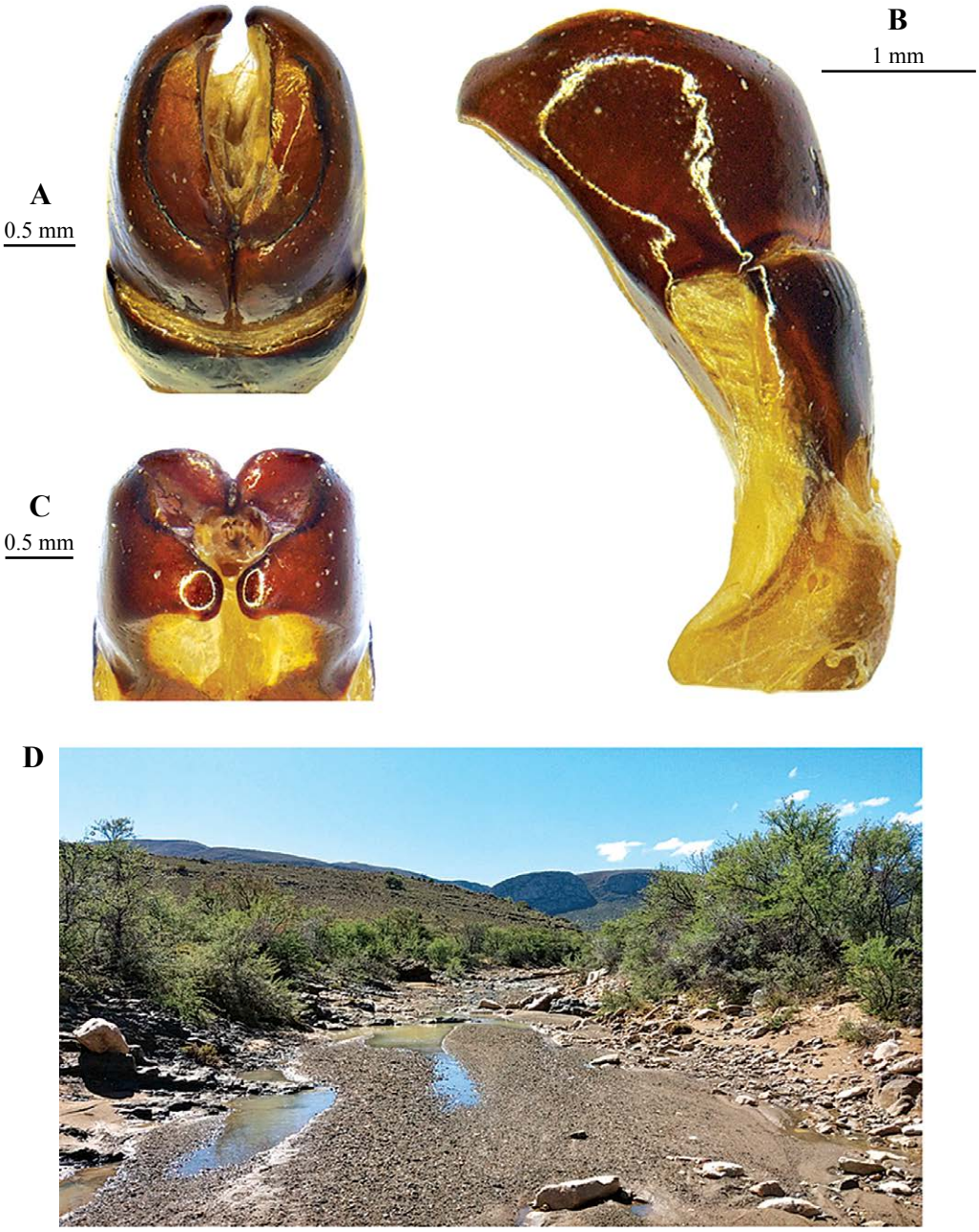

Fig. 43 – *Ichnestoma spatulata* sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the Boesmanspoortberg area near Willowmore. Photographs by Lynette Clennell.

the Succulent Karoo Biome (Mucina & Rutherford 2006). The landscape is generally flat to slightly undulating, with regular stony ridges in the higher parts. Outside the influence of dry riverbeds, the vegetation is dominated by low scrub with leaf-succulent vygies and small-leaved Karoo shrubs (Mucina & Rutherford 2006), while along river courses small trees and tall shrubs clearly prevail. *Ichnestoma spatulata* appears to be associated with the vegetation growing along riverbeds, with habitat preference for the vegetated banks of small tributaries of semi-permanently dry streams. Females have been observed mating and lying eggs under dense shrubs and tree clusters, dominated by *Vachellia karroo* (Fig. 43 D).

Remarks. There is a very small degree of variability in the clypeal shape and extent of white createceous markings in the male of this species. The lateral margins of the clypeus generally taper towards the apical third and then may either diverge gently or more sharply, to impart a subparallel to semi-furcate shape. The sinuation at the apex, however, varies little among specimens and is very gentle across the range (Fig. 24). The white lining on pronotal and elytral

margins is generally narrow and fade abruptly towards the anterior (basal) margins (Fig. 41 A, C). Around the apical sutural margins, this lining can continue along the suture for a few millimiters in some specimens, albeit in an intermittent pattern. Although most specimens lack completely any sign of white marking on the pygidium, three males exhibit a pair of mid-lateral spots of moderate size on its surface. Within the type series analysed in this study, the size ranges as follows: male TL = 18.1-20.3 mm, MW = 9.7-10.2 mm (n = 9); female TL = 18.9-19.6 mm, MW = 10.4-10.7 mm (n = 2).

Data. Republic of South Africa: Holotype: ♂, EC, Willowmore, 26 Dec 2004, R Perissinotto & L Clennell, drowned in farm dam/stream (ISAM); Paratypes: 1♂, 1♀, *ibidem* (BMPC); 2♂♂, *ibidem* 945 m, 4 Jan 2017, P. Malec & P. Šípek lgt (PMPC, UKCR); 6♂, 2♀, *ibidem* 23 Jan 2018, (pers. obs.); 1♂, South Africa, Addo 15 May 1991, K. Coles Department of Entomology [locality most probably erroneous] (DMNH).

Genus *Karooida* gen. nov.
Type Species: *Ichnestoma krikkeni* Holm, 1992

Diagnosis. Superficially, males of this genus can easily be separated from members of either sister genera, i.e. *Ichnestoma* and *Mzansica*, as they are characterised by having elytra always fuscous-brown and lacking in any cretaceous markings throughout the body surface. The total length of species belonging in it is generally smaller than that of most *Ichnestoma* species, but rather similar to that of *Mzansica*. At the level of aedeagus, the longitudinal incavations on the dorsal lobes of the aedeagal parameres are short and round, with smooth external margins. This contrasts with those of *Ichnestoma*, which are generally bean-to club-shaped, and also with those of *Mzansica*, which are rather elongate and sausage-shaped. Females of the three genera can be separated mainly on the basis of their degree of brachiptery, with *Ichnestoma* exhibiting the least wing reduction (W:E ≥ 0.80), *Karooida* an intermediate reduction (W:E = 0.70-0.80) and *Mzansica* the most extreme reduction (W:E < 0.70). Also, the pygidial surface of *Karooida* females is consistently smooth, due to its exclusive ultrafine sculpture. The same occurs in most *Ichnestoma* females, however in those of *Mzansica* the pygidial surface is rugose with variable shallow macrosculpture.

Description (key characters)

Body. Size: male TL = 14.2-20.4 mm, MW = 7.3-11.1 mm; female TL = 13.4-18.2 mm, MW = 7.3-12.0 mm. Shape elongate and dorso-ventrally compressed in male, but rather globose in female.

Head. Black, with dense rugose to round sculpture across entire surface; male clypeus either short and sinuate or elongate with straight, bi- or trilobate apex; female clypeus with round lateral margins and sinuate apex; antennal clubs hypertrophic in male, but shorter or equal to length of pedicel and flagellum combined.

Pronotum. Black, matte, covered in small round punctures with short but robust black to tawny setae emerging at centre of each puncture; broadly semicircular to roundly hexagonal in shape.

Scutellum. Black, and matte; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with few round punctures and short black setae.

Elytron. Fuscous-brown and matte; cretaceous markings completely absent; female wings drastically reduced, with W:E length ratio in range 0.70-0.80.

Pygidium. Black to dark brown and matte; velutinous and without macrosculpture, with few short black to tawny setae occasionally scattered on surface.

Legs. Black, with tarsal segments hypertrophic; with black setae increasing in density and length from pro- to metalegs; tibiae with sparse, coarse to round sculture across external surface; protibia bidentate and slender in male but tridentate and expanded in female; meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs in male; female with metafemora expanded and metatibial apical spine and spur shorter and much wider than in male.

Ventral surface. Black and shiny, covered in dense and long black to tawny setae in male, but setation drastically reduced in female; mesosternal lobe small, convex and slightly protruding outwards; abdominal sternites with marked concavity at middle in male, but slightly convex in female.

Aedeagus. Parameres with longitudinal incavations on dorsal lobes short and round, with smooth external margins.

Derivatio nominis. The genus is named after its distribution range, which appears to be restricted to the eastern Karoo region**.**

Remarks. In the description of the first species of this genus, *K. krikkeni,* Holm (1992) had already pointed out some of its distinctive features, which eventually became more obvious and consistent with the later discovery of *K. pringlei* and *K. struempheri*. In particular, the type pair used by Holm (1992) in the description of *I. krikkeni* lacked a precise locality record and was remarkably discoloured by age or exposure to light. Fresh specimens obtained during the course of this study exhibit consistently a fuscous-brown elytra and have allowed the fixing of its type locality and its unequivocal placing into this new genus. All species known so far are inhabitants of the mountain slopes of the eastern part of the Great Karoo plateau, above the Great Escarpment.

Key to species

1. Male clypeus wide and short, with apex deeply sinuate; dorsal lobes of parameres inverse apple-shaped in dorsal view; female

W:E ratio = 0.75; female clypeus with smoothly rounded lateral margins and sinuate apex; medium species ≈15-20 mm TL; distribution: EC (Winterberge and Bankberg) ..... *K. pringlei* (Perissinotto, Smith & Stobbia, 1999) comb. nov.

- Male clypeus elongate, with apex straight, bi- or trilobate 2

2. Male clypeus slightly bilobate to straight, with lateral margins parallel or tapering towards apex; dorsal lobes of parameres oval in dorsal view; female W:E ratio = 0.77; female clypeus short with rounded lateral margins and sinuate apex; small to medium species ≈13-17 mm TL; distribution: EC (southern Sneeuberge) ..... *K. krikkeni* (Holm, 1992) comb. nov.

- Male clypeus bi- or trilobate, with lateral margins diverging towards apex 3

3. Male clypeus bilobate; dorsal lobes of parameres pyriform in dorsal view; female W:E ratio = 0.78; female clypeus elongate with rounded lateral margins and sinuate apex; small to medium species ≈13-17 mm TL; distribution: EC (southern Drakensberg) ..... *K. balli* gen. et sp. nov.

- Male clypeus trilobate 4

4. Male clypeus with median lobe wide and rounded; body setation tawny or black; dorsal lobes of parameres wide pyriform in dorsal view; female W:E ratio = 0.79; female clypeus elongate with lateral margins roundly angulate and sinuate apex; medium species ≈15-19 mm TL; distribution: EC (Kramberg) ..... *K. sagittata* gen. et sp. nov.

- Male clypeus with median lobe narrow, round, flat or projecting; body setation always black 5

5. Male clypeus with median lobe round or flat; dorsal lobes of parameres pyriform in dorsal view; female W:E ratio = 0. 74; female clypeus elongate with lateral margins roundly angled and slightly sinuate apex; medium species ≈14-18 mm TL; distribution: EC (Bamboesberg, Suurberg) ..... *K. struempheri* (Holm & Perissinotto, 2004) comb. nov.

- Male clypeus with median lobe projecting; dorsal lobes of parameres oval in dorsal view; female W:E ratio = 0.74; female clypeus with lateral margins roundly angled and straight apex; medium species ≈15-17 mm TL; distribution: NC (Kikvorsberg) ..... *K. kikvorsti* (Holm & Perissinotto, 2011) comb. et stat. nov.

Fig. 44 – Comparative clypeal shape of the species of the genus *Karooida* gen. nov.: male (top row) and female (bottom row) dorsal views.

Fig. 45 – Comparative aedeagal shape of the species of the genus *Karooida* gen. nov: dorsal (top row) and frontal (bottom row) views.

***Karooida balli* gen. et sp. nov.** (Figs 44-45, 46-48)

Diagnosis. Like in *K. sagittata,* the elytral surface of this species is virtually glabrous, but its colour is generally darker than in that species, in both sexes. The clypeal shape of the male of the two species also differs substantially, in that *K. balli* has a marked notch at the apex, imparting a proper bilobate character to the structure, while that of *K. sagittata* is convex and roundedly pointed (Fig. 44). The parameres of *K. balli* are slightly narrower and longer in dorsal view than those of *K. sagittata,* and the kidney-shaped dorsal incavations of the lobes are shifted substantially forward towards the apex in *K. balli*, in comparison to those of *K. sagittata* which are positioned right in the middle (Fig. 45). Also, in frontal view the lobes of *K. balli* exhibit a marked projection on both dorsal and ventral sides, while in *K. sagittata* the dorsal projection is obsolete.

Description of holotype male (Figs 46 A-E, 48 A-C)

Size. Length 16.7 mm; width 8.9 mm.

Body. Black and matte, with elytra very dark brown (Fig. 46 A); with dense, black setae on head, pronotum and lateral margins, reduced to a sparse few on scutellar base

and absent on elytra; small ad shallow round punctures on entire surface, becoming coarser and larger on head but sparse and shallower on elytra and scutellum (Fig. 46 A, C, D).

Head. Black with medium size dark setae on vertex and frons; with coarse round to rugose sculpture across entire surface; clypeus laterally expanded both at base and apex, with small lateral invaginations and spinal projections at base but deep median notch at apex; lateral and anterior margins steeply raised, with concavity particularly developed around anterior margin; antennal club, flagellum and pedicel black to very dark brown, club hypertrophic but shorter than flagellum and pedicel combined (Fig. 46 D).

Pronotum. Black, matte, covered in small round punctures with short but robust black setae emerging at centre of each puncture; anterior lateral margins smoothly rounded, but posterior forming blunt right angles, with irregularly spaced and shallow concavities throughout disc; basal or posterior margin almost straight across both elytra and scutellum (Fig. 46 A, C).

Scutellum. Black and matte; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with few round punctures and short black setae, becoming denser along basal margin (Fig. 46 A).

Elytron. Dark brown to black and matte, with darkest infusions along margins and on umbones; completely glabrous and with costae obsolete; shallow round to irregular

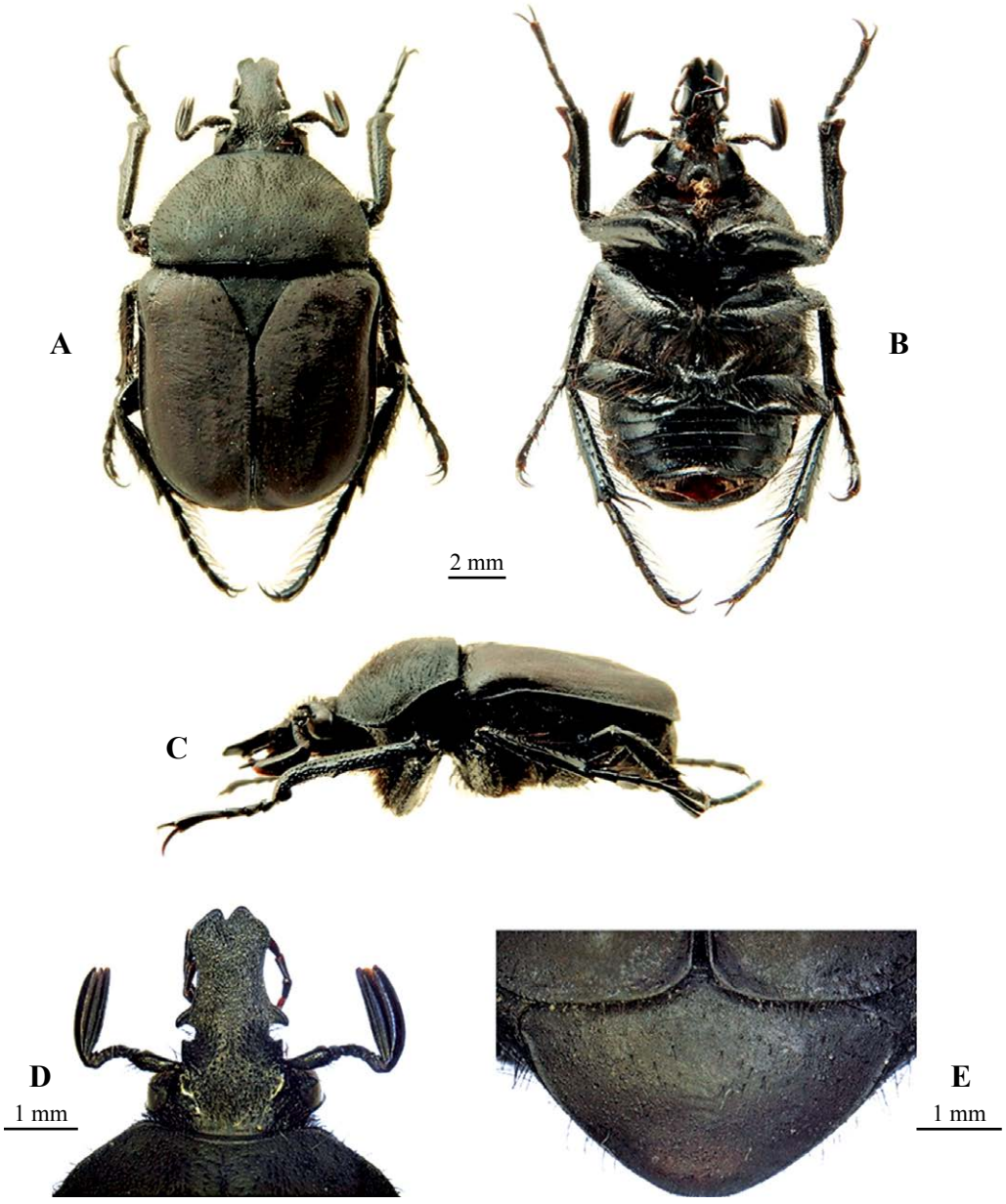

Fig. 46 – *Karooida balli* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

sculpture scattered across surface, but very sparse on disc; apex forming blunt right angle, without any spinal projection (Fig. 46 A).

Pygidium. Black to dark brown and matte; velutinous and without macrosculpture but with few short black setae on disc and lining of moderately dense medium sized setae along apical and lateral margins (Fig. 46 E).

Legs. Completely black, with tarsal segments hypertrophic; with black setae increasing in density and length from pro- to metalegs; tibiae with sparse, coarse to round sculture across external surface; protibia bidentate, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 46 A, B, C).

Ventral surface. Entirely black and shiny, covered in dense and long black to dark brown setae, except on lateral portions of abdominal sternites, becoming sparser on metasternum, femoral and coxal bases; mesosternal lobe convex and slightly protruding outwards, exhibiting round punctures and long setae across entire surface; metasternal lobe with narrow but moderately deep concavity along median sulcus; abdominal sternites with marked concavity and scattered but robust setae at middle (Fig. 46 B).

Aedeagus. In dorsal view, with widest part towards base and apex of lobes roundly pointed; lobes with both dorsal and ventral projections equally well-developed in frontal view (Fig. 48 C); kidney-shaped incavations of dorsal lobes shifted markedly towards apex and delimited

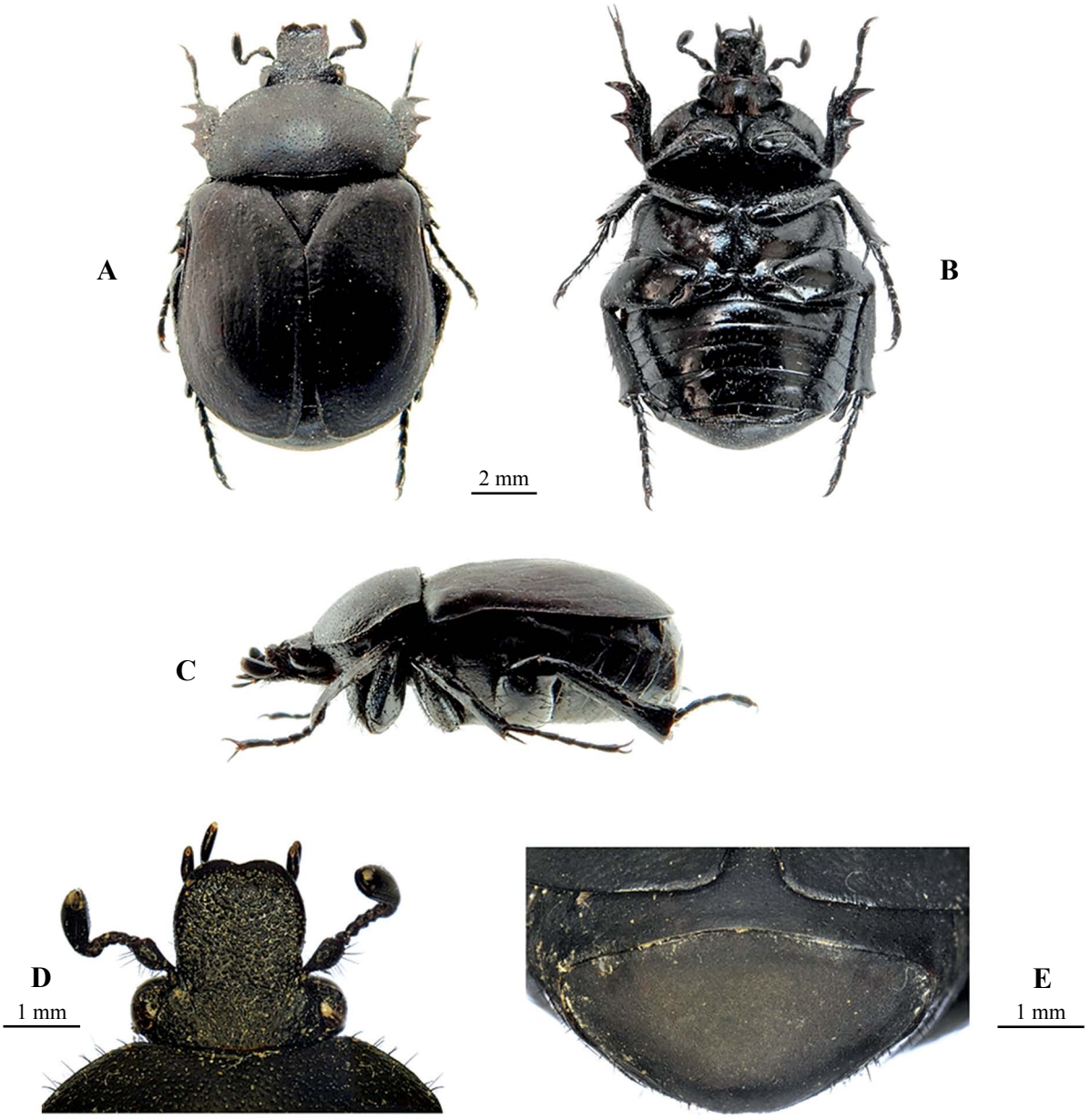

Fig. 47 – *Karooida balli* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

externally by smooth margin, without serration or ridged features (Fig. 48 A).

Derivatio nominis. This species is dedicated to Dr Jonathan B. Ball of Cape Town, a renowned entomologist and former radiologist, who together with Andre P. Marais discovered at Dordrecht the only population currently known.

Description of female (Figs 44, 47). The female of this species is very similar to that of both *K. struempheri* and *K. sagittata*, and it may be extremely difficult to separate them just on the basis of external morphology. In particular, the clypeus of *K. balli* exhibits gently rounded lateral margins and a moderate sinuation at apex, similar to those of the two species mentioned above. Its most salient features can be summarised as follows. a) Body black to dark brown and matte, with sparse short black setae only around margins and shallow coarse to round punctures on head and pronotal surfaces, becoming extremely small and scattered on pronotum and elytra; b) clypeus laterally rounded, concave, with moderate sinuation at apex; c) pronotum globose and covered in dense round, shallow punctures; d) scutellum equilateral triangular, with few shallow punctures but no setae; e) elytra dark brown to black, with extremely small and scattered sculpture and weak costal markings; f) brachypterous, with wing size = 7.0 mm and W:E ratio = 0.78; g) pygidium black, with small, scattered round puncutres and short dark setae emerging at centre of each punctures; h) tarsal segments

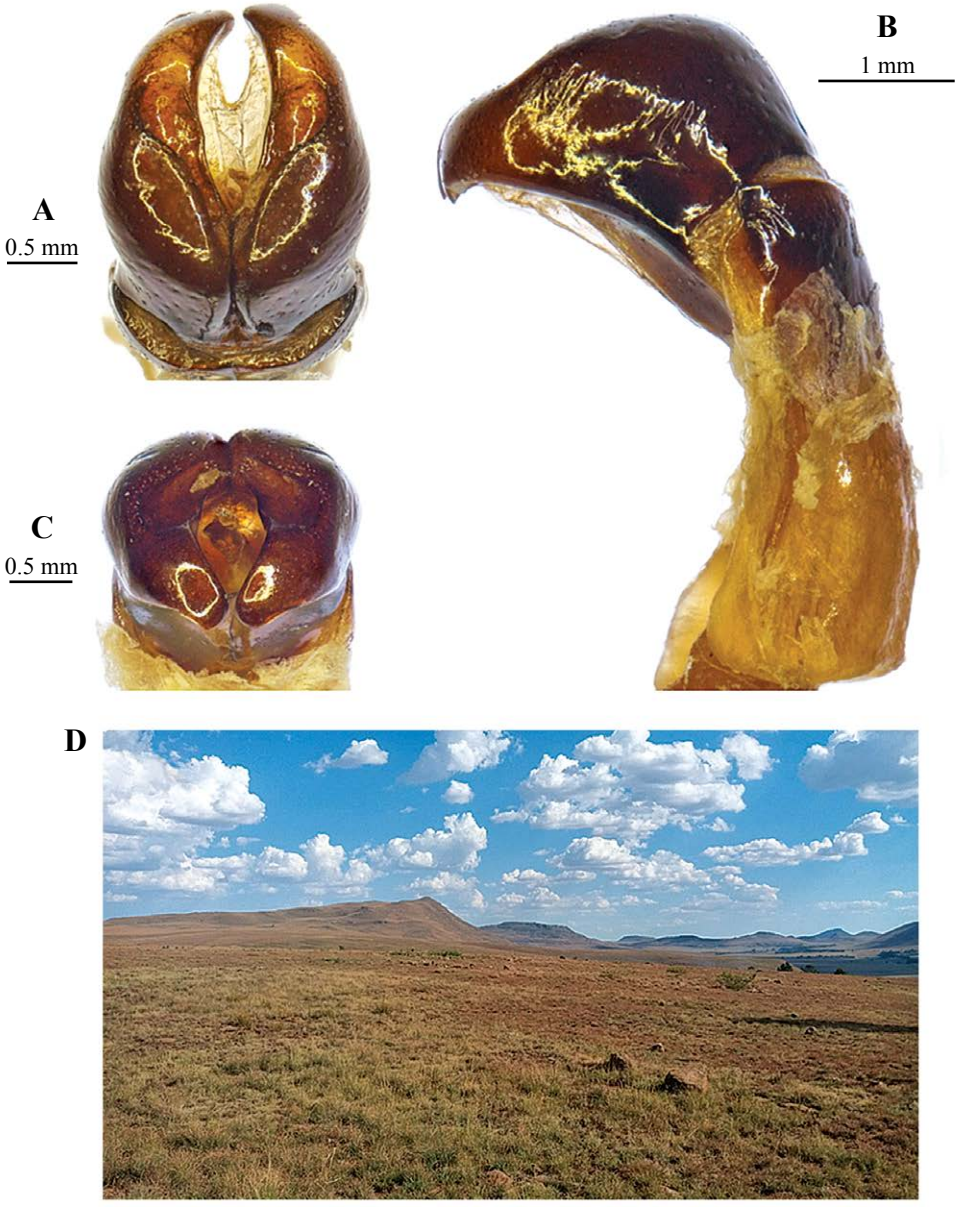

Fig. 48 – *Karooida balli* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, mountain environs near Dordrecht, with the typical habitat of the species. Photographs by Lynette Clennell.

slim and not hypertrophic, protibiae tridentate, more robust and wider than in male, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation much less dense and shorter than in male, with abdominal sternites weakly convex.

Remarks. Most male specimens exhibit a deep notch at the centre of the clypeal apical margin, thereby imparting to the structure a bilobed shape (Fig 46 D). However, some specimens deviate from this typical shape by having also two symmetric, minor lateral sinuations, leading to a virtual quadrilobate clypeal apex. The elytral colour is generally quite consistent across the various specimens analysed, and darker than in any other species of the subgenus to the point that even some males may superficially look entirely black. Within the type series analysed in this study, the size ranges as follows: male TL = 16.7-19.0 mm, MW = 8.6-9.5 mm (n = 26); female TL = 13.9-15.4 mm, MW = 7.3-8.9 mm (n = 6).

Distribution. The type locality of Dordrecht, on the lower slopes of the Southern Drakensberg, is thus far the only place where *K. balli* is known to occur. It is likely though that it will occur in the surrounding highlands at altitudes between 1800 and 2000 m.

Biology. This species replaces its closest relative, *K. sagit-*

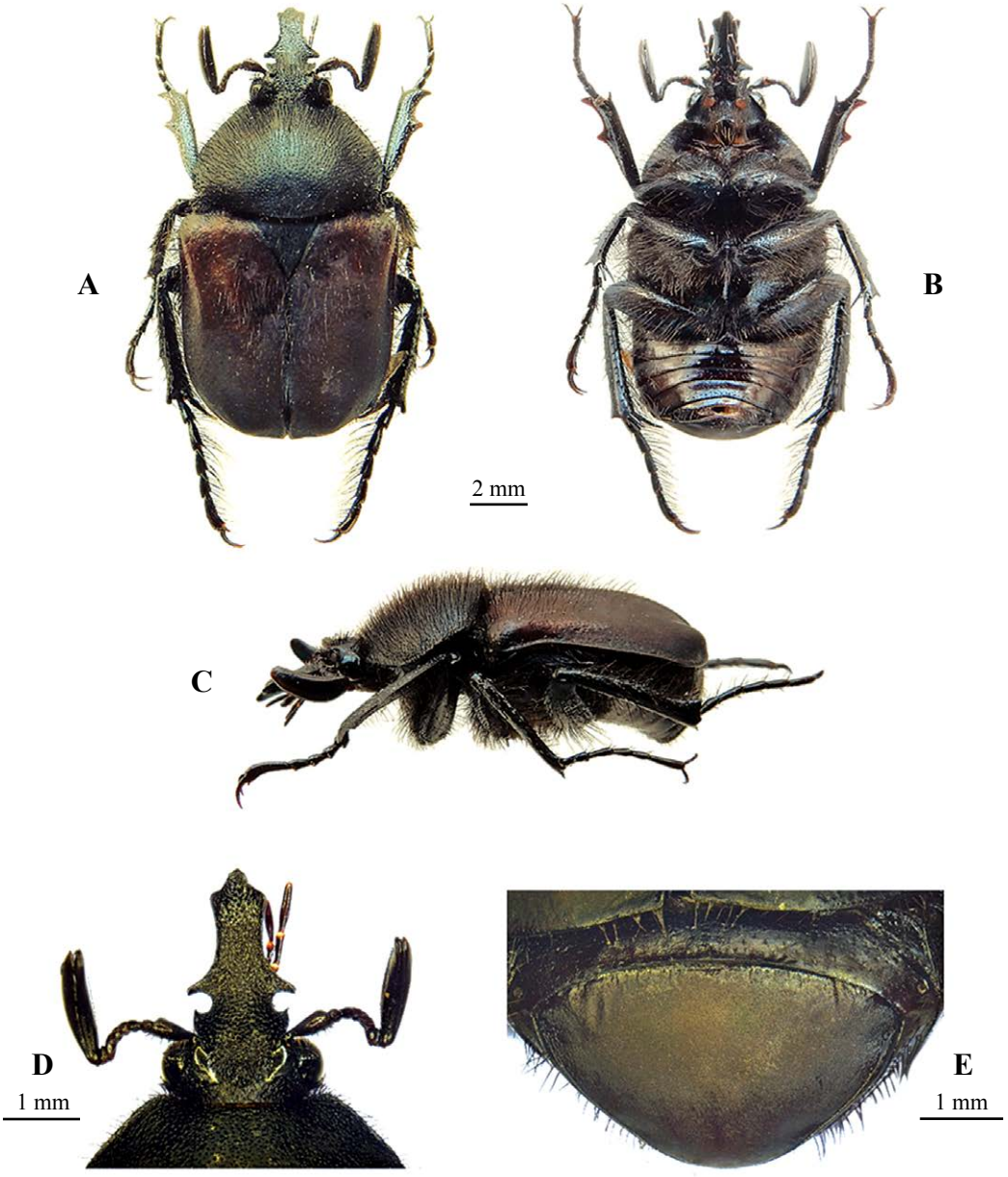

Fig. 49 – *Karooida kikvorsti* (Holm & Perissinotto, 2011) comb. et stat. nov, male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

tata, across the major divide between the arid Karoo region and the much wetter Drakensberg range. Thus the habitat of *K. balli* falls within the Drakensberg Grassland Bioregion, with vegetation type at the interface between Stormberg Plateau Grassland and Southern Drakensberg Highland Grassland (Mucina & Rutherford 2006). The landscape is dominated by steeply sloping mountainous areas supporting extensive fields of tussock grassland, occasionally interrupted by dwarf shrubland on exposed rocky areas. Prominent graminoid grass species include *Themeda triandra*, *Festuca* spp., *Eragrostis* spp., *Merxmuellera disticha*, while the shrub species include among others *Felicia filifolia*, *Chrysocoma ciliata*, *Helichrisum* spp. and the taller *Rhus pyroides* (Mucina & Rutherford 2006).

Data. Republic of South Africa: Holotype: ♂, E. Cape Prov., Dordrecht Mountain, 1729 m, 12 Dec 2013, A.P. Marais & J.B. Ball Leg. (ISAM). Paratypes: 12♂♂, *idem* (BMPC); 18♂, 6♀, *ibidem* 31 Dec 2015, dead on ground, R. Perissinotto & E.L. Pringle (ISAM, TMSA, BMPC, EPPC).

***Karooida kikvorsti* (Holm & Perissinotto, 2011) comb. et stat. nov.** (Figs 44-45, 49-51)

Ichnestoma struempheri kikvorsti Holm & Perissinotto, 2011: 90; Beinhundner 2017: 1153.

Remarks. As highlighted in Holm & Perissinotto (2011), the population occurring on the Kikvorsberg is very iso-

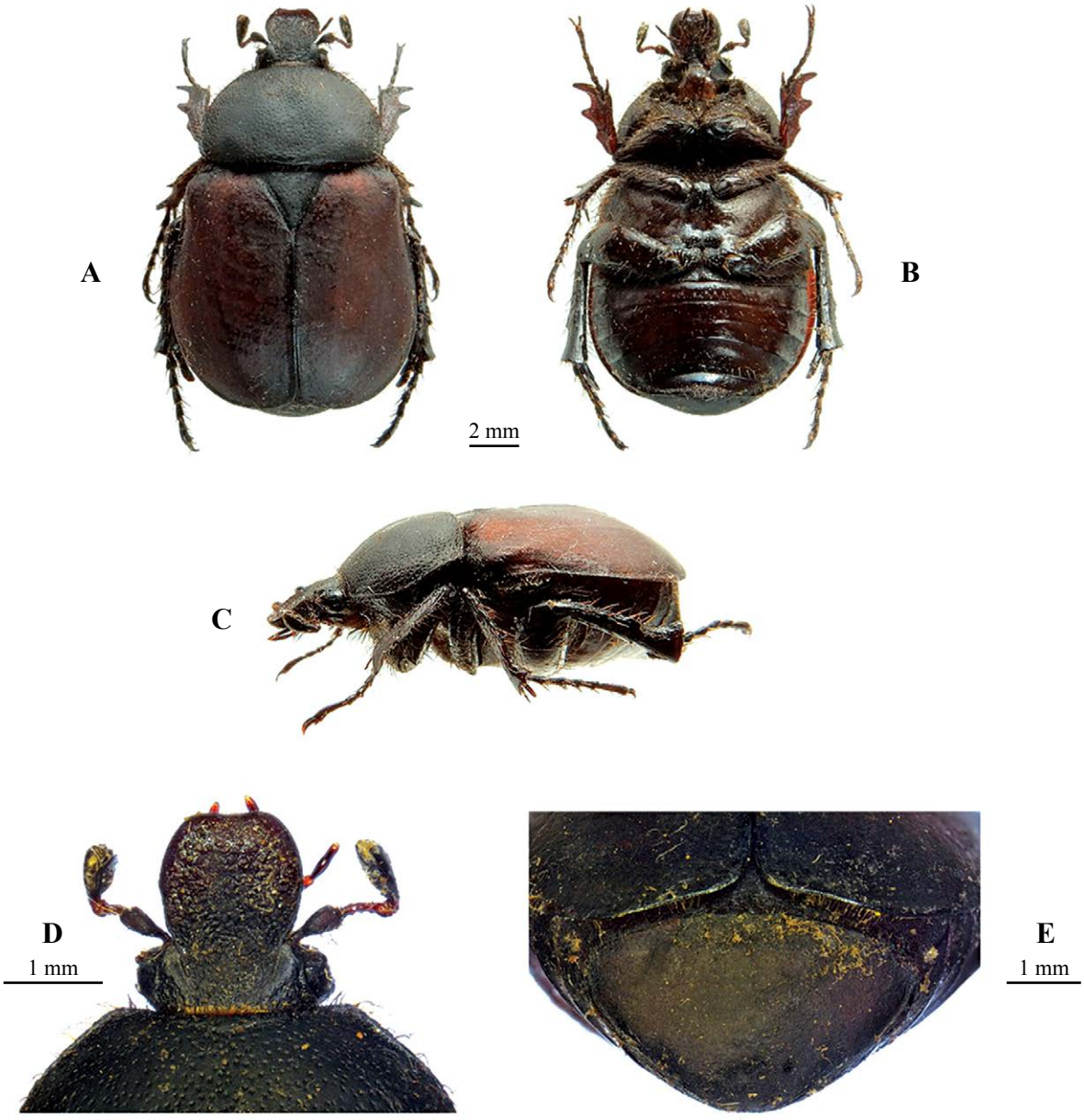

Fig. 50 – *Karooida kikvorsti* (Holm & Perissinotto, 2011) comb. et stat. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

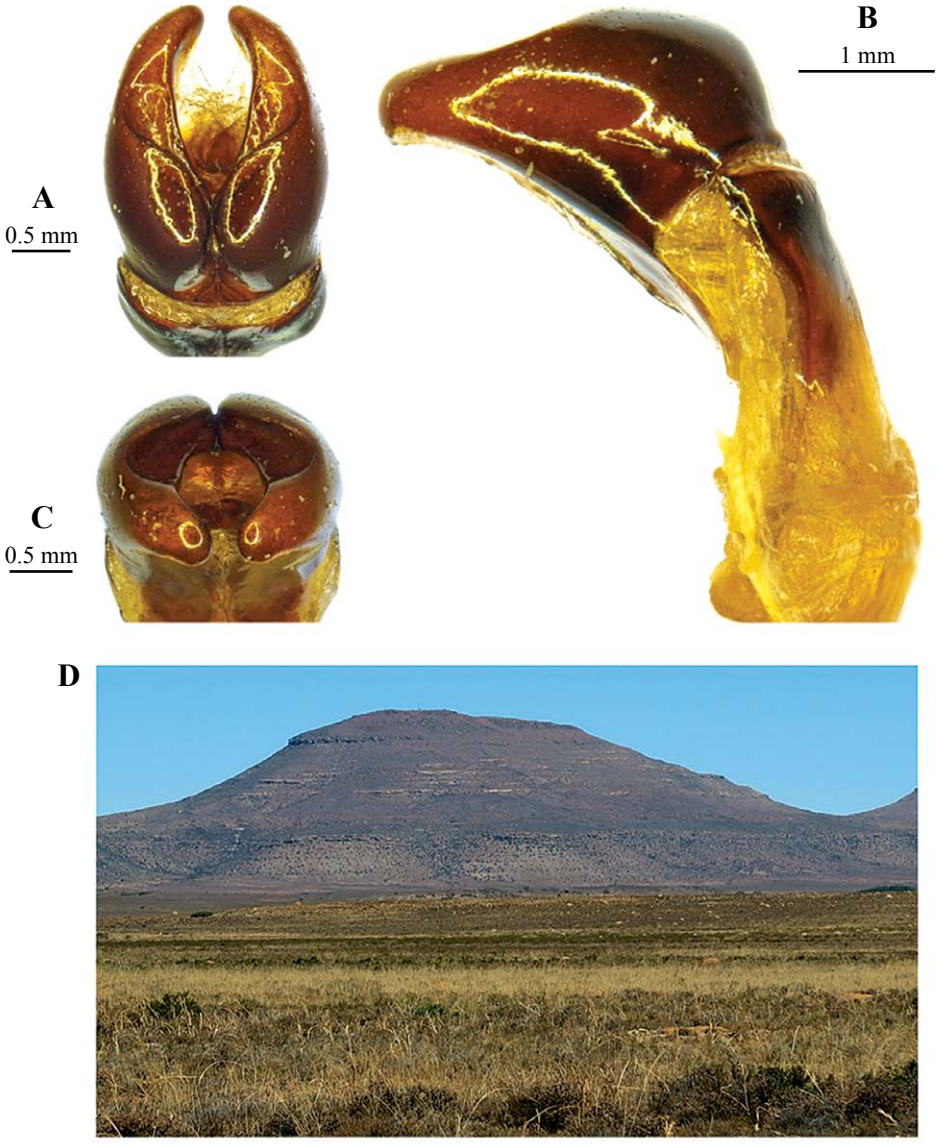

Fig. 51 – *Karooida kikvorsti* (Holm & Perissinotto, 2011) comb. et stat. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, view of the Kikvorsberg, with the habitat of the species just below the summit. Photographs by Lynette Clennell.

lated and located approximately 70-100 km from its closest relative, *K. struempheri*. The male differs from *K. struempheri* in many respects, particularly at the level of the clypeus, which exhibits consistently a well-developed median lobe, while this is at best only feebly defined in *K. struempheri* (Fig. 44). Other differences include extensive setation on elytral suture and basal two thirds of elytral disc, which on the other hand are absent or very short and scatted in *K. struempheri*. At the level of the aedeagus, the parameres of *K. kikvorsti* exhibit longer and narrower lobes than those of *K. struempheri*, and the grooves on the dorsal lobes are deeper and more elongate in the former than the latter species (Fig. 45). Similarly, the female of *K. kikvorsti* has a longer and wider clypeus (laterally expanded in the middle) than its *K. struempheri* counterpart (Fig. 44) and its setae are longer than in the latter species throughout the body surface. All this is suggestive of a substantial separation between the two and consistent with the elevation of *K. kikvorsti* to proper species. The female is brachypterous with a W:E length ratio = 0.74. Size: male TL = 15.4-17.5 mm; MW = 7.7-8.3 mm (n = 11); female TL = 14.8-16.5 mm, MW = 7.8-9.0 mm (n = 5).

Distribution. *Karooida kikvorsti* is still only known from the type locality of Kikvorsberg, situated on the outskirts of the Northern Cape town of Noupoort. It is most likely though that it may occur on the nearby, interconnected mountains that attain a similar altitude, like the Oppermanskop and the Bosberg.

Biology. This is a high altitude dweller, occurring between about 1850 and just over 2000 m, on the southern side of the upper slopes of the mountain. The species inhabits the Karoo Escarpment Grassland habitat of the broader Grassland Biome of southern Africa (Mucina & Rutherford 2006). The typical vegetation here is of tussock grassland type, dominated by *Merxmuellera disticha* and other species associated with dry highveld. There is also a scattered, but significant low shrub component interspersed with grasses throughout this grassland. Out of a total of eight 3rd instar larvae collected in the field, only one female adult emerged successfully under in situ-simulated laboratory conditions at Durban.

Data. Republic of South Africa: Holotype: ♂, NC, Kikvorsberg [S31°07' E25°07'], 18 Dec 2004, R. Perissinotto & L. Clennell (TMSA). Allotype: ♀, *idem* (TMSA). Paratypes: 38♂♂, 5♀♀, *ibidem*, mostly dead on ground (BMPC, EPPC, HMPC, TGPC). Other material: 1♀, *ibidem*, ex larva, Dec 2004, emerged at Durban, Oct 2005 (BMPC).

***Karooida krikkeni* (Holm, 1992) comb. nov.**
(Figs 44-45, 52-54)

Ichnestoma krikkeni Holm, 1992: 379; Holm & Marais 1992: 26; Beinhundner 2017: 1148.

Remarks. Holm (1992) regarded this species as closest to *I. cuspidata*, but this was based mainly on the shape of the male clypeus. Otherwise, it is remarkably different to that species and certainly conforms to the general description of the genus *Karooida*, particularly in terms of lack of cretaceous markings, brown elytral colour and

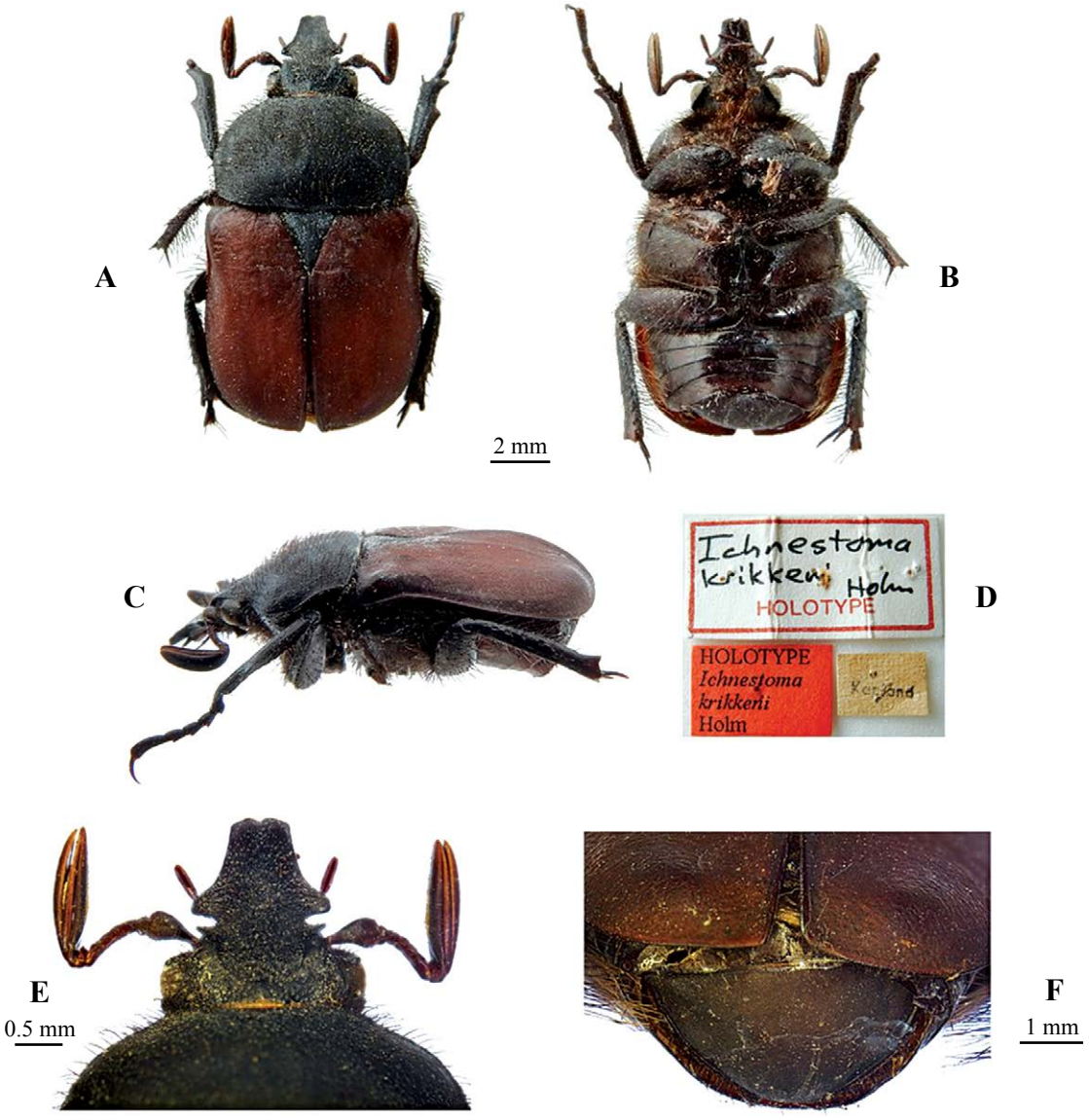

Fig. 52 – *Karooida krikkeni* (Holm, 1992) comb. nov., holotype male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, data labels; **E**, clypeus; **F**, pygidium. Photographs by Lynette Clennell.

body size, as well other characters such as pygidial sculpture and parameres (Figs 52, 54). Recent specimens have been collected in the area around the Eastern Cape town of Graaf-Reinet. Despite matching reasonably well the original description of Holm (1992), particularly at the level of the parameres, these show a remarkable variation in the male clypeal shape, which is often more elongate, lacking the mid-apical sinuation, or even exhibiting parallel lateral margins (rather than regularly tapering from base to apex), compared to the holotype. These specimens also exhibit consistently a fuscous-brown elytra, indicating that the type specimens are probably discoloured by age or exposure to light, especially the allotype female. Total body size of the male and female specimen is respectively: TL = 14.2-17.4 mm, MW = 7.3-8.1 mm (n = 16); TL = 13.4-16.5 mm, MW= 8.0 - 9.7 mm (n = 4).

Distribution. "Kapland" was the Dutch name of the old Cape Colony and Graaf-Reinet was the first town to be established in the eastern part of this territory, in 1786. The recent records show that this species occurs on the lower slopes of the southern Sneeuberg range, to the northeast of Graaf-Reinet (Fig. 54 E), thereby fixing the type locality.

Biology. The typical habitat of this species seems to be linked to the Karoo Escarpment Grassland (Mucina & Rutherford 2006). This dry vegetation type is dominated by

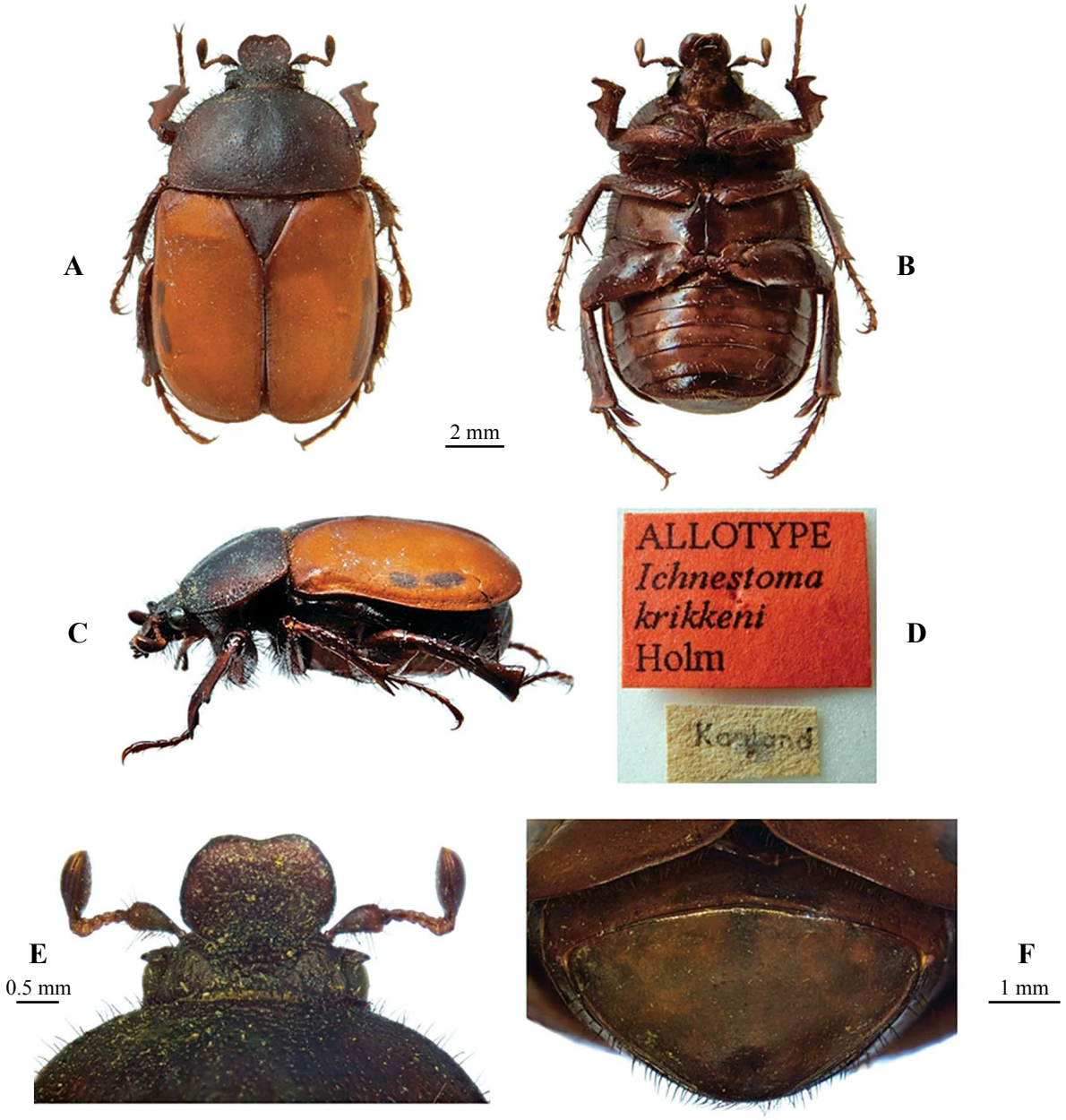

Fig. 53 – *Karooida krikkeni* (Holm, 1992) comb. nov., allotype female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, data labels; **E**, clypeus; **F**, pygidium. Photographs by Lynette Clennell.

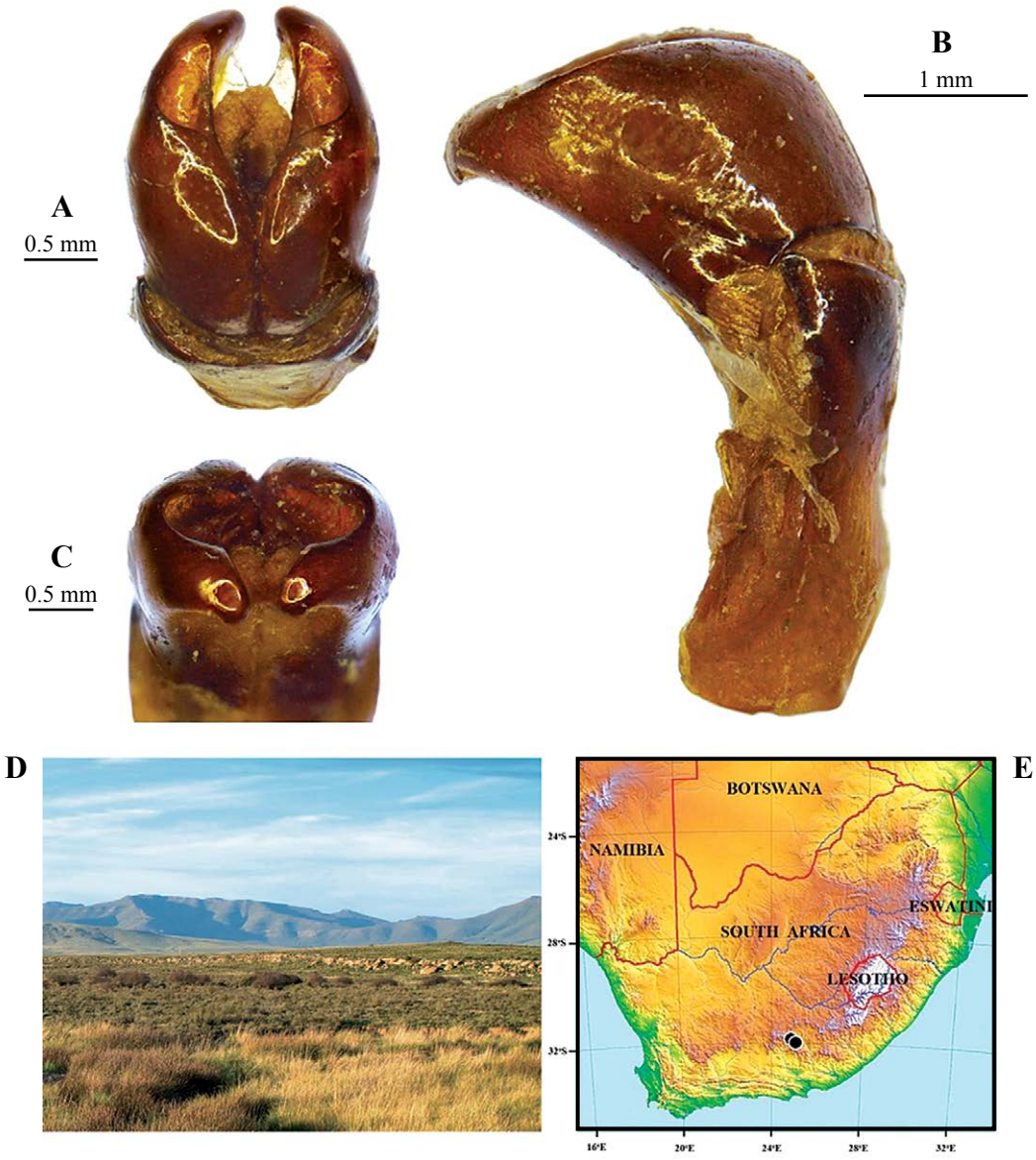

Fig. 54 – *Karooida krikkeni* (Holm, 1992) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the environs of the Lootsberg Pass, north-east of Graaf-Reinet; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

tussock species like *Merxmuellera disticha*, interspersed with shrub components, under which larvae of *(K.) krikkeni* presumably develop where shade, moisture and leaf litter accumulations are suitable.

Data. Republic of South Africa: Holotype: ♂, 'Kapland' (TMSA). Allotype: ♀, *idem* (TMSA). Other material: 16♂♂, 4♀♀, South Africa, EC, Lootsbergpas, 18 Dec 2006, mostly dead on ground, R. Perissinotto & E.L. Pringle (ISAM, TMSA, BMPC, EPPC, MDPC); 1♂, South Africa, EC, Wapadsbergpas, 18 Dec 2006, R. Perissinotto & L. Clennell (BMPC); 3♂♂, 4♀♀, RSA, Eastern Cape, Lootsberg Pass 1785 m, 31°50'14" S, 24°51'38" E, 31 Dec 2016, dead on ground, P. Malec & P. Šípek lgt (PMPC).

***Karooida pringlei* (Perissinotto, Smith & Stobbia, 1999) comb. nov.** (Figs 44-45, 55-57)

Ichnestoma pringlei Perissinotto, Smith & Stobbia, 1999: 221; Beinhundner 2017: 1151.

Remarks. This is the largest and most distinct species in the genus, as in comparison to all other species it exhibits a very short and wide clypeus in both sexes. The male clypeus, in particular, is very stable and varies little in shape and size. The male genitalia are characterised by grooves on the dorsal lobes of parameres extending all the way to the base and forming a thin, dark dorso-lateral ridge in the apical half (Fig. 45). Conversely, in all the other species of this genus the groove on the dorsal lobes is generally con-

stricted towards the basal half and there is never a sharp ridge emerging in its apical half. Finally, *K. pringlei* lacks almost completely the black setation, which on the other hand is typical of the pronotal and upper elytral surface of the other species of *Karooida*. The female is brachypterous, with a W:E ratio = 0.75. Total body size of male and female specimens is respectively: TL = 15.6-20.4 mm, MW = 8.7-11.1 mm (n = 25); TL = 14.7-18.2 mm, MW= 9.4-12.0 mm (n = 10).

Distribution. Apart from occurring in the central part of the Winterberge range, between Bedford and Tarkastad (Eastern Cape), as originally reported in Perissinotto et al. (1999), the species has more recently also been recorded from the Bankberg, near Cradock (Fig. 57 E).

Biology. The species has been collected at an altitude of about 1300-1500 m, in sandstone soil of the Dry Highveld Grassland Bioregion (Mucina & Rutherford 2006). The vegetation here is of the Karoo Escarpment type, dominated by grass and scrub species like *Merxmuellera disticha, Themeda triandra*, *Helichrysum asperum* and *Selago albida*. Larvae of *K. pringlei* were unearthed from a depth of 1-12 cm around and under a variety of grass and scrub species, including *Merxmuellera disticha*, *Felicia filifolia* and *Hermannia* sp. (Perissinotto et al. 1999). The third instar was described in Perissinotto et al. (1999) and, together with that of *M. stobbiai* (Deschodt et al. 2009), remains the only immature stages currently described for the Ichnestomina.

Data. Republic of South Africa: Holotype: ♂, E Cape,

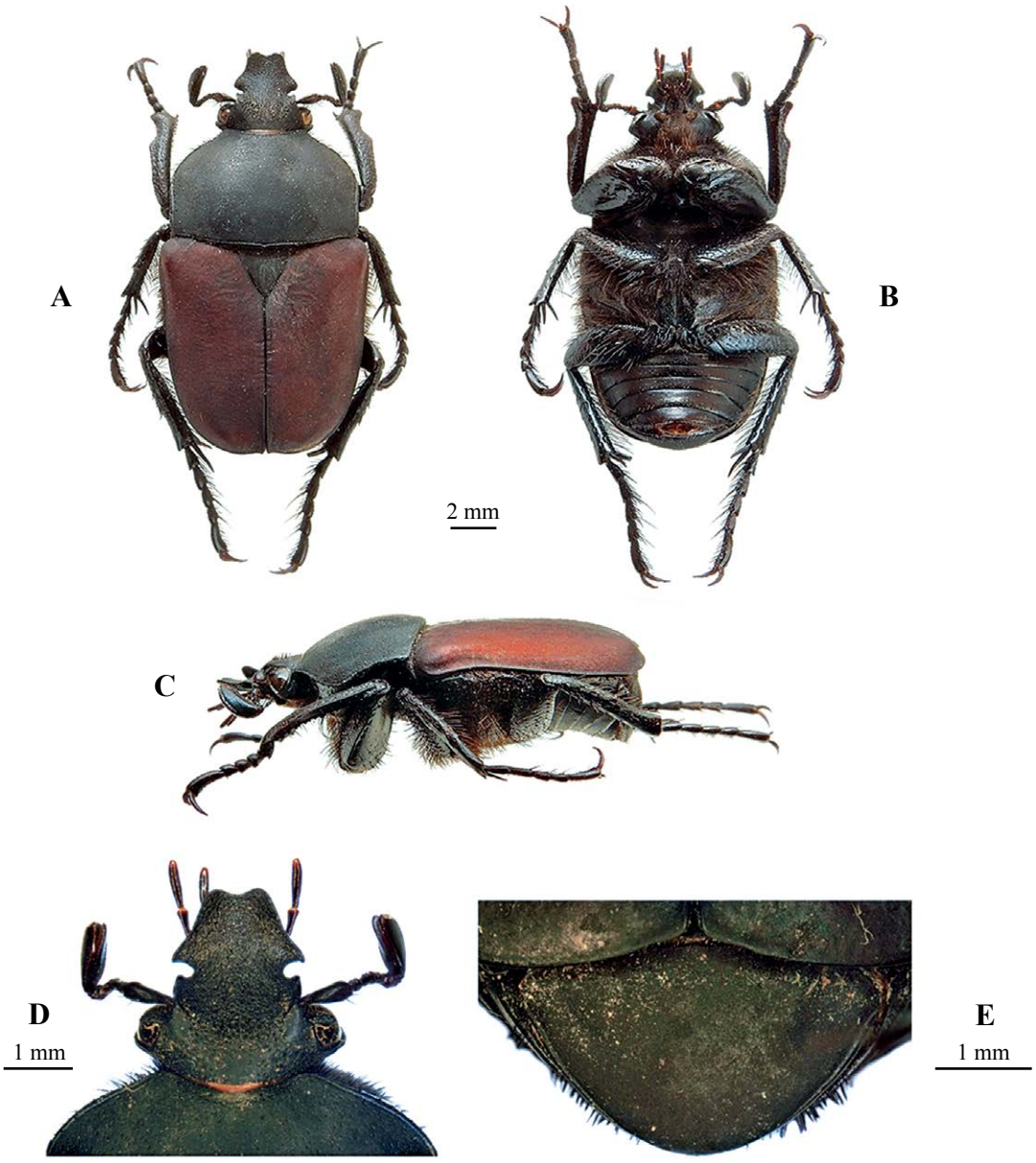

Fig. 55 – *Karooida pringlei* (Perissinotto, Smith & Stobbia, 1999) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

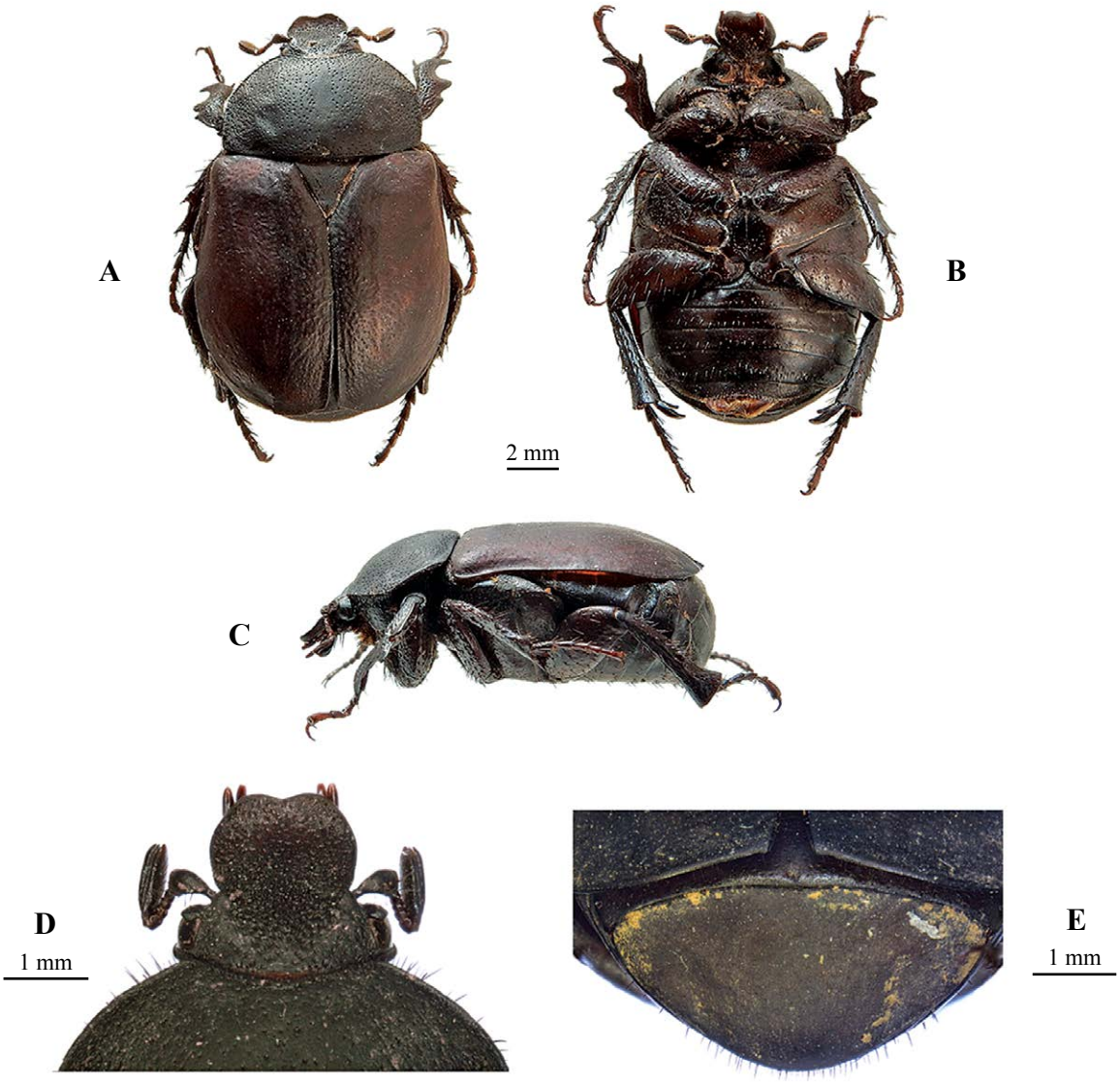

Fig. 56 – *Karooida pringlei* (Perissinotto, Smith & Stobbia, 1999) comb. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

Winterberge, 12 Jan 1998, R. Perissinotto & L. Clennell (TMSA). Allotype: ♀, *idem*. Paratypes: 13♂♂, 3♀♀, *ibidem*, dead on ground (BMPC, TMSA, DMPC, HMPC); 38♂♂, 13♀♀, *ibidem* 17-18 Dec 1998, R. Perissinotto, L. Clennell & E.L. Pringle (AMSA, EPPC; BMPC, HMPC, PMPC, TGPC); 6♂♂, South Africa, Bedford-Winterberge, 14 Jan 1999, E.L. Pringle (EPPC). Other Material: 1♂, South Africa, Eastern Cape, Huntley Glen Farm, Bedford Dist., 1 Dec1999, Perissinotto (ISAM COL-A067972); 1♂, *ibidem* 23 Dec1999 E.L. Pringle (EPPC); 7♂♂, South Africa EC, Bankberg, Nr Cradock, 2 Jan 2001, EL Pringle (EPPC, BMPC).

***Karooida sagittata* gen. et sp. nov.** (Figs 44-45, 58-60)

Diagnosis. *Karooida sagittata* is the only species currently known within the genus to exhibit light tawny setae on its surface in about 50% of the population. Its male genitalia are the most distinctive characters, in order to separate it from its closest relatives, *K. struempheri* and *K. balli.* The dorsal lobes of the parameres of *K. sagittata* are in fact shorter but wider, than in the other two species and the lateral expansion is shifted from the middle to the lower, basal third (Fig. 45). On the other hand, the kidney-shaped dorsal incavations of the lobes are positioned right in the middle, while these are shifted substantially forward towards the apex in *K. balli*. Concerning clypeal shape, there is substantial variability in all three species, but in *K. sagittata* the apical margin generally resembles a blunt arrow-head, with minor signs of sinuation visible in a specimen only. In *K. balli*, there is generally a deep notch at the apex, imparting a bilobate shape overall, while in *K. struempheri* the typical trilobate form prevails by far in all the populations currently known (Fig. 44). Lastly, the elytral

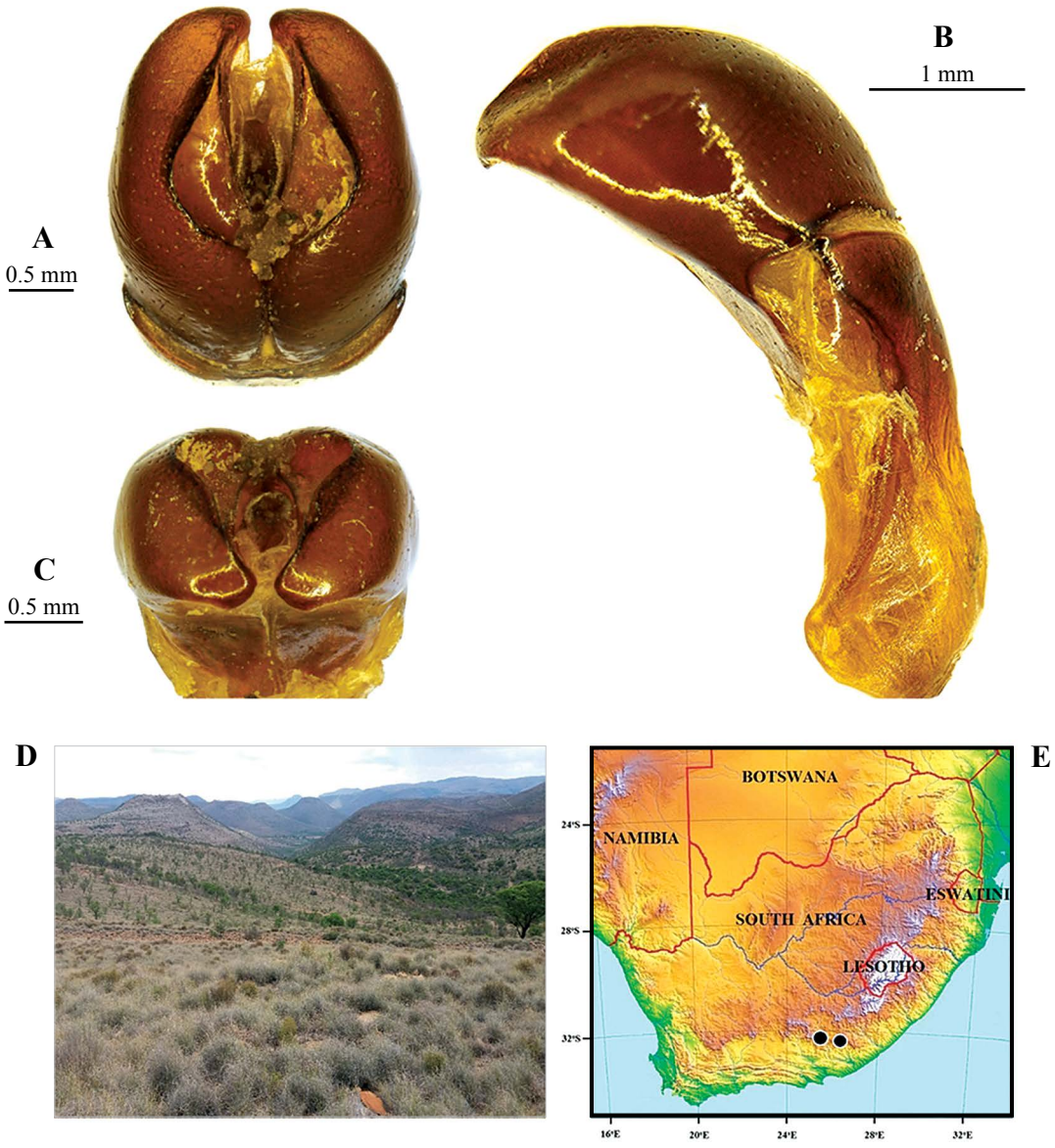

Fig. 57 – *Karooida pringlei* (Perissinotto, Smith & Stobbia, 1999) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the highland grasslands of the Winterberge range in the Eastern Cape; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

surface of *K. sagittata* does not exhibit any setation, while that of *K. struempheri* has several black setae on the basal half, particularly around the scutellum.

Description of holotype male (Figs 58 A-E, 60 A-C)

Size. Length 18.2 mm; width 9.1 mm.

Body. Black and matte, with elytra dark reddish brown (Fig. 58 A); exhibiting dense, light tawny setae on head, pronotum and lateral margins, becoming extremely short and sparse on scutellum and absent on elytra; small and shallow round punctures on entire surface, becoming coarser and larger on head but sparse and shallower on elytra (Fig. 58 A, C, D).

Head. Black with tawny setae long on vertex, but becoming very short on frons; with wide and coarsely round punctures across entire surface; clypeus in the shape of blunt arrow-head, with very small lateral invaginations and spinal projections at base, expanding slightly laterally towards apex and eventually forming blunt, concave apex with lateral and anterior margins raised; antennal club, flagellum and pedicel black to dark brown, club hypertrophic but shorter than flagellum and pedicel combined (Fig. 58 D).

Pronotum. Black, matte, covered in round punctures with short tawny setae emerging at centre of each puncture; lateral margins abruptly rounded, especially posteriorly, steep declivity present between anterior margin and central disc; basal or posterior margin smoothly and unin-

terruptedly rounded across both elytra and scutellum (Fig. 58 A, C).

Scutellum. Black and matte; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with few round to horseshoe punctures and even fewer short light setae, concentrated mainly in basal half (Fig. 58 A).

Elytron. Dark fuscous-brown and matte, with darker infusions along all margins and on umbones; glabrous with the exception of few minute tawny setae along suture; with costae obsolete and tiny round to irregular punctures scattered across surface, very sparse and shallow on disc; apex bluntly squared, not protruding or forming spinal projection (Fig. 58 A).

Pygidium. Black and matte; velutinous and without macrosculpture but lining of moderately dense medium sized tawny setae along apical and lateral margins (Fig. 58 E).

Legs. Completely black, with tarsal segments hypertrophic; tawny setation increasing from pro- to metalegs, both in density and length; tibiae with sparse, coarse to round sculpture across external surface; protibia bidentate, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs, particularly on metatibia (Fig. 58 A-C).

Ventral surface. Entirely black and shiny, covered in dense and long tawny setae, except on abdominal sternites, metasternum, femora and coxal bases, where setae become

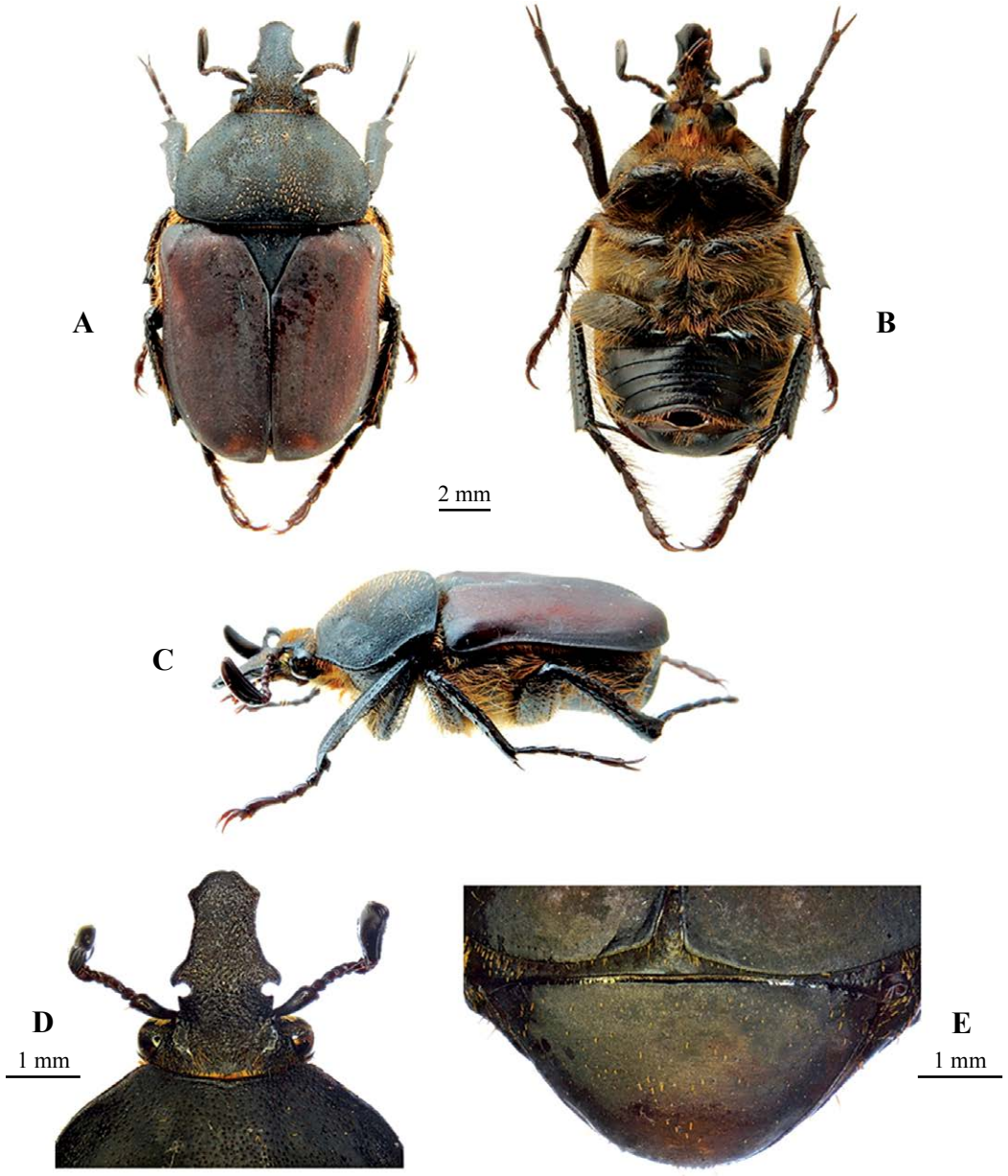

Fig. 58 – *Karooida sagittata* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

scattered or absent; mesosternal lobe flat and semicircular, not protruding and with base exhibiting long setae; metasternal lobe with club-shaped concavity along median sulcus; abdominal sternites forming marked concavity at middle (Fig. 58 B).

Aedeagus. Oval-shaped in dorsal view, with widest point towards base and apex of lobes roundly pointed; lobes with dorsal projection obsolete, but ventral projection well-developed in frontal view (Fig. 60 A, C); kidney-shaped incavations of dorsal lobes positioned slightly towards apex and delimited externally by smooth margin, without serration or ridged features (Fig. 60 A).

Derivatio nominis. The species name is derived from the shape of the male clypeus, which is broadly reminiscent of a blunt arrow-head (i.e. *sagitta* in Latin).

Description of female (Figs 44, 59). Only one female specimen is currently known for this species. It has a clypeus similar to that of the closest species mentioned above, with the widest point at mid length and a moderate sinuation at apex. Its most salient features can be summarised as follows. a) Body black to dark brown and matte, with sparse short light setae, mainly around margins and shallow coarse to round punctures throughout dorsal surface, but extremely small on elytra; b) clypeus laterally rounded, concave, with moderate sinuation at apex; c) pronotum globose and covered in dense round, shallow punctures; d) scutellum isoscelic triangular, with scattered punctures but no setae; e) elytra dark brown, with extremely small and scattered sculpture and feeble costal markings; f) brachypterous, with wing size = 7.1 mm and W:E ratio = 0.79; g)

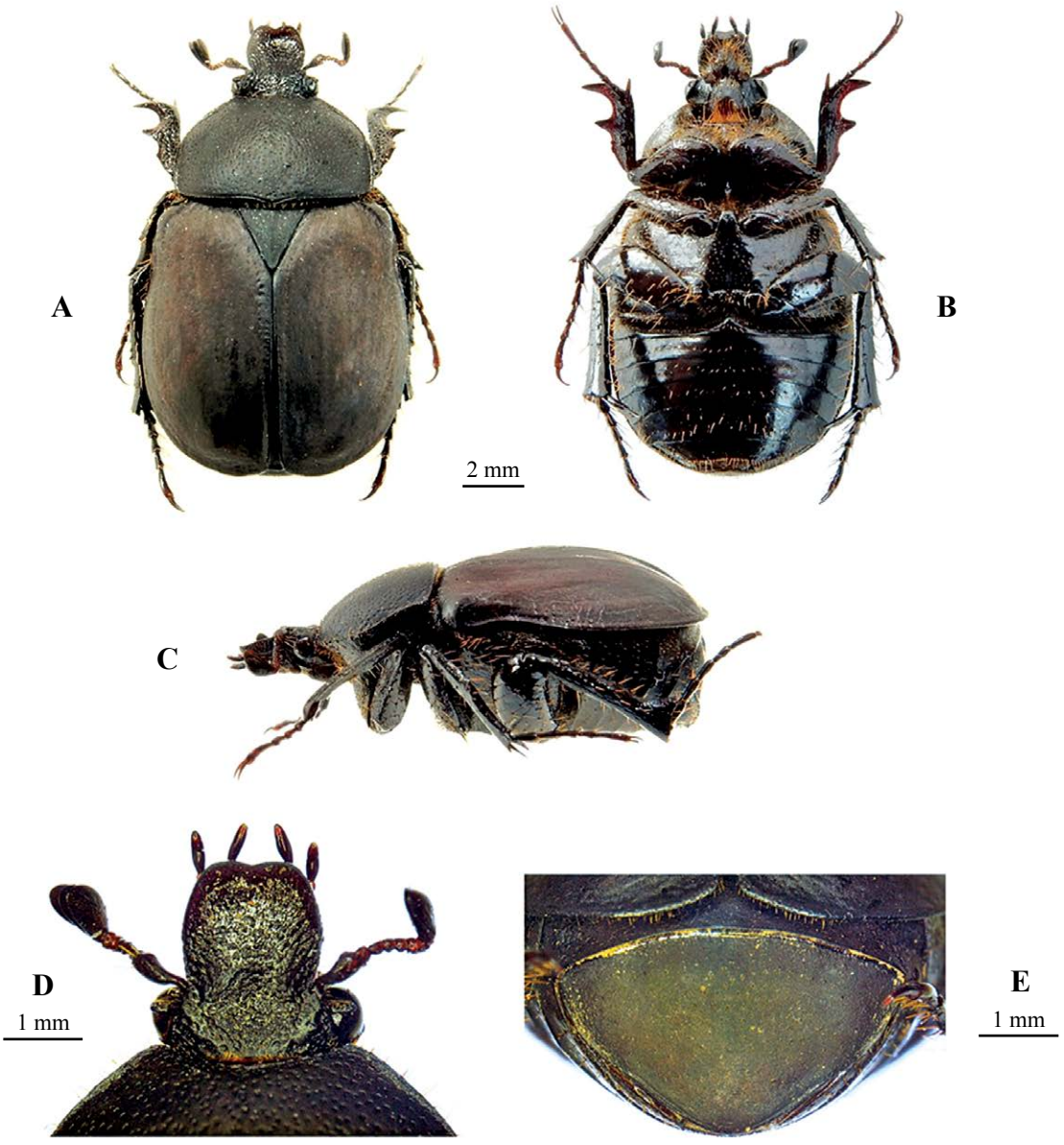

Fig. 59 – *Karooida sagittata* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

pygidium black to dark brown, with small and scattered round punctures; h) tarsal segments slim, not hypertrophic but protibiae tridentate, more robust and wider than in male, metafemora expanded and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny, with setation extremely reduced and shorter than in male, with abdominal sternites weakly convex.

Remarks. Approximately half of the specimens originating from Kramberg, including the holotype, have a light pubescence of tawny coloured setae, while the remaining exhibit the typical dark, black to brown, pubescence characteristic of the genus. The male clypeus in this species varies substantially in length, but is always narrow and shows a consistent apical margin in the shape of a blunt arrow-head or spear. The single male specimen known from Springfield, in the Free State, exhibits a wider and shorter clypeus than those of the Kramberg population, with a slightly trilobate apical margin. Within the type series analysed in this study, the size ranges as follows: male TL = 14.9-19.1 mm, MW = 7.7-9.2 mm (n = 6); female TL = 15.3 mm, MW = 8.4 mm (n = 1).

Distribution. As far as it is currently known, the main population of *K. sagittata* appears to be located on the slopes of the Kramberg, west of Aliwal North in the Eastern Cape Province. The few other records available, indicate that the species also occurs on other mountain ranges between Aliwal North and Burgersdorp, and possibly also

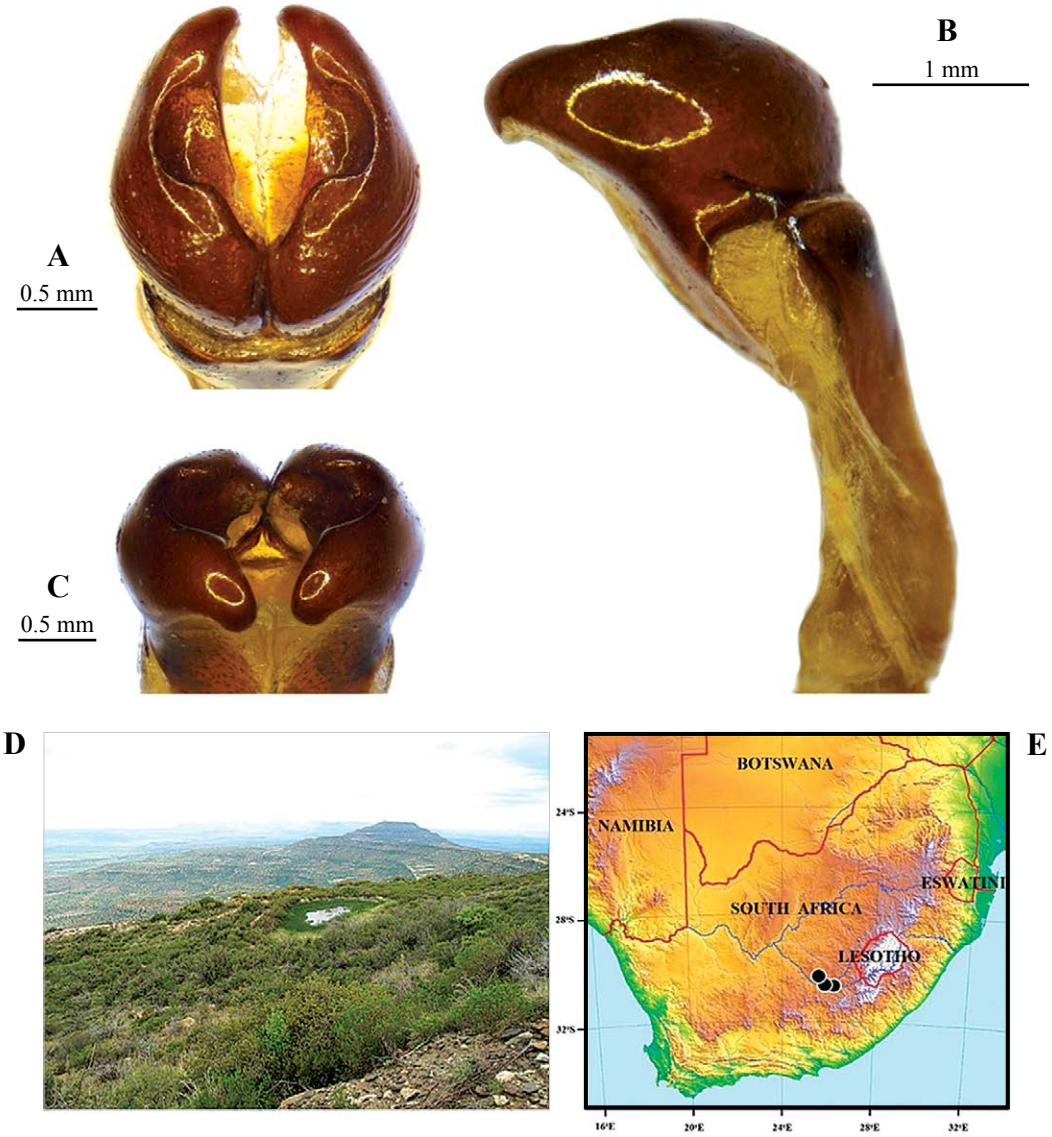

Fig. 60 – *Karooida sagittata* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the shrubland of the Kramberg near Aliwal North; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

further north into the Free State. The old male specimen from Springfontein ("Orange FS") in the former Allard's Collection has provisionally been included under this species, but may actually represent a new taxon. This is however not pursued further here because the specimen is in poor state of preservation and no other specimens are currently known from this or other localities in the Free State Province.

Biology. This species seems to be linked to the Grassland Biome and specifically to the Dry Highveld Bioregion (Mucina & Rutherford 2006). The geological features of the area include gentle to moderate slopes with rocky outcrops and flat-top hills, while the vegetation is of the Besemkaree Koppies Shrubland type. This consists of double layer karooid shrubland, with the upper layer dominated by relatively tall trees like *Rhus* spp., while the lower layer is dominated by dwarf shrubs and grasses (Mucina & Rutherford 2006).

Data. Republic of South Africa: Holotype ♂: EC, Kramberg, 14 Dec 2001, drowned in farm dam, R. Perissinotto & L. Clennell (ISAM). Paratypes: 4♂♂, 1♀, *idem* (BMPC, TMSA); 1♂, South Africa, Ec, Knapdaarhoogte 1525 m, Nr Burgesdorp, 12 Jan 2006, drowned in farm trough (pers. obs.); 1♂, S-Africa, Orange FS, Springfontein, Nov [19]19, Ex collection Dr Vincent Allard received from Cheistophe Allard, 21 Feb 2015 (GBPC).

***Karooida struempheri* (Holm & Perissinotto, 2004) comb. nov.** (Figs 44-45, 61-63)

Ichnestoma struempheri Holm & Perissinotto, 2004: 74; Beinhundner 2017: 1153.

Remarks. *Karooida struempheri* is most closely related to both *K. krikkeni* and *K. kikvorsti*, from which it differs in the shape and size of its male clypeus, parameres and extent of setation on pronotal and elytral surfaces (Figs 44-45). Their respective populations are also located between 70 and 150 km from each other, and are separated by substantial discontinuities between the respective mountain ranges that they occupy. It is evident that this isolation has lasted for a sufficient period of time to have invariably progressed to speciation. The female is brachypterous with a W:E ratio = 0.74. Body size of male and female specimens is respectively: TL = 14.6-17.7 mm, MW = 8.1-9.2 mm (n = 18); TL = 13.9-16.7 mm, MW= 8.8-10.3 mm (n = 5).

Distribution. The type series and most subsequent collections of this species originate from the south-western margins of the Bamboesberg range, between Steynsburg and Hofmeyr in the Eastern Cape. A few dead specimens were also retrieved from the Suurberg, some 50 km to the north-west of the type locality (Holm & Perissinotto 2011). These two mountain ranges are however relatively well connected through a variety of intermediate, smaller mountains of suitable elevation, which are likely to host stepping-stone populations.

Biology. This species seems to occur mainly in the Sub-Escarpment Grassland Bioregion, where it is associated with the Tarkastad Montane Shrubland vegetation unit (Mucina & Rutherford 2006). Its habitat lies at altitudes of about 1200-1800 m, with vegetation consisting of low, largely open mixed shrubland of white grasses and dwarf shrubs. Small, scattered *Vachellia karroo* trees are also characteristic of the landscape. Females of *K. struempheri* have generally been found crawling or mating under large bushes of *Rhus burchellii* (EL Pringle, pers. comm.). It is presumed that such large shelters offer sufficient shade from extreme heat and against complete dehydration of the soil, thereby providing an ideal ground for larval development.

Data. Republic of South Africa: Holotype: ♂, Eastern Cape Province, Hofmeyr, Hennings Hoek Farm, 31º 24'S, 26º00'E, 29 Dec 1998, W.P. Strümpher (TMSA-CPH7930). Paratypes: 1♀, 1♂, *idem* (TMSA-CPH7930, SANC-COLS-16027). Other Material: 31♂♂, 5♀♀, South Africa, Eastern Cape, Nr Hofmeyr, 8 Dec 2004, E.L. Pringle (BMPC, EPPC, DMPC, HMPC, TGPC); 16♂♂, 4♀♀, *ibidem* 22 Dec 2010, drowned in farm dams (pers. obs.); 4♂♂, South Africa, EC, Suurberg, 31°12'53"S 25°34' 57"E, 22 Dec 2004, dead on ground, R Perissinotto & L Clennell (BMPC); 1♂, South Africa, EC, Hofmeyr, Souvereign Farm, 31 Dec 2016 (PMPC).

Genus *Mzansica* gen. nov.

Type Species: *Ichnestoma luridipennis* (Burmeister, 1842)

Diagnosis. This genus can be promptly separated from all the other Ichestomina as it exhibits testaceous to brick-red elytra, while the head, pronotum and scutellum are completely black. Like in the genus *Karooida*, but contrary to the pattern observed in *Ichnestoma*, species in this genus are characterised by the complete absence of cretaceous markings on their body surface. *Mzansica* species can attain the smallest size among all the Ichestomina. The longitudinal incavations on the dorsal lobes of their aedeagal parameres are oblong, with serrated or smooth external margins, thus remarkably different to those of both *Karooida* and *Ichnestoma* species. In *Mzansica*, female wings are extremely reduced, more so than in any other genus of the Ichnestomina, with W:E length ratio < 0.70. The pygidial surface of *Mzansica* females is rugose with variable shallow macrosculpture, while in the other two sister genera, this is ultrafine and smooth in both sexes.

Description (key characters)

Body. Size: male TL = 11.8-24.5 mm, MW = 6.5-10.2 mm; female TL = 12.3-17.6 mm, MW = 7.1-11.4 mm. Shape elongate and dorso-ventrally compressed in male, but globose in female.

Head. Black, with wide and coarsely round to irregular punctures across entire surface; male clypeus either oblong with apical fork or short and wide with weakly sinuate apex; female clypeus with parallel lateral margins and weakly to deeply sinuate apex; antennal clubs hypertrophic in male, but shorter or equal to length of pedicel and flagellum combined.

Pronotum. Black, matte and finely punctate, with long tawny or black setae emerging at centre of each puncture; broadly semicircular in shape.

Scutellum. Black, and matte; isoscelic triangular with sharply pointed apex and wide but shallow lateral grooves; with long but few tawny or black setae and equally scattered fine punctures.

Elytron. Testaceous to brick-red and matte; cretaceous markings completely absent; female wings extremely reduced, with W:E length ratio < 0.70.

Pygidium. Black to dark brown and matte; velutinous with occasional fine and shallow round punctures in males, but rugose with variable shallow macrosculpture in females.

Legs. Black, with tarsal segments hypertrophic; with setation increasing in density and length from pro- to metalegs; tibiae with sparse, coarse to round sculpture across external surface; protibia bi- or tridentate and slender in male, but always tridentate and expanded in female; meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs in male; female

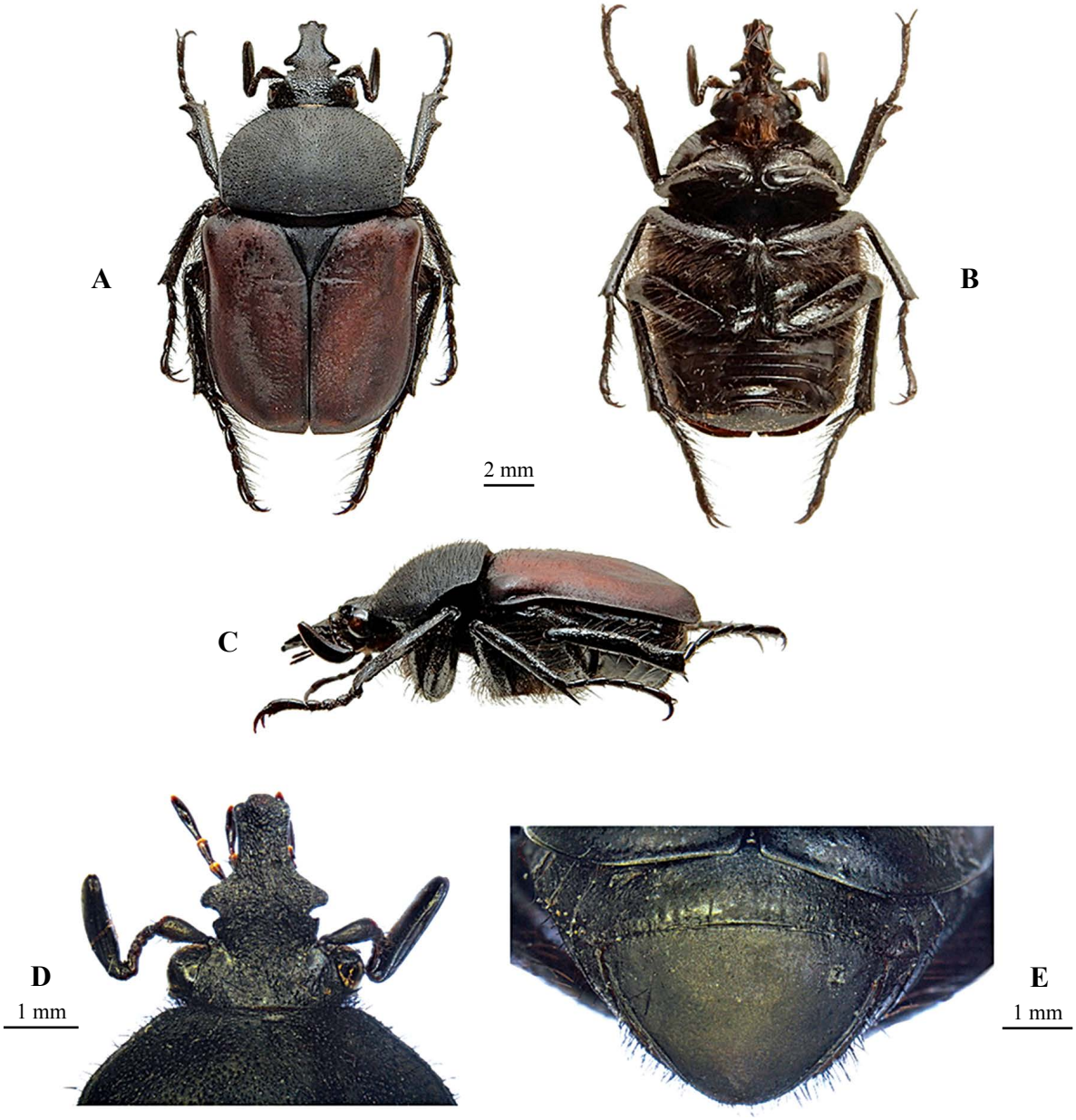

Fig. 61 – *Karooida struempheri* (Holm & Perissinotto, 2004) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

with metafemora hypertrophic and metatibial apical spine and spur shorter but much wider than in male.

Ventral surface. Black and shiny, covered in dense and long tawny to black setae in male, but setation drastically reduced in female; mesosternal lobe extremely reduced, not protruding and with base covered in long setae; abdominal sternites with marked concavity at middle in male, but slightly convex in female.

Aedeagus. Parameres with longitudinal incavations on dorsal lobes oblong and sausage-shaped, with serrated or smooth external margins.

Derivatio nominis. The name *Mzansica* is derived from the current popular name for South Africa "Mzansi". With the exception of the record from Ramotswa, Botswana, all species included in this genus occur in South Africa.

Remarks. *Mzansica* Species are inhabitants of high mountain slopes above the Great Escarpment across the whole of South Africa and southern Botswana. As already suggested by Holm & Stobbia (1995), there are certainly other undiscovered species in this group. The two females recorded from the Soutpansberg by Distant (1911) and from Sandspruit near Polokwane (formerly known as Pietersburg) (Schein 1961) respectively, are good examples of this and most likely represent new species. Similarly intriguing is the Limpopo River area reported as type locality of the "*I. nasuta*" (= *nasula*) described in Bohe-

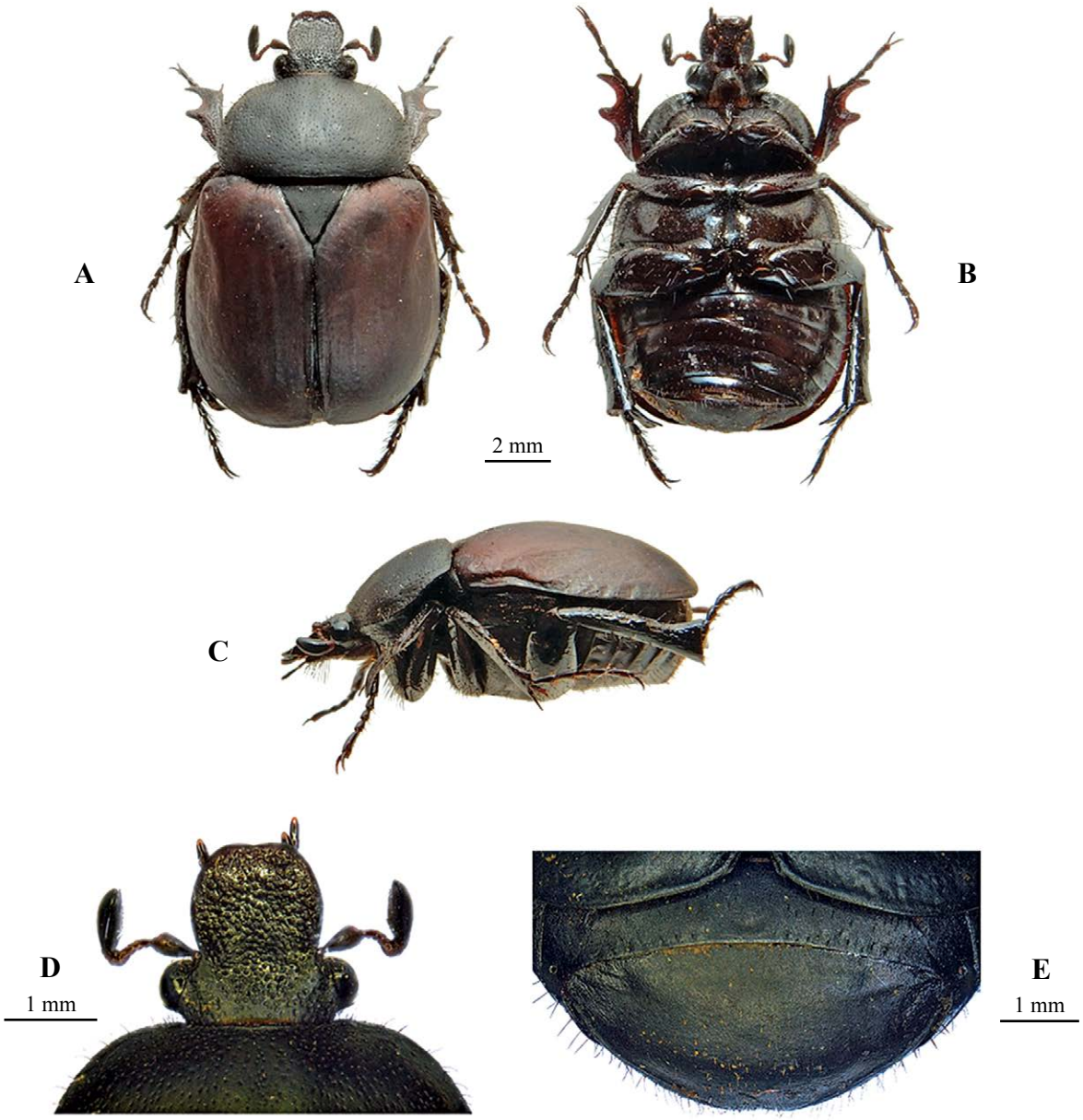

Fig. 62 – *Karooida struempheri* (Holm & Perissinotto, 2004) comb. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

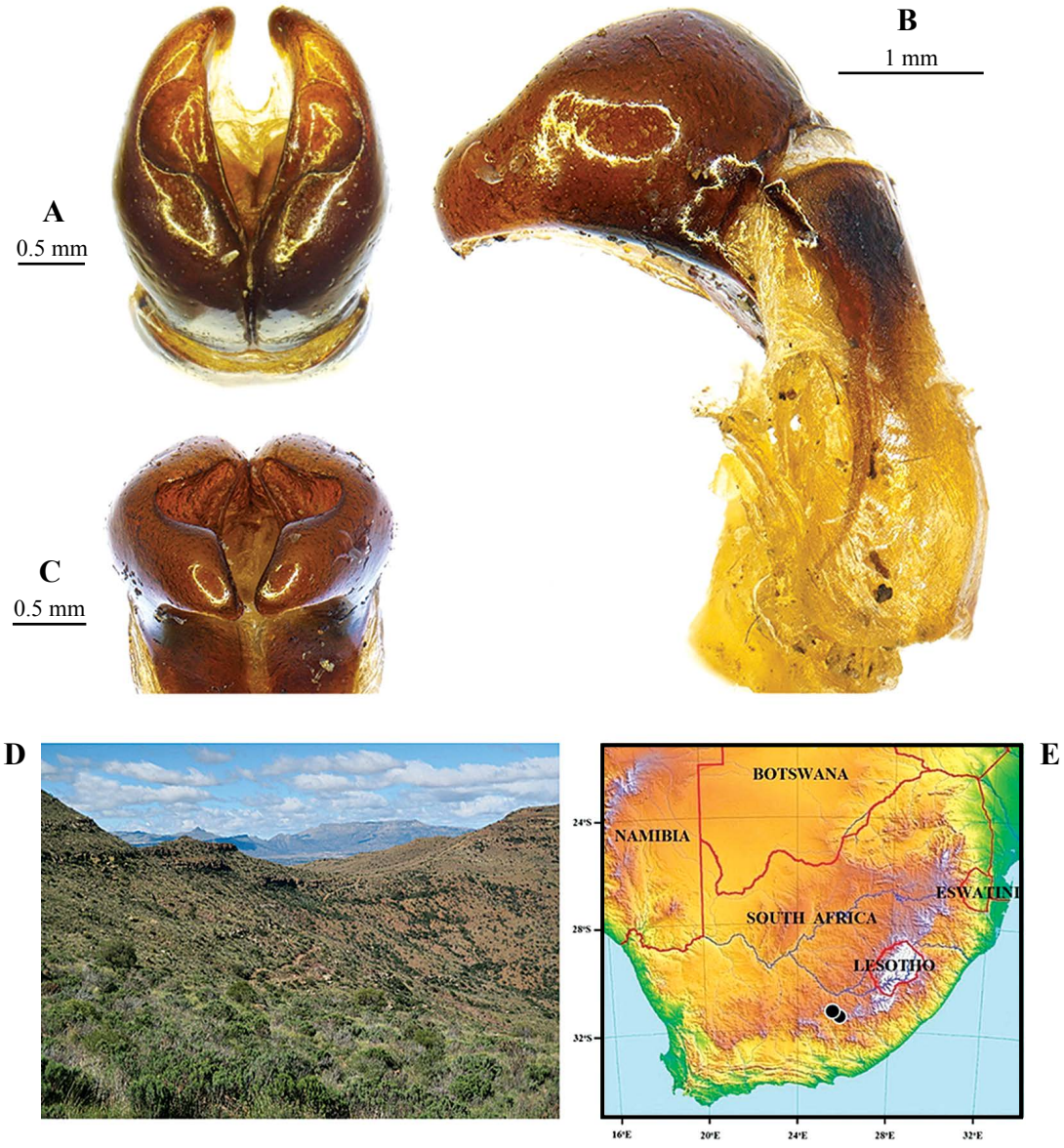

Fig. 63 – *Karooida struempheri* (Holm & Perissinotto, 2004) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in montane shrubland of the southern Bamboesberg range near Hofmeyr; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

man (1857), with explicit reference to the species earlier described by Schaum (1848) from "Port Natal". Clearly the two could not have represented the same species, and therefore the Limpopo River population must belong to another taxon. Unfortunately, it was not possible to trace and access any of these specimens for the purpose of this study. It is also very likely that other new species will be discovered in the future on the highest elevations and the more isolated mountain ranges above the Great Escarpment, in the yet insufficiently explored Cape provinces. The only species of this genus previously described from this region, *M. luridipennis,* has actually been confused in the literature with other, new species described here below. Two relatively distinct groups are recognised within this genus, chiefly on basis of clypeal and aedeagal shapes - *nasula* or "Eastern" and *luridipennis* or "Western" species-complexes.

Mzansica nasula species-complex

Key characteristics

1) Male clypeus with median shaft forming apical fork with two, symmetric lateral projections;
2) aedeagus with grooves on dorsal lobes of parameres not producing serrated dark edge on dorso-lateral margins;
3) four species are recognised within this cluster, the already known *M. nasula* from KZN, *M. stobbiai* from

the Magaliesberg range of GP and *M. ficqi* from the Wolkberg of LP, as well as *M. botswanica*, new species from Ramotswa in Botswana, previously overlooked and confused with *M. nasula*;

4) species-complex named after *M. nasula*, the first species to be historically recognised and described within this group.

Key to species

1. Male clypeus hypertrophic, with apical bifurcation small but sharp; dorsal lobes of parameres roundly pentagonal in dorsal view; female W:E ratio = 0.55; female clypeus elongate with irregularly parallel sides and strongly sinuate apex; medium to large species ≈15-24 mm TL; distribution: LP (Wolkberg) ..... *M. ficqi* (Stobbia, 1995) comb. nov.
- Male clypeus moderately elongate, with apical bifurcation expanded and carinate 2
2. Male clypeus with lateral invaginations extremely enlarged and apical fork strengthened by dorsal and ventral carinas; dorsal lobes of parameres narrow pentagonal in dorsal view; female W:E ratio = 0.53; female clypeus elongate with irregularly parallel sides and strongly sinuate apex; small to medium species ≈12-17 mm TL; distribution: GP, NW, LP (Magaliesberg, Witwatersrand) .... *M. stobbiai* (Holm, 1992) comb. nov.
- Male clypeus with lateral invaginations of average width and apical fork strengthened by ventral carinas only 3
3. Male clypeus with fork poorly expanded laterally and V-shaped; dorsal lobes of parameres inverse pyriform in dorsal view; female W:E ratio = 0.57; female clypeus squarish with irregularly parallel lateral margins and sinuate apex; small to medium species ≈13-18 mm TL; distribution: BOT, NWP (Ramotswa, Dinokana) .... *M. botswanica* gen. et sp. nov.
- Male clypeus with fork more expanded laterally and anchor-shaped; dorsal lobes of parameres roundly rectangular in dorsal view; female yet unknown; small to medium species ≈14-17 mm TL; distribution: KZN (coastal region?) .... *M. nasula* (Schaum, 1848) comb. nov.

***Mzansica botswanica* gen. et sp. nov.** (Figs 64-65, 66-68)

Diagnosis. Until now, this species has been confused with the closely related *M. nasula* and consequently also with *M. stobbiai*. Péringuey (1907: 376-377) had clearly confused the two species in his review, as the distribution reported at the end of his description explicitly refers to "British Bechuanaland (Ramoutsa)". The differences between *M. nasula* and *M. stobbiai* have been adequately clarified in Holm (1992) and are also reported here below, within the remarks section of the two species. Regarding *M. botswanica*, it differs from *M. nasula* by having a clypeus with apical fork strongly sinuate at middle and lateral projections thicker, shorter and more blunt than in the latter species. The fork takes the shape of a widely open "V", while in *M. nasula* this resembles more an anchor (Fig. 64), as also highlighted in the original description of Schaum (1848). Its antennal clubs are also as long as the rest of antennal parts combined, while these are slightly shorter in *M. nasula.* The elytra are more densely punctured and its costae more raised in *M. nasula* than in *M. botswanica.* Lastly, the dorsal lobes of the parameres of *M. botswanica* are wider at centre and more rounded at apex than those of *M. nasula*. In dorsal view, the kidney-shaped

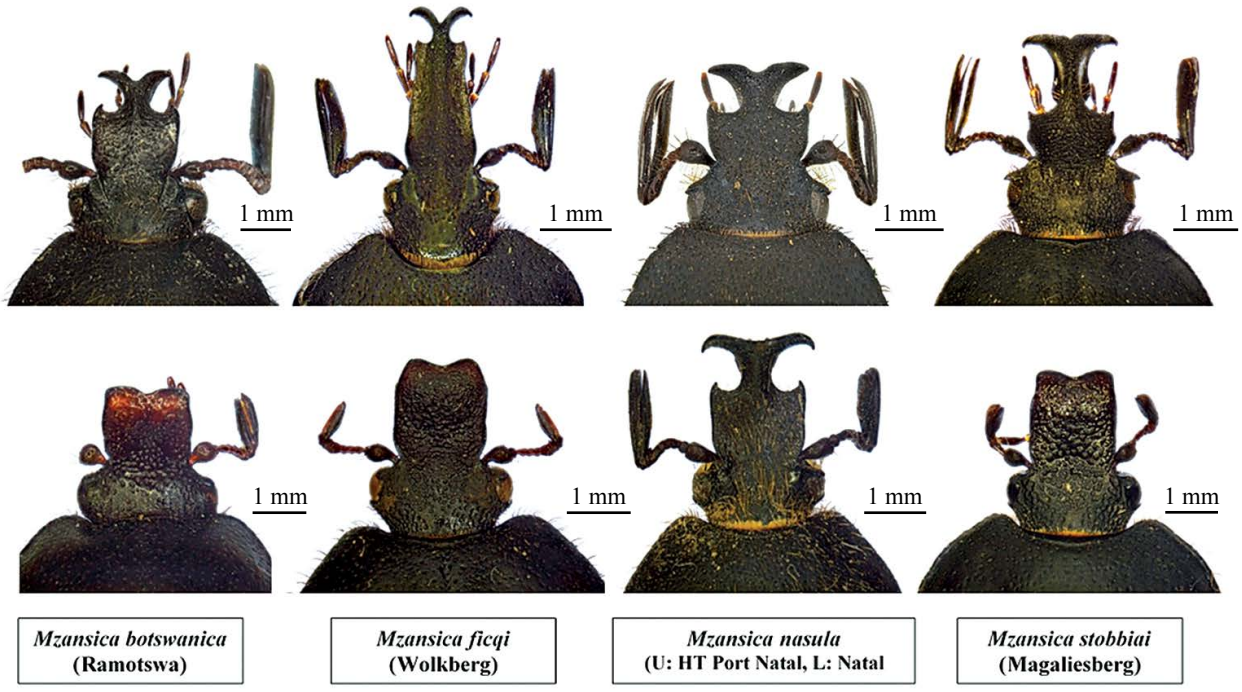

Fig. 64 – Comparative clypeal shape of the species of the genus *Mzansica* gen. nov., *nasula* complex: male (top row) and female (bottom row) dorsal views, except (*M.*) *nasula* for which only the clypeus of two males is shown (U = upper, L = lower, HT = Holotype).

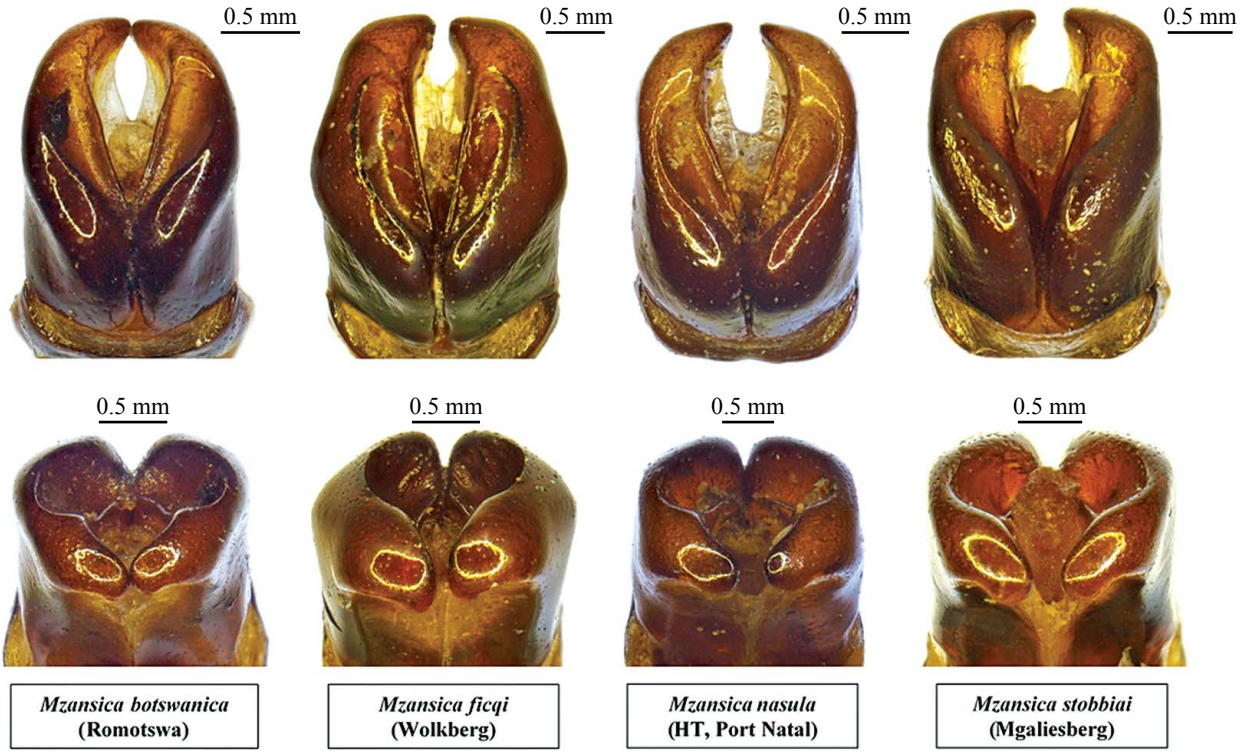

Fig. 65 – Comparative aedeagal shape of the species of the genus *Mzansica* gen. nov., *nasula* species-complex: dorsal (top row) and frontal (bottom row) view of parameres.

dorsal incavations of the lobes are also shifted significantly forward towards the apex in *M. botswanica* in comparison to those of *M. nasula* (Fig. 65)

Description of holotype male (Figs 66 A-E, 68 A-C)

Size. Length 17.8 mm; width 8.6 mm.

Body. Black and matte, with elytra light testaceous (Fig. 66 A); surface covered in light, medium to long setae, becoming shorter and scattered on basal portion of elytra and absent on apical two-thirds; coarse to round punctures on entire surface, becoming denser and better defined on pronotum and head (Fig. 66 A, C, D).

Head. Black with some long, light setae concentrated mainly on vertex; with wide and coarsely round punctures across entire surface; clypeus forking out into a broad v-shaped apical horn and exhibiting wide lateral invaginations, slightly elevated at margins and with carinate longitudinal ridge at centre; supra-ocular process diverging slightly away from base and turning inward with hamate point; antennal club, flagellum and pedicel black to dark brown, club hypertrophic and as long as flagellum and pedicel combined (Fig. 66 D).

Pronotum. Black, matte and finely punctate, with long light setae emerging at centre of each puncture; lateral margins smoothly rounded both anteriorly and posteriorly, steep declivity present between anterior margin and central disc; basal or posterior margin smoothly and uninterruptedly rounded across both elytra and scutellum (Fig. 66 A, C).

Scutellum. Black and matte; isoscelic triangular with sharply pointed apex but narrow and shallow lateral grooves; with long but few light setae and equally scattered fine punctures (Fig. 66 A).

Elytron. Testaceous and matte, with darker infusions on humeral umbones, along sutural, peri-scutellar and external margins; costae three and five weak but discernible; basal third of surface exhibiting scattered, medium to short light setae, particularly around scutellum; round punctures very shallow and coarse, often with minute setae at centre; apex bluntly squared, not protruding or forming spinal projection (Fig. 66 A).

Pygidium. Black to dark brown and matte; with occasional fine and shallow round punctures and lining of dense, long to medium sized dark setae along apical and lateral margins (Fig. 66 E).

Legs. Femora and tibiae black, but hypertrophic tarsal segments black at base becoming progressively brown and lighter towards apex; dark setation increasing from pro- to metalegs, both in density and length; tibiae exhibiting coarse to round sculpture across whole surface; protibia bidentate, meso- and metatibia with poorly developed mid outer spine but elongate and sharp apical spurs (Fig. 66 A-C).

Ventral surface. Black to brown and shiny, covered in dense, dark brown and very long setae, except on abdominal sternites, femora and coxal bases, where setae become scattered or absent; mesometasternal process very

reduced, not protruding and with base covered in long setae; abdominal sternites forming marked concavity at middle (Fig. 66 B).

Aedeagus. Elliptical in dorsal view, with widest point at centre and apex smoothly rounded; with dorsal projection well developed, but ventral projection obsolete in frontal view (Fig. 68 A, C); club-shaped incavations of dorsal lobes positioned medially and delimited externally by normal margin, without serration or ridged features.

Derivatio nominis. The species name is derived from Botswana, the country where most of the type specimens originated from. This is also the only country outside South Africa where a species is currently known to occur within this genus.

Description of female (Figs 64, 67). The only known female of this species has a clypeus significantly shorter than those of the other species of the same group. Its most salient features can be summarised as follows. a) Body black to testaceous and matte, with sparse short light setae, mainly around margins and shallow coarse to round punctures throughout dorsal surface; b) clypeus irregularly squared, concave, with weak lateral sinuations and marked incision at apex; c) pronotum globose and covered in sparse round, shallow punctures; d) scutellum equilateral triangular, with few short setae and scattered punctures; e) elytra testaceous, with dense but coarse sculpture and weak costal markings; f) brachypterous, with wing size = 4.7 mm and W:E ratio = 0.57; g) pygidium black to dark brown, with-

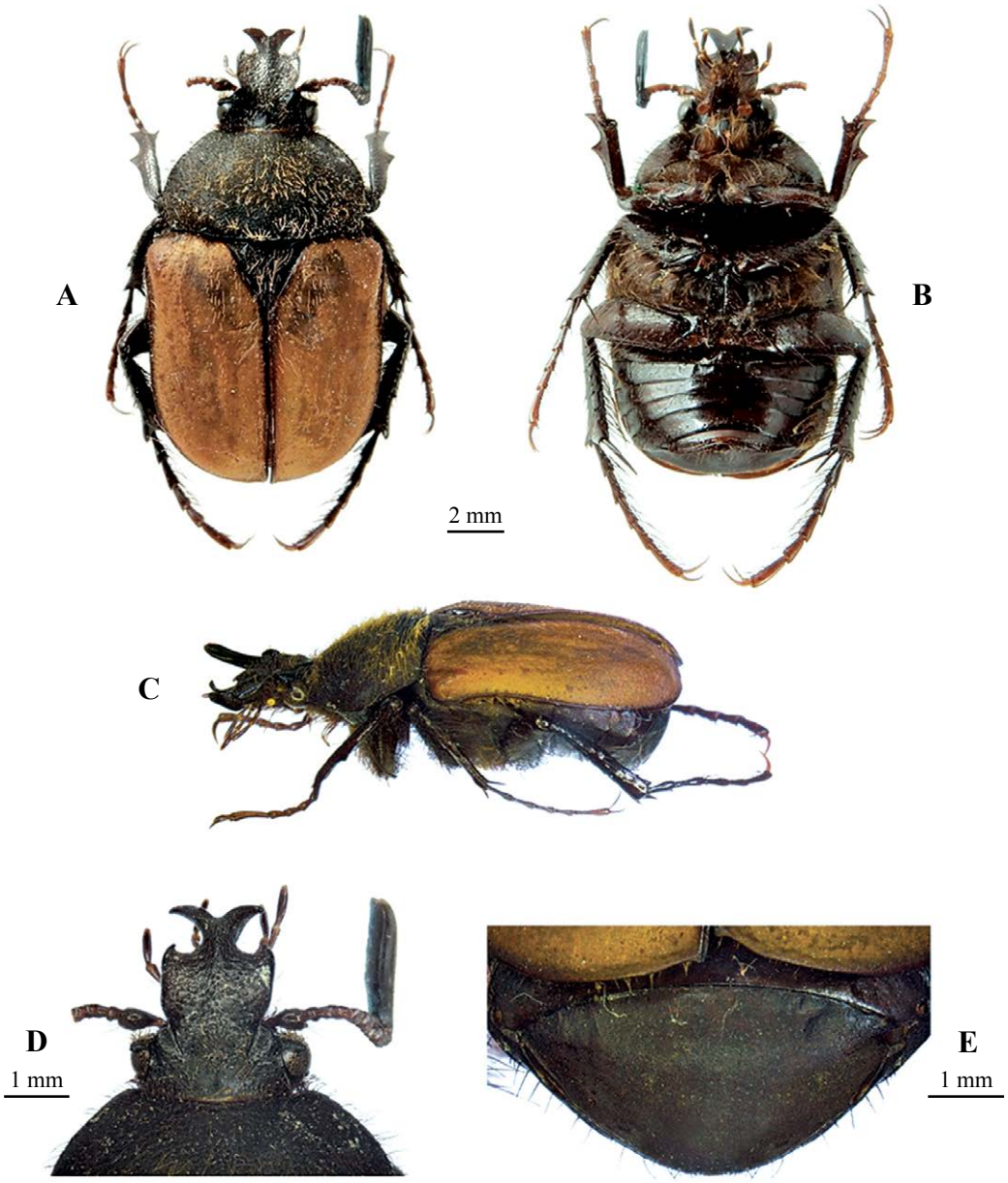

Fig. 66 – *Mzansica botswanica* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

out mascrosculpture but with weak symmetric baso-lateral depressions; h) tarsal segments not hypertrophic but protibiae tridentate, more robust and wider than in male, metafemora hypertrophic and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface dark brown to black and shiny, with setation extremely reduced and shorter than in male, with abdominal sternites markedly convex.

Remarks. The male clypeus of the four specimens known so far for this species exhibits only minor variability in the shape of the apical fork, which can range by a few degrees in its angle of lateral span. Within the type series analysed in this study, the size ranges as follows: male TL = 13.4-17.8 mm, MW = 6.9-8.6 mm (n = 4); female TL = 13.7 mm, MW = 7.1 mm (n = 1).

Distribution. The only two records currently known for this species are "Ramoutsa" and "Linokana". These were the colonial era names for the current towns of Ramotswa and Dinokana, which are located relatively close to each other in southeastern Botswana and the North-West Province of South Africa, respectively (Fig. 68 E). Both records are from the turn of the twentieth century, but unfortunately there seem to be no more recent data to confirm this distribution.

Biology. Unfortunately, nothing is known about this spe-

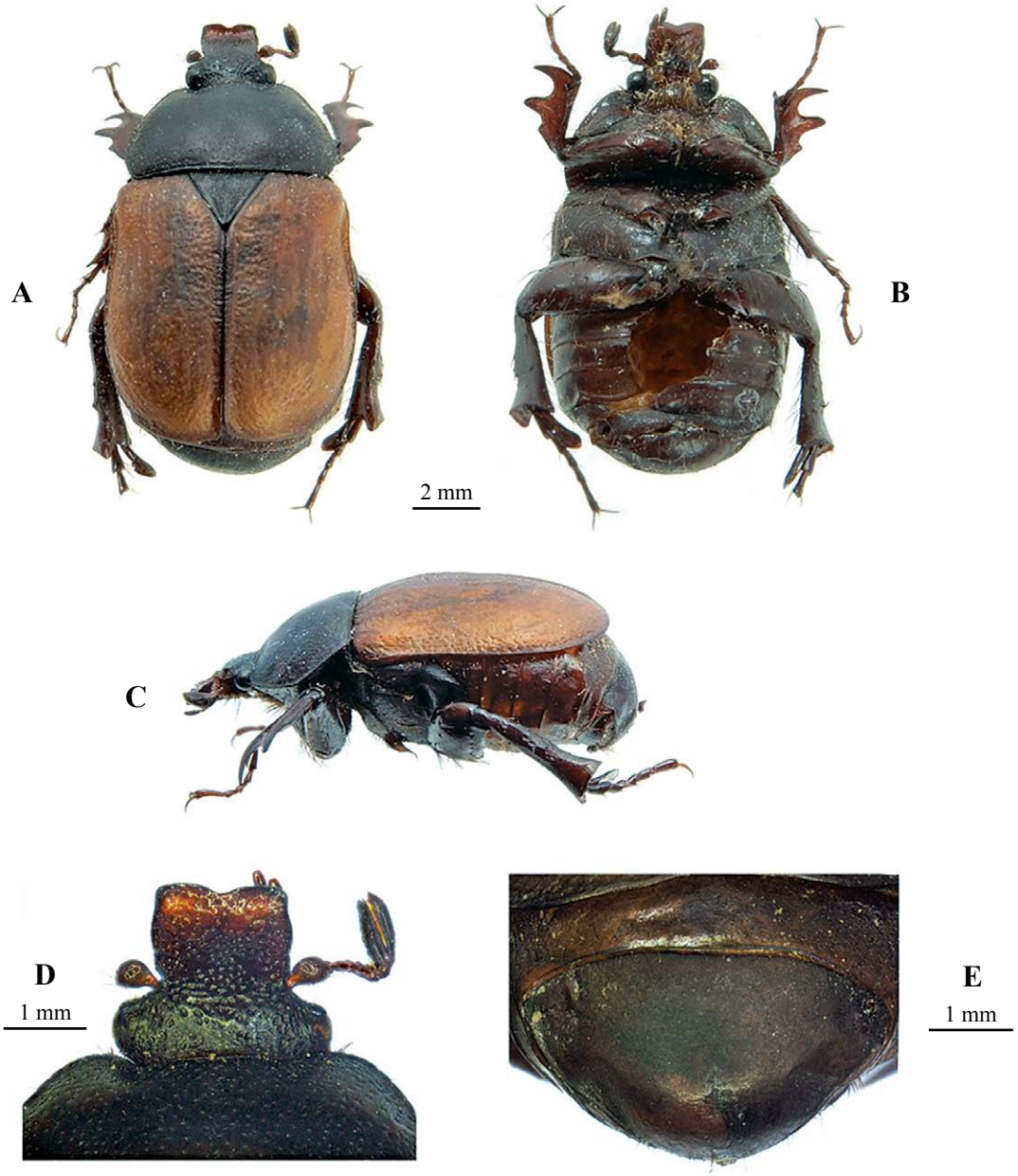

Fig. 67 – *Mzansica botswanica* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

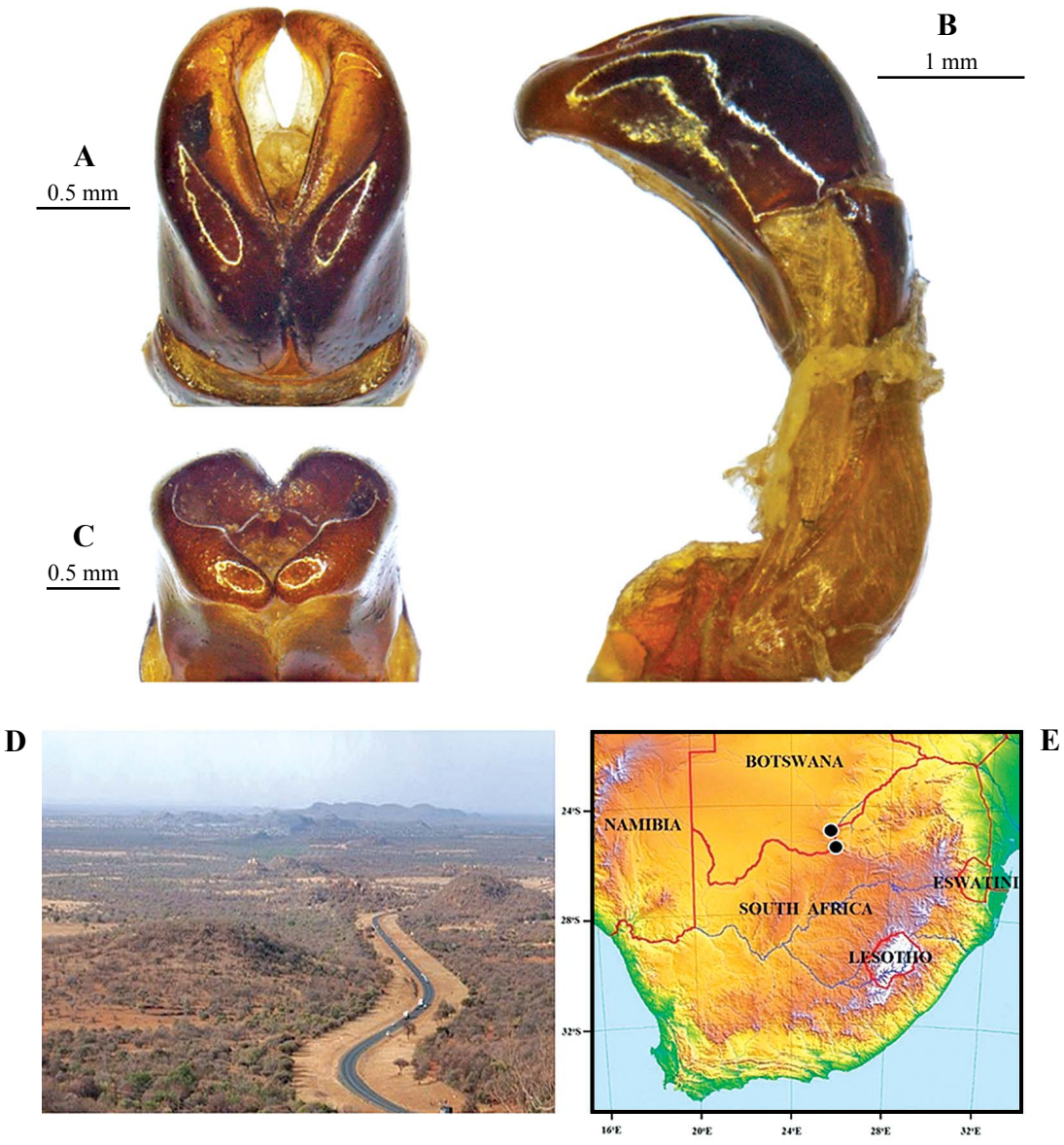

Fig. 68 – *Mzansica botswanica* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, potential habitat in the environs of Ramotswa, Botswana; **E**, known distribution range. Photographs A-C by Lynette Clennell, D from allthecities.com; map adapted from Mapsland (Copyright© 2019 Mapsland).

cies yet, but it is reasonable to assume that its biological cycle and habitat characteristics conform to those of the sister species of the *nasula* group that occur in the eastern part of South Africa. The vegetation and geological features of the area between Dinokana and Ramotswa are typical of the Savanna Biome, and specifically of the Central Bushveld Bioregion (Mucina & Rutherford 2006). Landscape features are dominated by rocky hills that can reach heights of up to 300 m above the surrounding plains, with maximum altitude above sea level of about 1500 m. The vegetation type is very variable, depending heavily on factors such as slope, exposure, aspect and local habitat, and exhibits a combination of trees, shrubs, bush clamps and dense grass layers, especially during the wet season (Mucina & Rutherford 2006). Thus, the habitat of this species, with its savanna characteristics, seems to deviate substantially from those of the other *Mzansica* species. However, this remains a hypothesis that will need to be tested with adequate investigations in situ and, hopefully, with the collection of new, fresh specimens in the area.

Data. Botswana: Holotype ♂: 'Bechuana', Ramoutsa [= Ramotswa], 1894, Rev. O'Neil (ISAM: SAM-COL A026574). Paratypes: 1♂, 1♀, *idem* (ISAM: SAM-COL A069769; SAM-COL A026575); 1♂, No data (TMSA: CPH7925); **Republic of South Africa:**1♂, Linokana [= Dinokana], *nasuta* Schaum (GBPC).

***Mzansica ficqi* (Stobbia, 1995) comb. nov.**
(Figs 64-65, 69-71)

Ichnestoma ficqi Stobbia, 1995, in Holm & Stobbia, 1995: 290.

Ichnestoma ficqi Holm & Stobbia, 1995: Beinhundner 2017: 1148.

Ichnestoma fleiqui Holm, 1994: Sakai & Nagai 1998: 206 (err.).

Remarks. The male of this species is characterised by an extremely hypertrophic clypeus, which is unique among the members of this genus and actually reminiscent of the shape of the male clypeus of *I. rostrata*. The female is also outstanding, in having a particularly elongate clypeus with indentations on its lateral margins and among the shortest wings so far recorded for any species among the Ichnestomina. Its W:E ratio is in fact only 0.55, second only to *M. stobbiai* which has a ratio of 0.53, indicating that populations situated at the easternmost end of the distribution range of the Ichnestomina exhibit the most extreme reduction in wing size. Body size of male and female specimens is respectively: TL = 19.7-24.5 mm, MW = 8.5-10.2 mm (n = 14); TL = 15.1-17.6 mm, MW= 9.6-11.4 mm (n = 9).

Distribution. This species is currently known only from the northern slopes of the Wolkberg range in the eastern Limpopo Province. The area represents the northern termi-

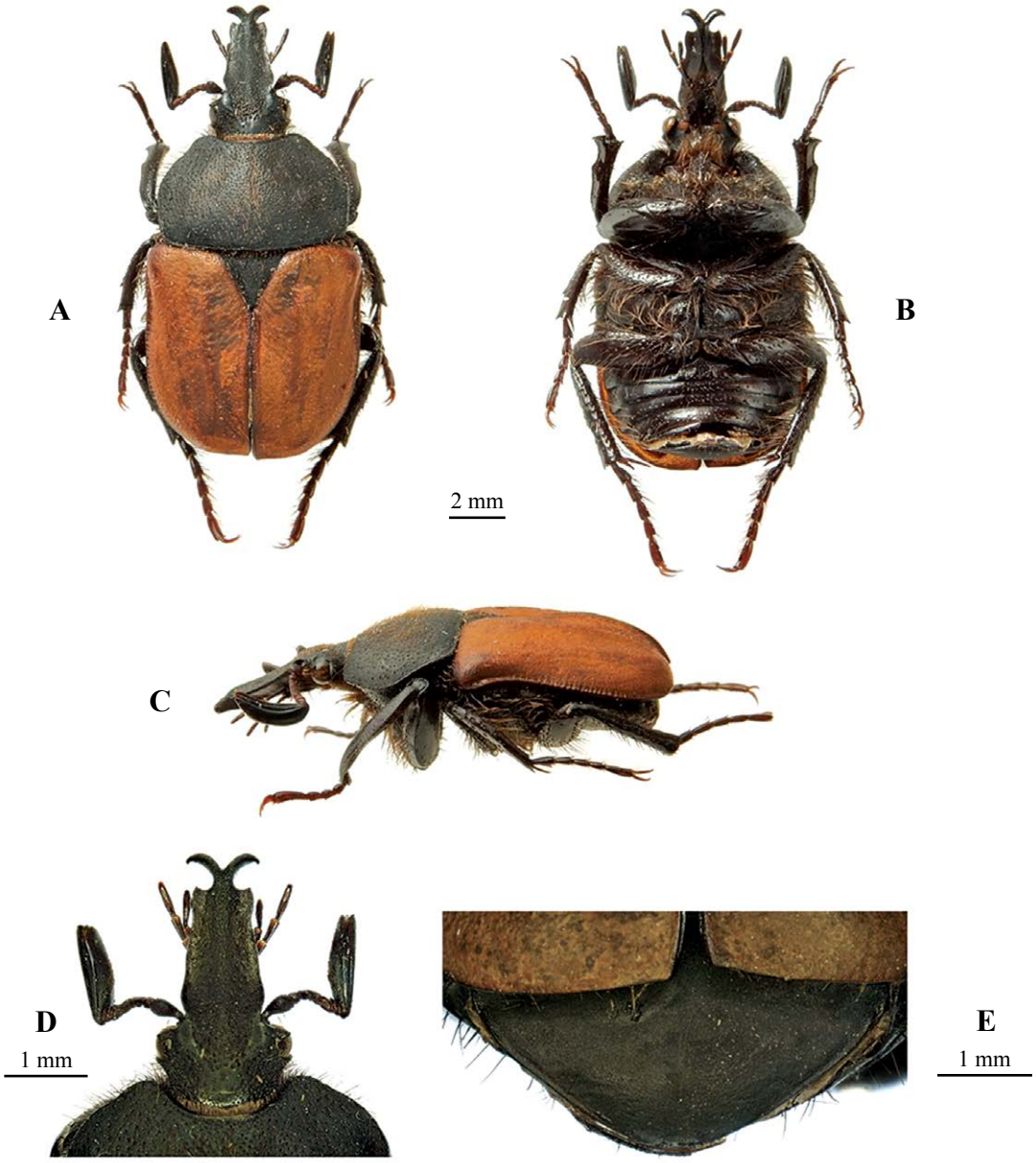

Fig. 69 – *Mzansica ficqi* (Stobbia, 1995) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

nation and a subrange of the Drakensberg mountain range, thereby highlighting the possibility that the species may actually occur on other adjacent mountains, where there is continuity of altitudinal elevation and similar vegetation type.

Biology. The typical habitat of *M. ficqi* is found in the Mesic Highveld Grassland Bioregion, at altitudes ranging between 1600 and 1800 m, just above the pine plantations of the Serala State Forest. The vegetation units here is predominantly of the Northern Escarpment Quartzite Sourveld type (Mucina & Rutherford 2006) and is composed of short grassland rich in forb species interspersed with scattered trees and shrubs. As indicated by data accompanying some specimens, larvae and/or cocoons were obviously collected from the natural habitat of the species and successfully bred in captivity at Pretoria by the late Piero Stobbia.

Data. Republic of South Africa: Holotype: ♂, North Transvaal, Wolkberg (Serala) 1700 m N. Side, 14 Nov 1993, P. Stobbia (TMSA-CPH7900). Paratypes: 91♂♂, 24♀♀, *idem* (SANC-COLS-14764, BMNH{E} 2011-127, MNHN, MRAC, SMWN, ZSMC, BMPC, DMPC, MDPC, TGPC, EPPC, Sakai & Nagai 1998 Nr 472-Pl. 33-p. 206). Other Material: 2♂♂, South Africa, Transvaal, Wolkberg, 25 Oct 1992, H.C. Ficq (TMSA-CPH7902, SANC-COLS-17022); 1♂, South Africa, N. Transvaal, Wolk-

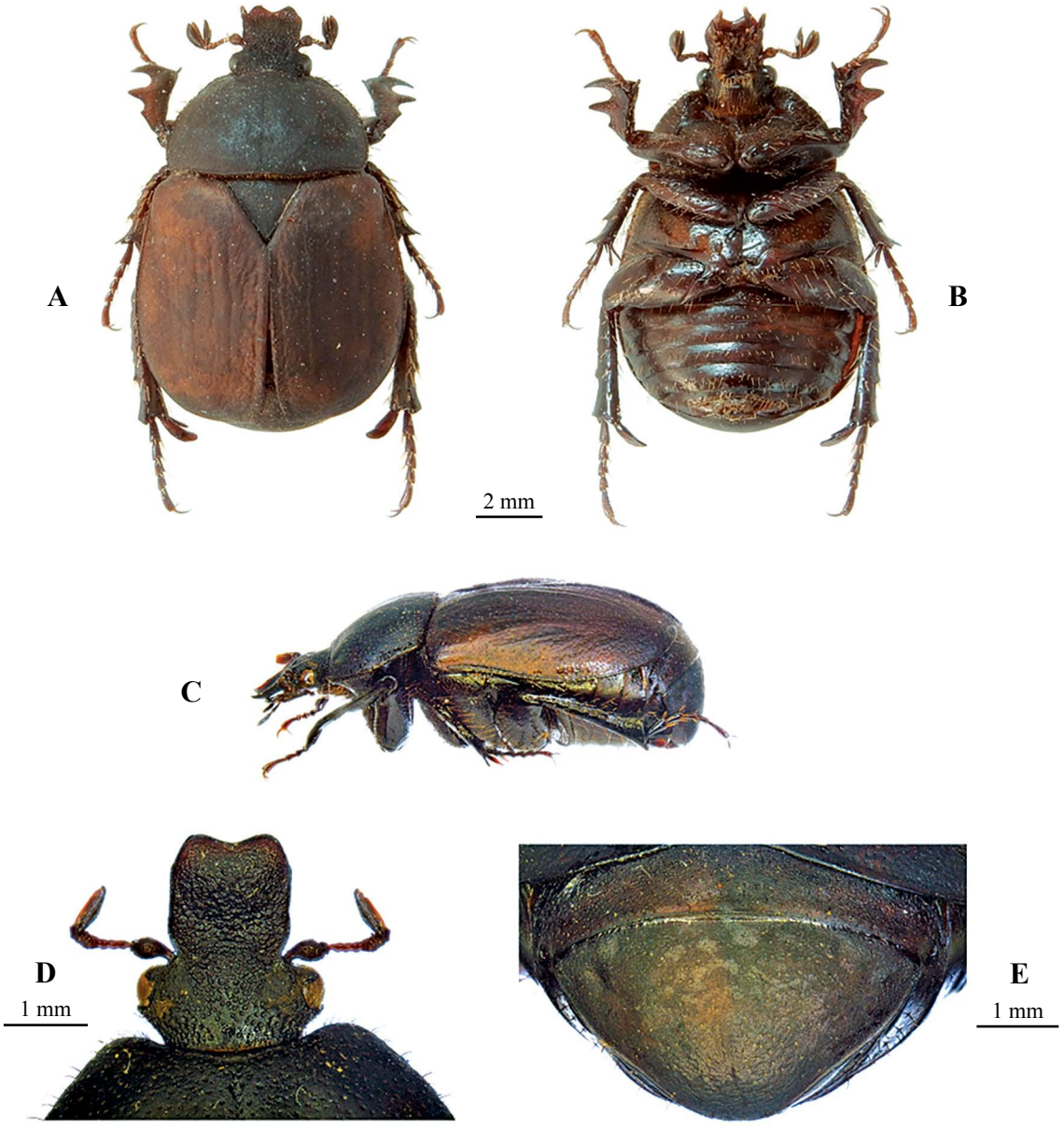

Fig. 70 – *Mzansica ficqi* (Stobbia, 19950 comb. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

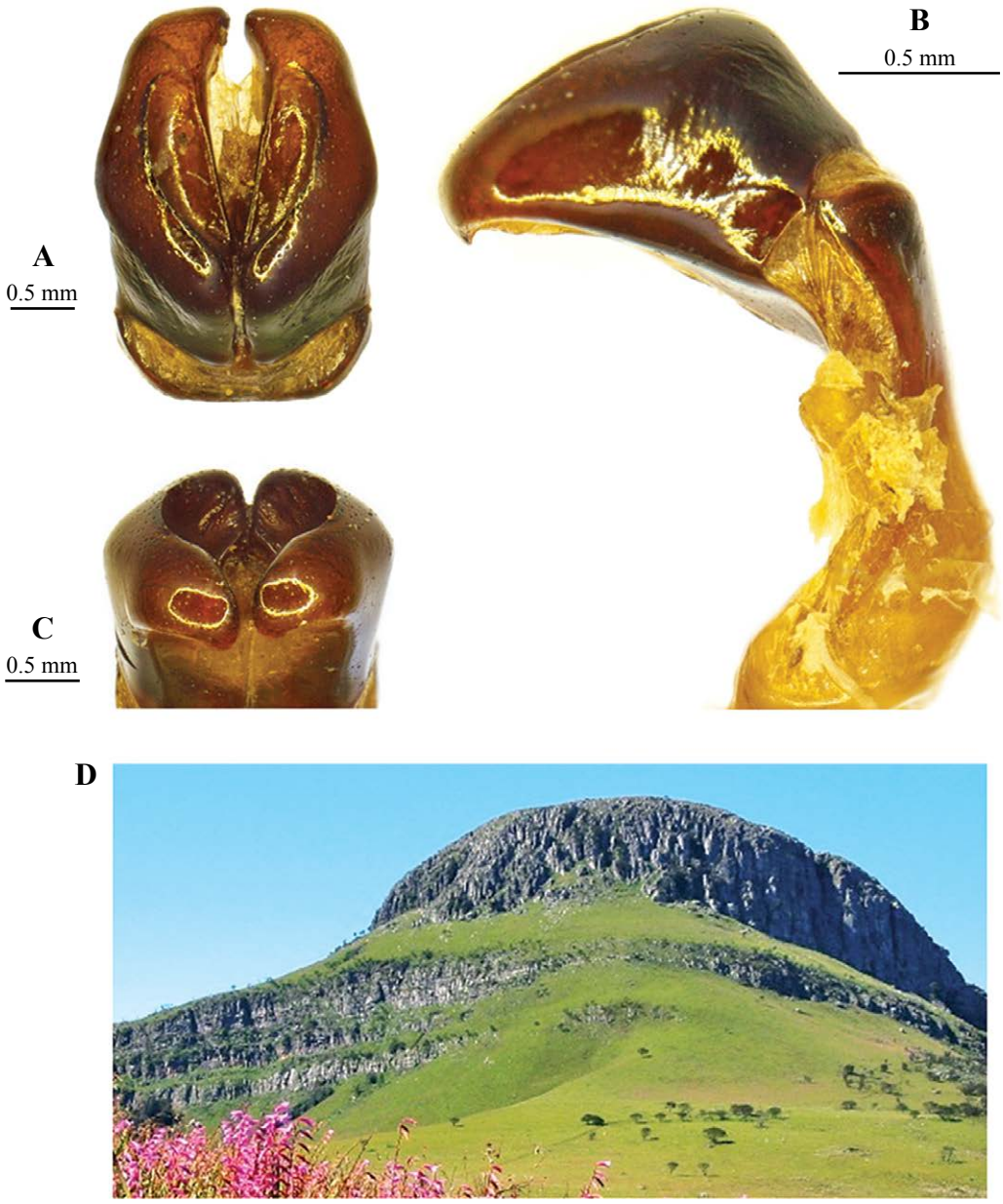

Fig. 71 – *Mzansica ficqi* (Stobbia, 1995) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, potential habitat on the slopes of the Wolkberg at Serala, Limpopo Province. Photographs A-C by Lynette Clennell, D from botsoclimpopo.wordpress.com).

berg-Serala, N Side 1600-1800m, ex cocoon, P. Stobbia (TMSA-CPH7903); 1♀, *ibidem* 30 Oct 1993 (TMSA-CPH7901); 2♂♂, RSA, Transvaal North, Wolkberg District, 14 Nov 1996, Coll. Alexis (RBIN).

***Mzansica nasula* (Schaum, 1848) comb. nov.**
(Figs 64-65, 72-73)

Ischnostoma nasula Schaum, 1848: 75.
Ischnostoma nasuta Schaum. Boheman 1857: 41; Péringuey 1907: 376; Allard 1991: 45.
Ichnestoma nasula Schaum. Holm 1992: 373; Holm & Marais 1992: 27; Beinhundner 2017: 1149.

Remarks. Despite being among the first to be described within the subtribe, *M. nasula* remains one of the least known Ichnestomina species. The female is yet unknown, its distribution range is ill-defined and the last collecting record dates back to 1972. Furthermore, its reference and description in the literature have been confused with other species, which are now recognised but were not at the time of the earlier descriptions. While Schaum (1848) did specifically refer to "Port Natal" as the type locality for the species, subsequent re-descriptions by Boheman (1857) and Péringuey (1907) cite the region of the Limpopo River and Botswana, respectively, as the areas of its distribu-

tion. The description reported in Péringuey (1907) actually refers to the new species *M. botswanica*, described above. Body size: TL = 14.5-16.8 mm, MW =7.0-8.2 mm (n = 5).

Distribution. Unfortunately, most of the labels accompanying specimens of the correct *M. nasula* are either completely lacking collecting data or without precise locality. The most frequently reported record is a vague "Natal", with only two specimens actually showing locality specifications, as "Port Natal" (the old colonial name for the city of Durban) and "P. Shepstone" (presumably Port Shepstone), respectively (Fig. 74 E). The problem is that both localities imply a coastal, humid habitat, which is apparently incompatible with what is known about all the other species of the genus, in terms of climatic and vegetation requirements.

Biology. Given the considerations reported above, the biology of this species remains an enigma. The vegetation in the immediate surrounds of Durban and Port Shepstone is typically of the KwaZulu-Natal Coastal Belt type, interspersed with pockets of wet Zonal & Infrazonal Forests (Mucina & Rutherford 2006). These are unlikely to provide a suitable habitat for an Ichnestomina species and, indeed, dedicated searches throughout the area over the past 25 years have produced no positive results. Thus, there may be only two

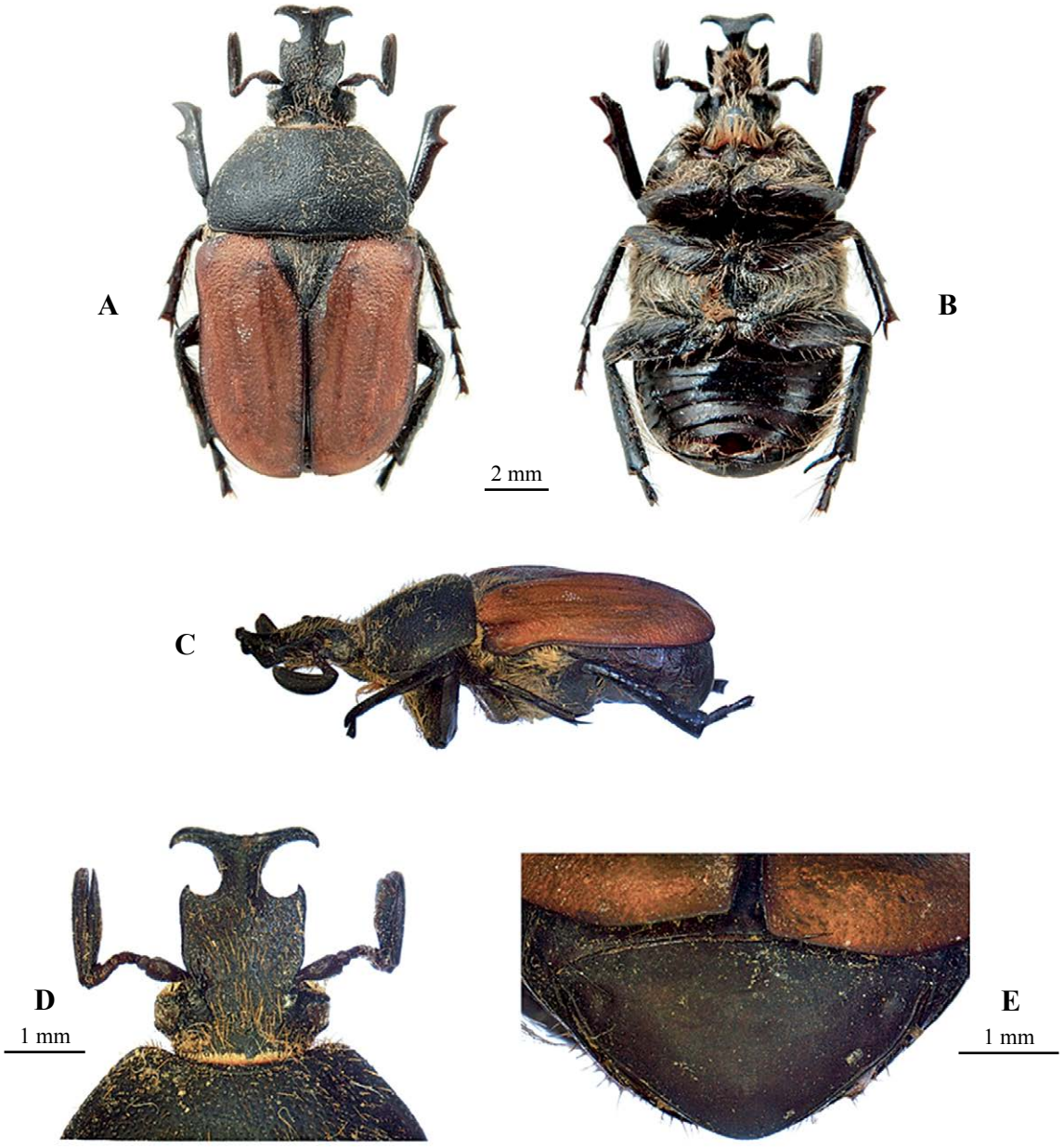

Fig. 72 – *Mzansica nasula* (Schaum, 1848) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

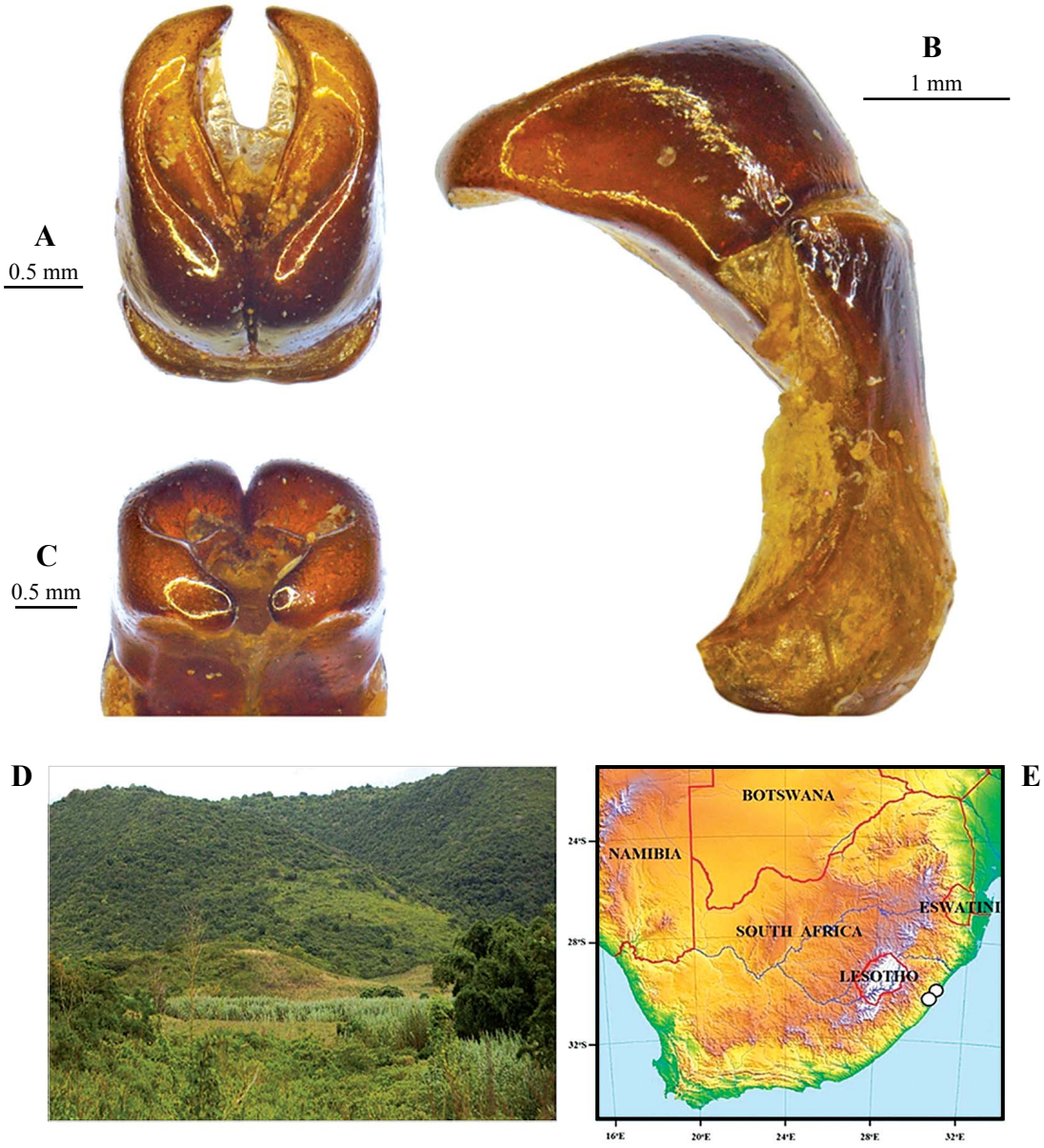

Fig. 73 – *Mzansica nasula* (Schaum, 1848) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, coastal habitat in the environs of Port Shepstone, southern KwaZulu-Natal; **E**, unconfirmed historically-reported distribution range. Photographs A-C by Lynette Clennell, D from agri4all.com; map adapted from Mapsland (Copyright© 2019 Mapsland).

viable hypotheses: 1) either the species was indeed a coastal dweller and is now extinct, due to the massive transformation that the area has undergone with agricultural and residential developments; or 2) the coastal reports are erroneous and the species actually occurs further inland in KZN, in areas that have remained poorly searched.

Data. Republic of South Africa: Holotype: ♂, Port Natal [= Durban], Dr Wahlberg / Caffrerie Bhn. (MHNG). Other material: 1♂, Comp. HT "Caffrerie Bhn. / Port Natal" (TMSA-CPH7925); 1♂, Natal (Cutter) (TMSA-CPH7926); 1♂, P. Shepstone, R. Strydom, Dec 1972 (BMPC); 1♂, Natal, 85/28, *Ischnostoma nasuta* Schaum (BMNH-NHMUK014400057); 1♂, Port Natal (ZMHB); 2♂♂, "no. 15, *Ischnostoma nasuta* Sch" (SANC-COLS-17215).

***Mzansica stobbiai* (Holm, 1992) comb. nov.**
(Figs 64-65, 74-76)

Ichnestoma stobbiai Holm, 1992: 374; Holm & Marais 1992: 28; Beinhundner 2017: 1152.

Ichnestoma stobbia Holm (= *stobbiai*). Sakai & Nagai 1998: 206.

Ischnostoma nasuta (*nec* Schaum, 1848). Allard 1991: 45.

Remarks. In contrast to *M. nasula*, with which this species was confused until recently, *M. stobbiai* is currently

the best known species of all the Ichnestomina. It differs from *M. nasula* mainly in the shape of the male clypeus, which is more elongate and heavily carinate. Its elytra also have odd-numbered interstriae more prominent than in *M. nasula* and the humeral calli are infused with black from the base. In *M. stobbiai*, the dorsal lobes of the parameres are more abruptly bent apically and have grooves projected towards the apical half, in comparison with those of *M. nasula*. The female is the most brachypterous among the member of this genus, with a W:E ratio = 0.53. Size: male TL = 13.8-17.4 mm, MW = 6.5-8.8 mm (n = 32); female TL = 12.5-16.1 mm, MW = 7.6-9.5 mm (n = 14).

Distribution. Scattered populations occur throughout the northern and central Gauteng Province to the north of Randfontein, and also in adjacent areas of the North West and Limpopo provinces (Kryger and Scholtz 2008, C. Deschodt pers. comm.)(Fig. 76 E).

Biology. *Mzansica stobbiai* occurs in small fragments of Dry Highveld Grassland, mainly along the Magaliesberg range. Eighteen semi-isolated populations have been discovered so far, but four of these have already been destroyed by residential developments (Kryger & Scholtz 2008). It is currently listed as an endangered species of conservation priority in the Gauteng Province. Its life cycle, third instar larva and pupa were described in Deschodt et al. (2009).

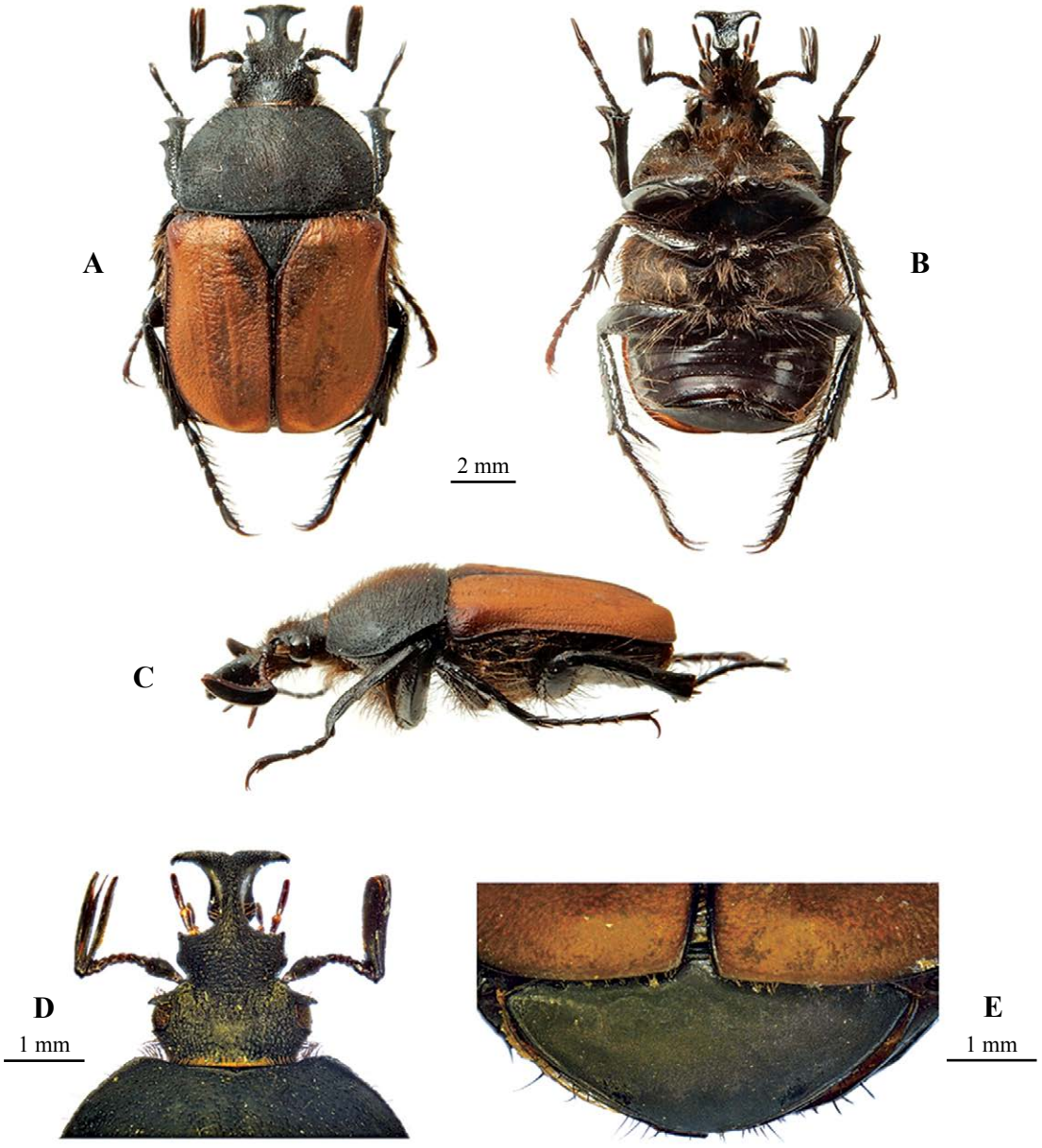

Fig. 74 – *Mzansica stobbiai* (Holm, 1992) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

Data. Republic of South Africa: Holotype: ♂, Transvaal, Donkerhoek, 26 Oct 1991, P. Stobbia (TMSA-CPH7935). Allotype: ♀, *idem*. Paratypes: 7♂♂, 4♀♀, *idem* (SANC-COLS-16026, CEMT); 45♂♂, 15♀♀, *ibidem* R.T. Van Viegen (SANC-COLS-16024, TMSA, TGPC, MDPC); 1♂, Strubens Valley, Florida, 3 Sep 1974, I. Brampton (TMSA-CPH7944); 7♂♂, *ibidem* 30 Oct 1971, W. Henning (TMSA-CPH7944, SANC-COLS-16025); 1♂, Doom Pools, Magaliesberg, 9 Oct 1983, Penrith (TMSA-CPH7942); 1♂, 1♀, Farm Rhenosterpoort, 24.43.S, 28.56.E, 21 Oct 1979, L. Schulze (TMSA-CPH7943); 1♂, Pretoria (W.L.D.), Distant Coll. 1911-383 (BMNH-NHMUK014400056); ; 1♀, Zusterstroom (on ground) 6 Nov 1904 (TMSA-CPH7941); 1♂, Kalkheuwel, Pretoria, Oct 1908, Swierstra (TMSA-CPH7940); 2♂♂, 1♀, Pretoria, Nov 1929, Kobrow (TMSA-CPH7937); 1♂, Voortrekkerhoogte, Oct 1961, G. Goode (TMSA-CPH7939). Other material: 1♂, RSA, Pretoria, Rietvlei, Oct 1988 (MDPC); 1♂, South Africa, Donkerhoek, Magaliesberg, 27 Nov 1993, A.P. Marais (ISAM COL-A067974); 2♂♂, 1♀, South Africa, Gauteng, Magaliesberg range 1700 m, 8 Oct 1995, P. Stobbia (ISAM COL-A027371); 11♂♂, 4♀♀, *ibidem* 1650 m, 16 Oct 1994 (BMPC, MDPC, HMPC); 6♂♂, 3♀♀, *ibidem* 14 Nov 1999 (EPPC, TGPC); 7♂♂, 1♀, RSA, Transvaal, Smuts Koppie, Irene 20 Oct 1992, T.R. Van Viegen (TGPC, BMPC, PMPC); 27♂♂, 16♀♀, *ibidem* 17 Oct 1994 (TMSA); 15♂♂, 8♀♀, Pretoria, Smuts Kop-

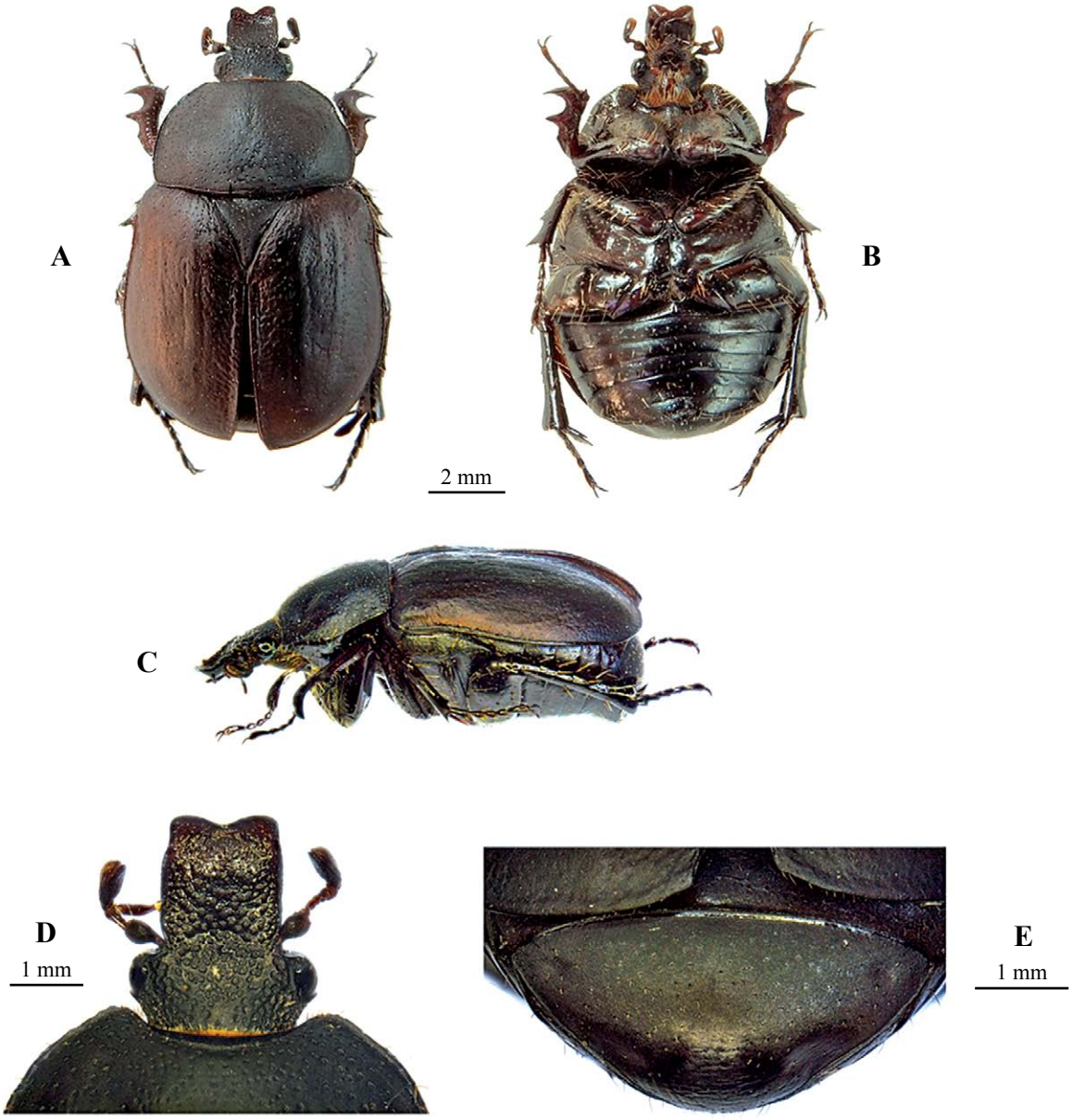

Fig. 75 – *Mzansica stobbiai* (Holm, 1992) comb. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

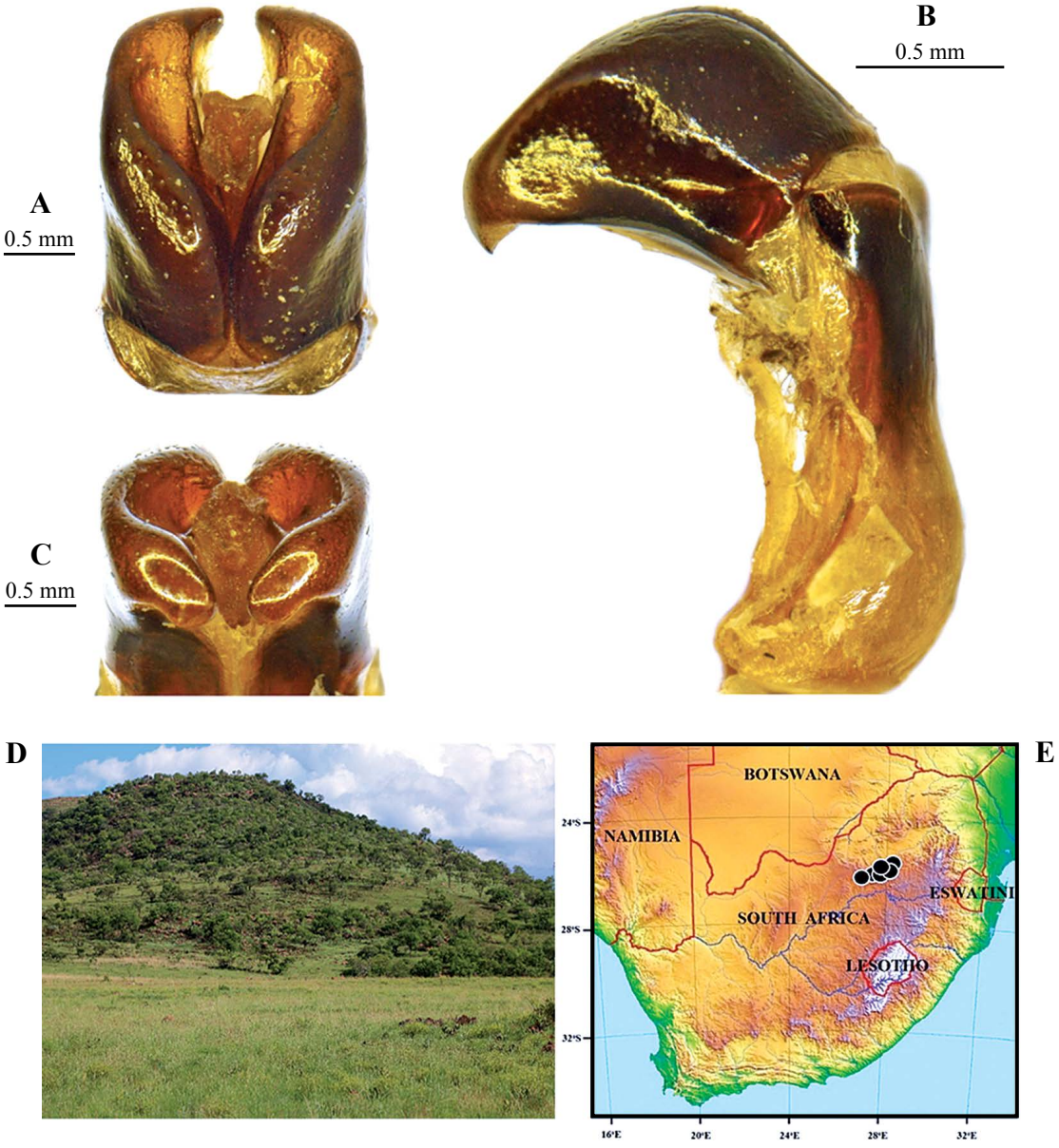

Fig. 76 – *Mzansica stobbiai* (Holm, 1992) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the environs of Hennops River near Pretoria; **E**, known distribution range. Photographs A-C by Lynette Clennell, D by Chistian Deschodt; map adapted from Mapsland (Copyright© 2019 Mapsland).

pie, 5 Oct 1993, Endrody-Younga (TMSA- CPH7947); 15♂♂, 5♀♀, *ibidem* 18 Oct 1994, C.L. Bellamy (TMSA-CPH7948); 14♂♂, *ibidem* 5 Nov 2005, J. du G. Harrison (TMSA-CPH7949); 2♂♂, 2♀♀, RSA, Tvl., Magaliesberg, Pretoria, 30 Oct 1999, leg. T. Beyers (HMPC); 1♂, RSA, Gauteng, 1334 m Hennops, 27 Oct 2014, H.C. Ficq (BMPC); 15♂♂, 4♀♀, Hennops River District, Aalwynskop, west base of hill, 19 Oct 2008, Martin Paulsen (TMSA-CPH7951); 1♂, RSA, Gauteng, Kudu Conservancy 1156 m , 14 Oct 2004, M. Paulsen (TMSA-CPH7950); 5♂♂, RSA, Gauteng, Ezemvelo N.R., 15 Oct 2009, D. MacFadyen (TMSA); 1♂, 1♀, RSA GP, Centurion, Irene (veld) 1494 m, 27 Sep 2014, P. Webb (SANC-COLS-17212); 2♂♂, RSA-GP, Irene, 19 Oct 2008, P. Webb (https://www.inaturalist.org/observations/10805490); 1♂, 1♀, *ibidem* 14 Oct 2012 (https://www.inaturalist.org/observations/10802497); 1♂, 1♀, *ibidem* 3 Nov 2019 (https://www.inaturalist.org/observations/35337512); 1♂, 1♀, South Africa, Sterkfontein 173, Krugersdorp, 22 Oct 2016, C.M. Deschodt (https://www.inaturalist.org/observations/16987817); 1 ♂, South Africa, Centurion, 0045, Pierre van Ryneveld, 9 Dec 2018, J. Heymans (https://www.inaturalist.org/observations/18918402); 1♂, South Africa, Krugersdorp, 1739, Rangeview, 2 Nov 2019, obs. by "*draino*" (https://www.inaturalist.org/observations/35228251).

Mzansica luridipennis species-complex

Key characteristics

1) Male clypeus short and wide, weakly sinuate at apical centre and with short expansions on lateral margins;
2) male protibia wide and tridentate;
3) aedeagus with grooves on dorsal lobes of parameres forming a markedly serrated edge on dorso-lateral margins;
4) four species are currently included: *M. luridipennis* from eastern part of EC, *M. falcipata* from western escarpment of EC, and two new species from NC, namely *M. denticulata* and *M. clarki*;
5) species-complex named after *M. luridipennis*, the first species to be historically recognised and described within this group.

Key to species

1. Male clypeus roundly square, with lateral invaginations obliterated and weak sinuation at apex; dorsal lobes of parameres circular in dorsal view; female W:E ratio = 0.61; female clypeus with smoothly rounded lateral margins and strongly sinuate apex; small to medium species ≈12-16 mm TL; distribution: EC (Tarkastad) ..... *M. luridipennis* (Burmeister, 1842) comb. nov.
- Male clypeus trapezoidal and variably elongate, with lateral invaginations fully developed 2
2. Male clypeus with lateral invaginations extremely enlarged and apex smoothly rounded; dorsal lobes of parameres elliptical in dorsal view; female W:E ratio = 0.65; female clypeus with parallel lateral margins and weakly sinuate apex; small to medium species ≈14-17 mm TL; distribution: NC (Komsberg) ..... *M. clarki* gen. et sp. nov.
- Male clypeus with lateral invaginations of average width and apex sinuate 3
3. Male clypeus expanded anteriourly and with apex deeply sinuate; dorsal lobes of parameres oval in dorsal view; female W:E ratio = 0.61; female clypeus with rounded lateral margins and moderately sinuate apex; small to medium species ≈13-17 mm TL; distribution: NC (Namaqualand) ..... *M. denticulata* gen. et sp. nov.
- Male clypeus constrained anteriourly and with apex weakly sinuate; dorsal lobes of parameres wide elliptical in dorsal view; female W:E ratio = 0.64; female clypeus with lateral margins slightly diverging anteriourly and with moderately sinuate apex; small to medium species ≈13-18 mm TL; distribution: EC (Sneeuberge, Agter-Renosterberg) ..... *M. falcipata* gen. et sp. nov.

Mzansica clarki gen. et sp. nov. (Figs 77-78, 79-81)

Diagnosis. This species is closest to *M. denticulata*, both in terms of geographic proximity and morphological similarities. However, the two are separated by a straight distance of about 500 Km and the shape of their male clypeus is substantially different and consistent to allow an easy separation between them (Fig. 77). The clypeus of *M. clarki* has a shape reminiscent of a battle-axe, without any sinuation at apex, while that of *M. denticulata* exhibits denticle-like projections laterally and a deep sinuation at apex (see also diagnosis section under that species). In *M. clarki* male, the elytra are also darker, generally of a brick-red colour, rather than ochraceous as in *M. denticulata*. Furthermore, the black setation on elytra extends to the entire surface in *M. clarki* males, while this is restricted to the basal half in *M. denticulata*. Females of the two species can also be recognized and separated on the basis of their clypeal shape, as those of *M. clarki* virtually lack any sinuation at the apex, while those of *M. denticulata* have a prominent one. Further diagnostic characters can be recognised at the level of the aedeagal parameres, as in dorsal view the shape of the dorsal lobes of *M. clarki* is perfectly elliptical, with maximal width at centre (Fig. 78). The sausage-shaped incavations of the dorsal lobes lack the trian-

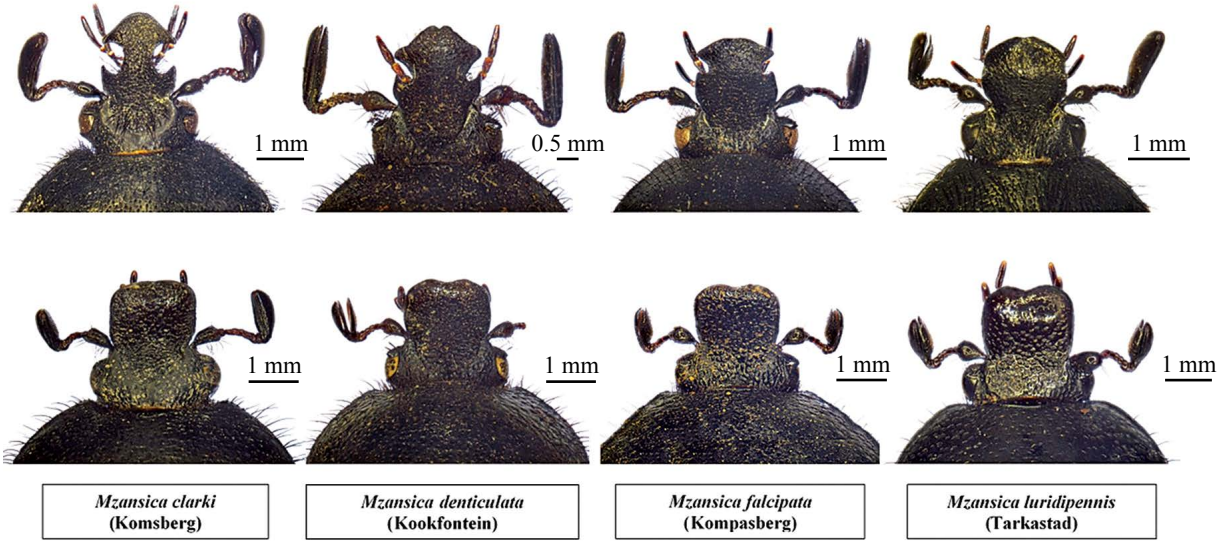

Fig. 77 – Comparative clypeal shape of the species of the genus *Mzansica* gen. nov., *luridipennis* species-complex: male (top row) and female (bottom row) dorsal views.

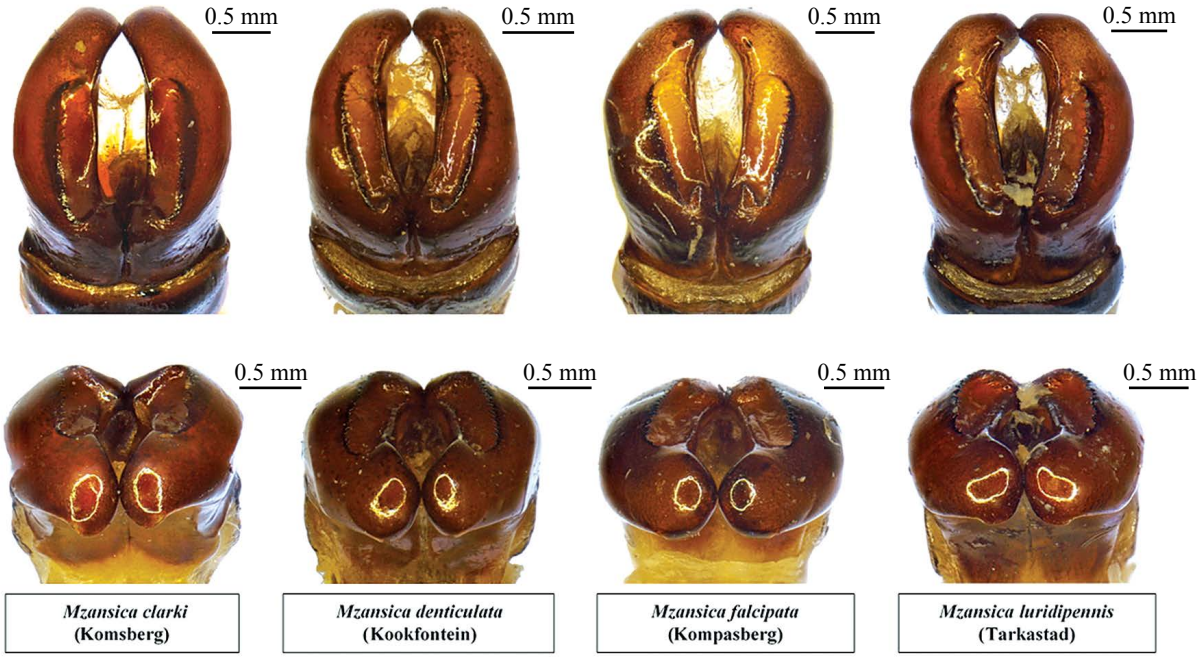

Fig. 78 – Comparative aedeagal shape of the species of the genus *Mzansica* gen. nov., *luridipennis* species-complex: dorsal (top row) and frontal (bottom row) view of parameres.

gular projection on the inner basal margin, which is a typical feature of the other species of the same group.

Description of holotype male (Figs 79 A-E, 81 A-C)

Size. Length 16.8 mm; width 8.4 mm.

Body. Matte, with black anterior parts and brick-red elytra (Fig. 79 A); whole surface covered in black to dark brown, medium to long setae, becoming more scattered on elytra; sculpture generally ultra-fine, with fine round punctures on pronotum becoming coarser on head (Fig. 79 A, C, D).

Head. Black and exhibiting long, black setae, mainly on vertex; with coarse round punctures across entire surface; clypeus in the shape of battle-axe, lacking sinuation at apex but exhibiting wide lateral invaginations, markedly elevated at margins and forming wide concavity between frons and margins; supra-ocular spines diverging slightly away from base and moderately sharp; antennal club, flagellum and pedicel black to dark brown, club hypertrophic but shorter than flagellum and pedicel combined (Fig 79 D).

Pronotum. Black and matte; covered in dense but small round punctures, with long black setae emerging at centre of each puncture; antero-lateral margins forming smooth right angles and leading to central disc through steep declivity; absence of any protuberance on anterior margin; basal or posterior margin smoothly and uninterruptedly rounded across both elytra and scutellum (Fig. 79 A, C).

Scutellum. Black and matte; isoscelic triangular with sharply pointed apex but narrow and shallow lateral grooves; with long but scattered black setae and no major punctures (Fig. 79 A).

Elytron. Brick-red and matte, with darker infusions on humeral umbones and along sutural and peri-scutellar margins; without noticeable costal markings, but entirely covered in scattered, long to medium sized black or dark brown setae, except on apical declivities; apices bluntly squared, not protruding or forming spinal projections; poorly visible round punctures at points of setal emergence (Fig. 79 A).

Pygidium. Completely black and matte; with ultrafine sculpture only and scattered dark setae on basal half; with lining of dense, long to medium sized black setae along apical and lateral margins (Fig. 79 E).

Legs. All legs black, with tarsal segments hypertrophic and setation increasing progressively from pro- to metalegs, both in density and length; protibia tridentate, with proximal tooth drastically reduced; mid outer spine absent in mesotibia and poorly developed in metatibia, but both tibiae exhibiting coarse sculpture and numerous black setae of various size across whole surface; apical spurs elongate and sharp on both tibiae (Fig. 79 A-C).

Ventral surface. Black and shiny, covered in dense, dark brown and very long setae, except on abdominal sternites and coxal bases; mesometasternal process very reduced, not protruding forward or upwards and with basal portion entirely coated with long, dark setae; metasternal lobe with marked triangular concavity around median sulcus; abdominal sternites forming concavity at middle, particularly in area of sternites 5–7 (Fig. 79 B).

Aedeagus. Elliptical in dorsal view, with widest point at centre; apex squarely rounded, with dorsal and ventral projections on each lobe visible in frontal view (Fig. 81

A, C); sausage-shaped incavations of dorsal lobes delimited at external margin by finely serrated edge; baso-medial projection on incavation absent.

Derivatio nominis. This species is named after the collector of its type series, Mr Derek Clark, a former conservation manager with the Eastern Cape Government and later with African Parks.

Description of female (Figs 77, 80). By comparison with the other females of species belonging in the same genus, the female of *M. clarki* exhibits a more reddish-brown elytral colour and a rather straight clypeal apex. Its most salient features can be summarised as follows. a) Body black to reddish-brown and matte, with sparse short black setae and round punctures on anterior portion only; b) clypeus squared, concave and with extremely weak sinuation at apex; c) pronotum globose and densely covered in round, shallow punctures; d) scutellum equilateral triangular, with few setae and obsolete punctures; e) elytra reddish-brown, with weak and coarse costal and sculptural markings; f) brachypterous, with wing size = 6.8 mm and elytron:wing ratio = 0.65; g) pygidium black, with dense but shallow round punctures and weak symmetric baso-lateral depressions; h) tarsal segments not hypertrophic but tibiae more robust and wider than in male, metafemora hypertrophic and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny but with setation much sparser and

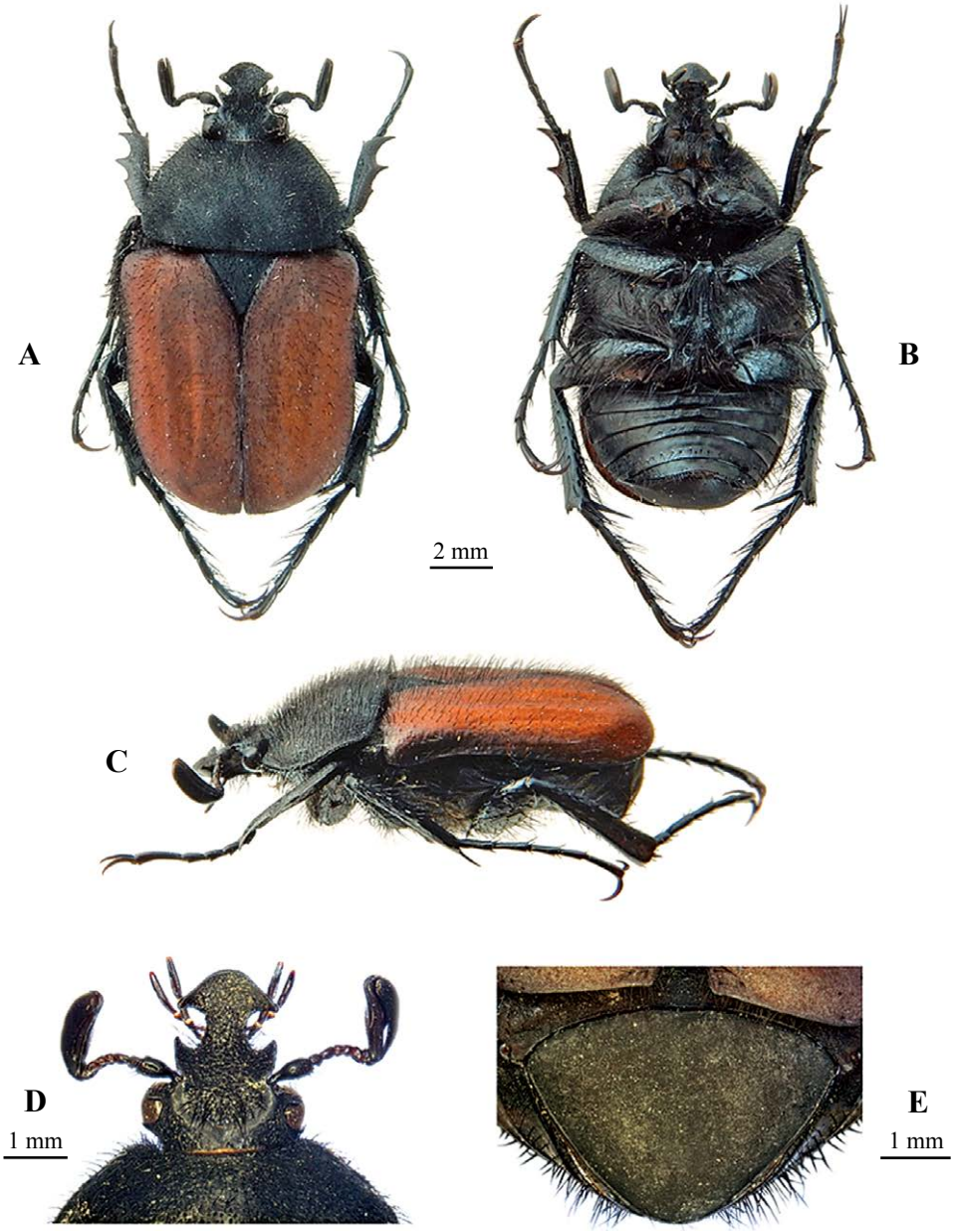

Fig. 79 – *Mzansica clarki* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

shorter than in male, with abdominal sternites slightly convex.

Remarks. Some variation exists in the male clypeus, both in its width and length. Some specimens exhibit a remarkable expansion of the lateral invaginations, as a direct result of clypeal elongation. A few large males also show a weak sinuation on the apical portion of the clypeal anterior margin. Within the type series analysed in this study, the size ranges as follows: male TL = 14.9-17.2 mm, MW = 8.1-9.5 mm (n = 24); female TL = 14.1-16.2 mm, MW = 8.8–10.1 mm (n = 7).

Distribution. *Mzansica clarki* is currently known only from a small colony of approximately 100 m^2, situated on the northern slopes of the Komsberg range, just south of the town of Sutherland in the Northern Cape.

Biology. This species appears to be restricted to the Roggeveld Karoo Bioregion of the Succulent Karoo Biome (Mucina & Rutherford 2006). The landscape features a variable combination of sloping plateaus, undulating hills and steep mountain slopes, while the vegetation is composed of sparse dwarf succulent and non-succulent shrubs, with a notable contribution of various grasses. These characteristics position this bioregion at the transition between two major arid biomes in southern Africa, the Succulent Karoo and the Nama-Karoo (Mucina & Rutherford 2006). The species occurs in close proximity to *Ichnestoma coetzeri*, however the latter is restricted to the Roggeveld Shale

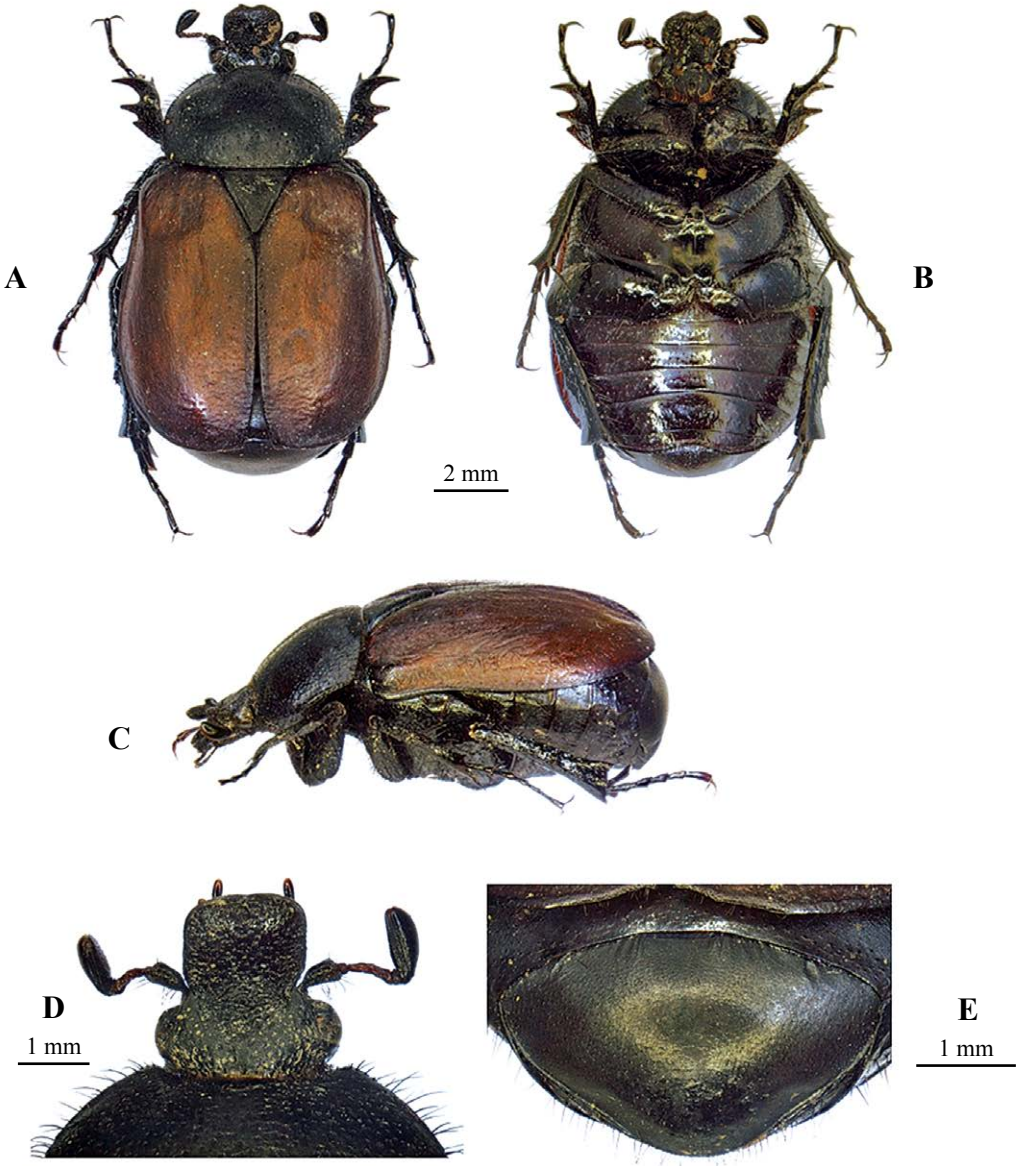

Fig. 80 – *Mzansica clarki* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

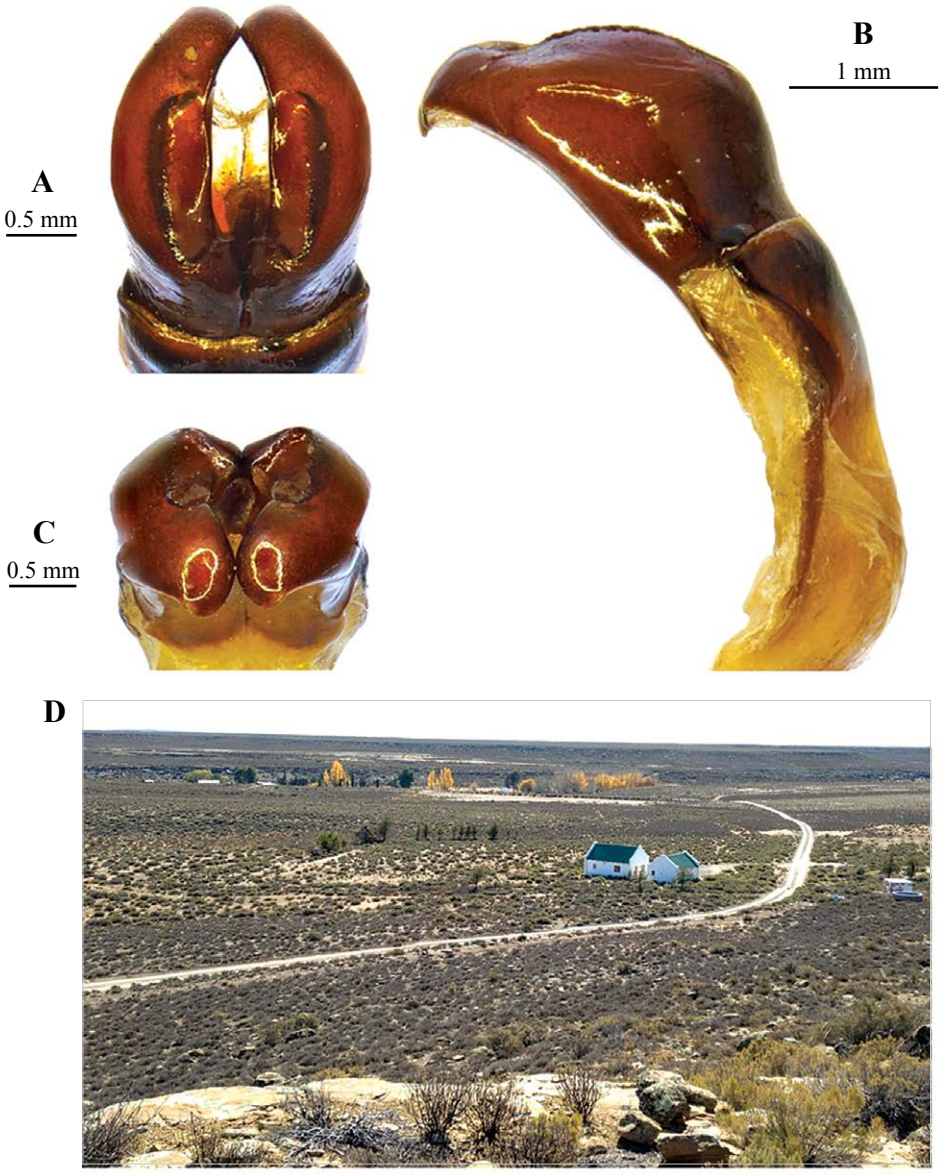

Fig. 81 – *Mzansica clarki* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, habitat in the environs of the Komsberg, Northern Cape. Photographs A-C by Lynette Clennell, D by Derek Clark.

Renosterveld vegetation type and so the two species do not actually fly together.

Data. Republic of South Africa: Holotype: ♂, NC, Komsberg, 25 Mar 2015, D. Clark (ISAM); Paratypes: 31♂ 12♀, *ibidem* 28 Mar 2015, dead on ground (TMSA, ISAM, BMPC, TGPC, CGPC, MPPC, EPPC).

***Mzansica denticulata* gen. et sp. nov.** (Figs 77-78, 82-84)

Diagnosis. This species is most closely related to *M. falcipata* and *M. clarki*, from which it differs mainly in the shape of the male clypeus and the parameres, as well as in its geographic distribution. Its male clypeus has a pentagonal shape, with denticle-like projections separated by a deep sinuation at apex (Fig. 77). Conversely, the clypeus of *M. falcipata* is shorter and exhibits moderate to poor sinuation at the apical margin, while that of *M. clarki* is longer but without any sinuation at apex. This characteristic is more or less also reflected in the female clypeus (Fig. 77). At the level of the parameres, in *M. denticulata* the dorsal lobes are wider towards the base and then gently taper towards the apex (Fig. 78), while in the other two species there is tapering at both ends, with maximal width in the central part. In frontal view, the lobes of *M. denticulata* also exhibit the most prominent dorsal projections among the three species (Fig. 78).

Description of holotype male (Figs 82 A-E, 84 A-C)

Size. Length 16.8 mm; width 8.5 mm.

Body. Matte and completely black, except elytra which are ochreous to light-brown with darker infusions at sutural margins, around scutellum and at humeral umbones (Fig. 82 A); head, pronotum and scutellum densely covered in fine, medium to long black setae, but elytra exhibiting setae only on upper third, becoming more scattered and very short at external and sutural margins; sculpture generally ultra-fine, with rugosity on head surface and small round punctures occasionally visible only around points of setal emergence (Fig. 82 A, C, D).

Head. Black and densely covered in long, black setae, with fine rugose sculpture across entire surface; clypeus pentagonal in shape with deep sinuation at apex and markedly elevated at margins, forming wide concavity between frons and anterior margin; supra-ocular spines parallel and moderately sharp, lateral invaginations well developed; antennal club, flagellum and pedicel black to dark brown, club hypertrophic and approximately as long as flagellum and pedicel combined (Fig. 82 E).

Pronotum. Completely black and matte; covered in dense and long setae but without significant sculpture; smoothly rounded on all margins except antero-lateral, which exhibit sharp angles; declivous towards entire anterior margin and without any elevation or protuberance on same; basal or posterior margin smoothly rounded across both elytra and scutellum (Fig. 82 A, C).

Scutellum. Completely black and matte; triangular with sharply pointed apex but narrow and shallow later-

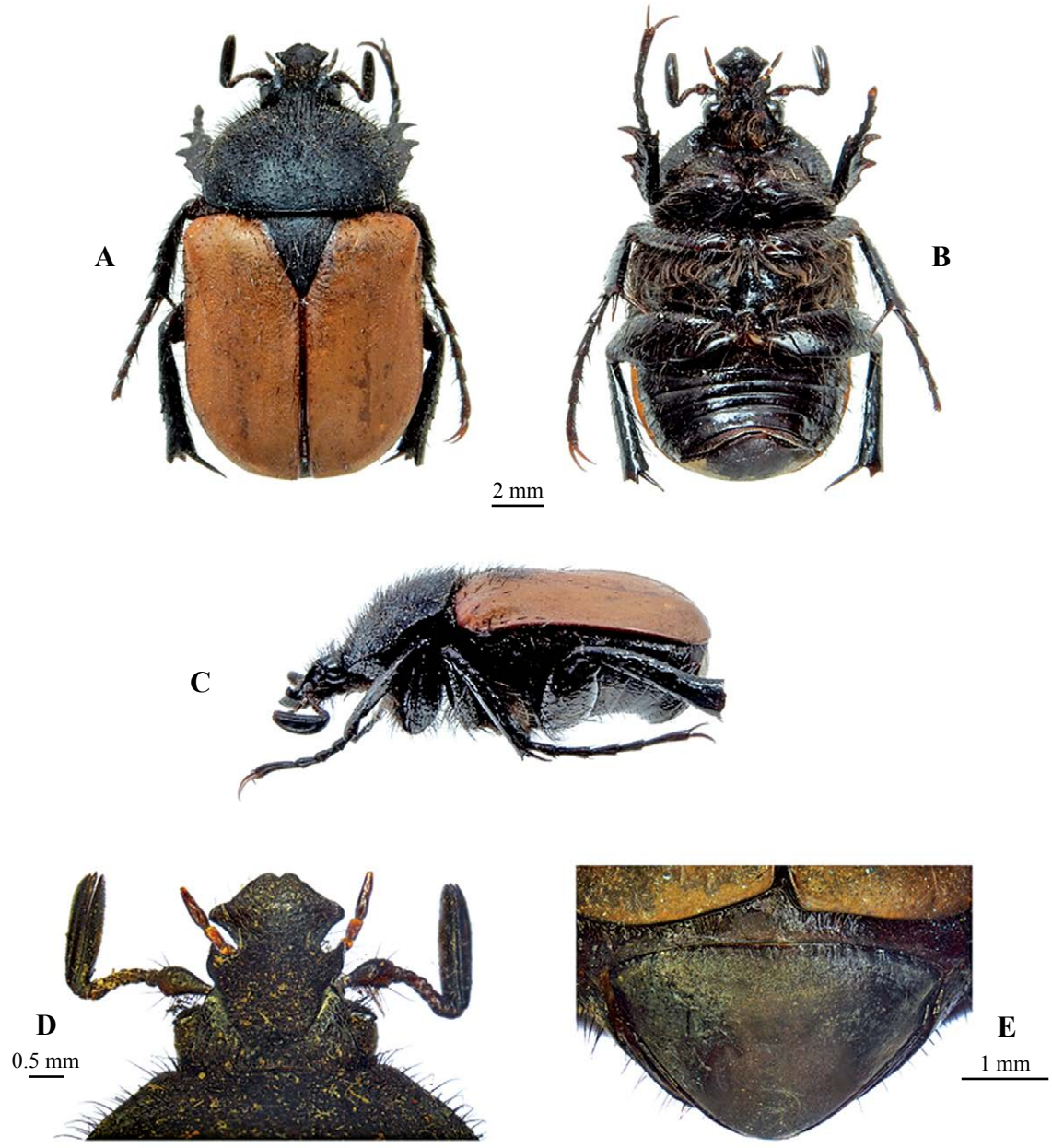

Fig. 82 – *Mzansica denticulata* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

al grooves; without any punctures or other types of macro-sculpture, but covered in dense, black setae of medium size throughout basal two-thirds of its surface (Fig. 82 A).

Elytron. Testaceous to light brown and matte, with darker infusions along sutural and peri-scutellar margins as well as on humeral umbones; with costae and intercostae virtually obsolete, and apical umbones weakly pronounced; exhibiting long, black, erect setae on basal third, becoming shorter and more scattered along outer margin and around suture; apices bluntly squared, not protruding or forming spinal projections; few scattered, fine to rounded punctures on basal third of surface only (Fig. 82 A).

Pygidium. Completely black and matte; as long as wide and lacking any macrosculpture or depression areas; without pubescence on general surface but with lining of scattered, short black setae along apical and lateral margins (Fig. 82 E).

Legs. All legs completely black and matte; tarsal segments hypertrophic, particularly on metalegs and showing progressively denser and longer setation from pro- to metatarsi; protibia tridentate but with proximal tooth drastically reduced and distal tooth most developed and sharply pointed; meso- and metatibia with mid outer spine poorly developed, but exhibiting coarse sculture and numerous black setae of various size across entire surface; apical spurs on both meso- and metatibia elongate and sharp (Fig. 82 A-C).

Ventral surface. Completely black and shiny but cov-

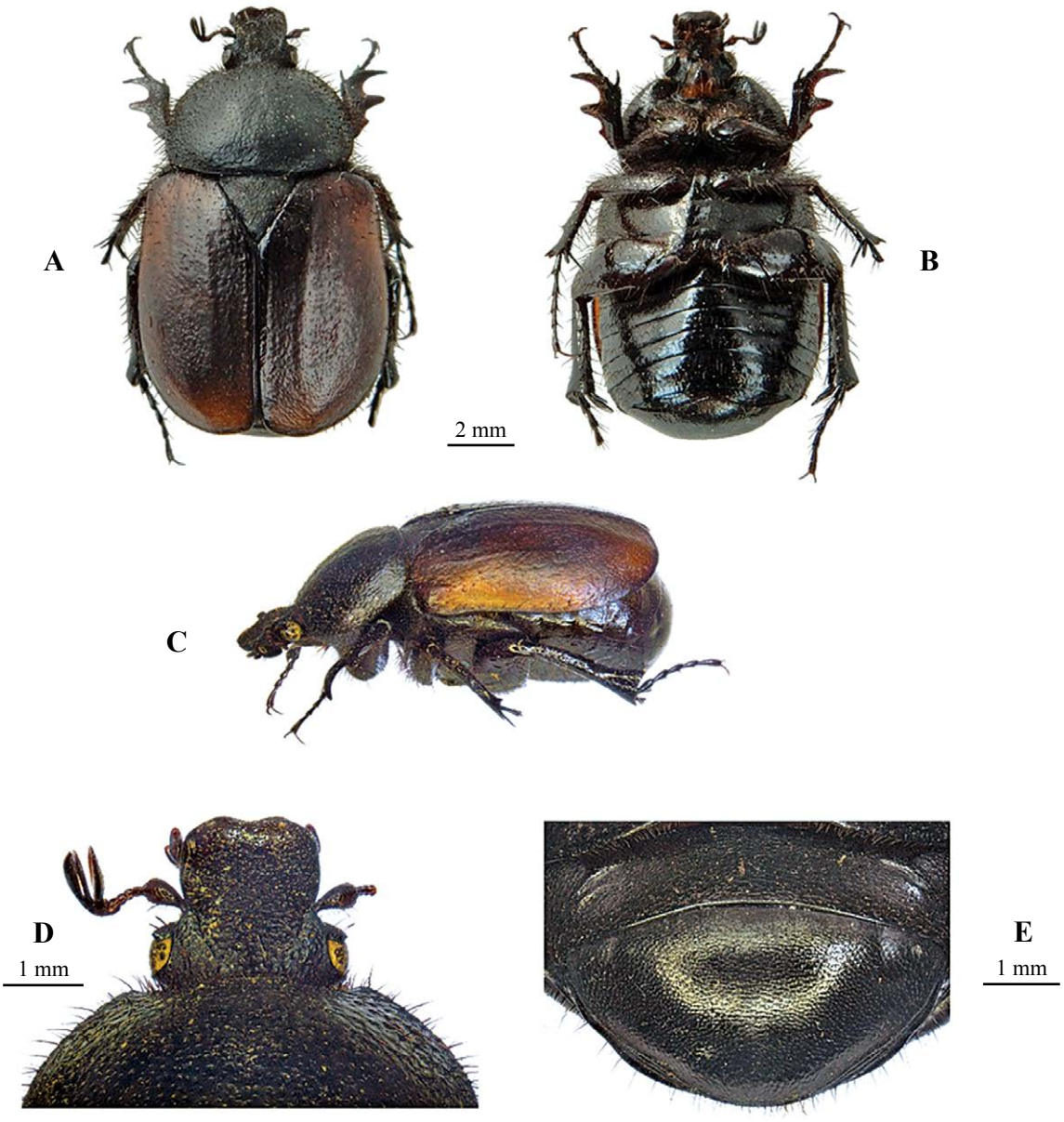

Fig. 83 – *Mzansica denticulata* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

ered in dense, very long setae ranging in colour from black to dark brown; setation drastically reduced on abdominal sternites and coxal and femoral bases; mesometasternal process very reduced, not protruding forward or upwards and partly covered by coxal bases and largely coated with long, dark setae; metasternal lobe with deep concavity around median sulcus; abdominal sternites forming weak concavity at middle in area of sternites 5–7 (Fig. 82 B).

Aedeagus. Wider at base and tapering smoothly towards apex; apex short and abruptly rounded, with prominent dorsal projection on each lobe visible in frontal view (Fig. 84 A-C); parameres with dorsal lobes exhibiting sausage-shaped incavation delimited on dorso-lateral side by finely serrated margin; baso-medial projection on incavation poorly developed (Fig. 84 A).

Derivatio nominis. The name of this species is retrieved from a provisional nomination proposed by Krikken (as reported in Holm 1992), who had already realised that more than one species was involved in what was then regarded as intraspecific variability within *M. luridipennis*. The meaning of the name reflects the characteristics of its clypeal apical margin, which exhibits a deep sinuation at the centre and a symmetric blunt-tooth projection on each side (Fig. 82 D).

Description of female (Figs 77, 83). Within the extreme sexual dimorphism that characterizes all species of this genus, the most salient features of the female of *M. denticulata* can be summarised as follows. a) Body black to dark brown and matte, with sparse setation but covered in mac-

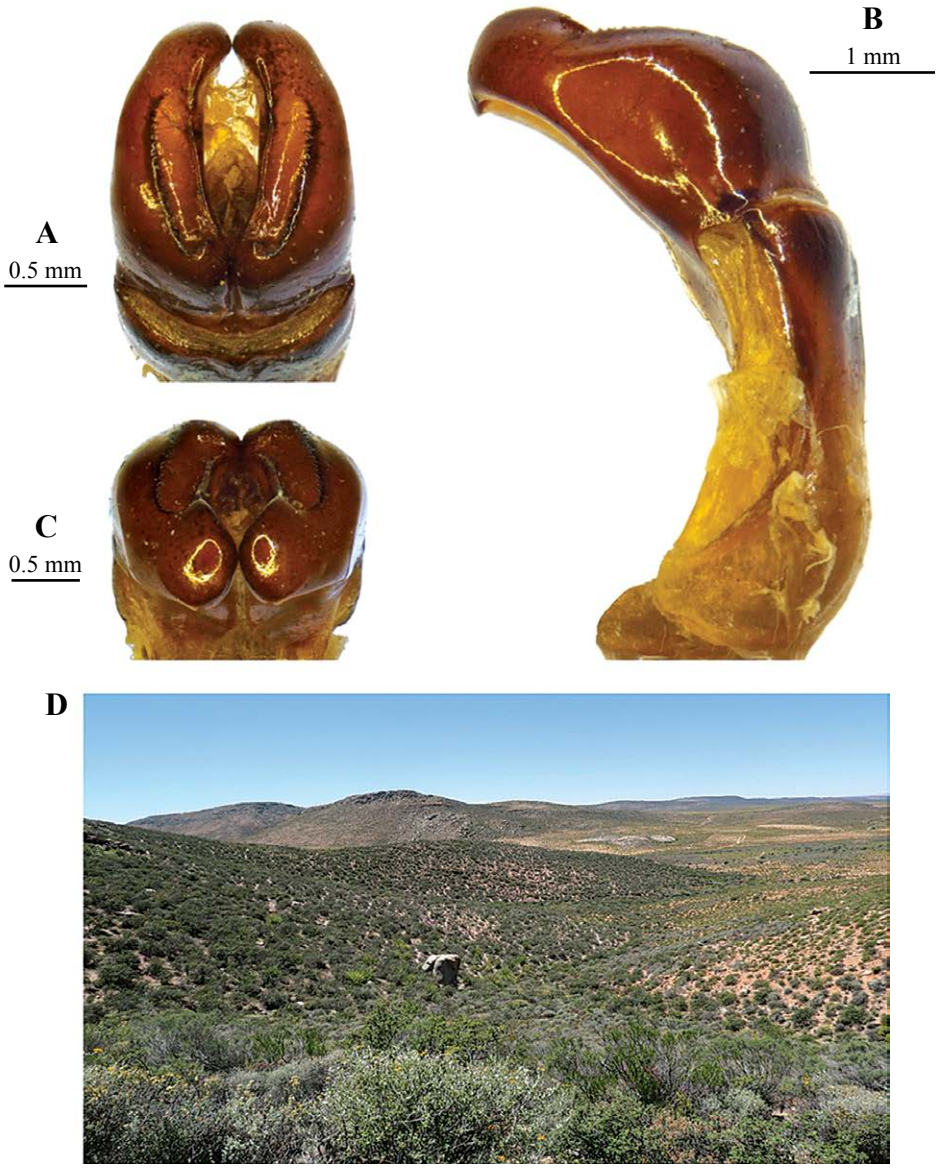

Fig. 84 – *Mzansica denticulata* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, potential habitat in the environs of Steinkopf, Northern Cape. Photographs by Lynette Clennell.

ro-sculpture, particularly on pronotum; b) clypeus broadly squared, with marked sinuation at apex; c) pronotum globose and densely covered in round punctures; d) scutellum equilateral triangular; e) elytra dark brown and exhibiting some costal and sculptural markings; f) brachypterous, with wing size = 5.4 mm and W:E ratio = 0.61; g) pygidium black with dense but fine rugose sculpture and weak symmetric baso-lateral depressions; h) tarsal segments not hypertrophic but tibiae more robust and wider than in male, metafemora hypertrophic and metatibial apical spine and spur shorter and much wider than in male; i) ventral surface black and shiny but with setation much sparser and shorter than in male, with abdominal sternites markedly convex.

Remarks. There is very little variability in either dorsal or ventral habitus in this species, with minor changes observed from individual to individual in the extent of the clypeal apical sinuation and the density of the pubescence on the dorsal surface. Within the type series analysed in this study, the size ranges as follows: male TL = 15.6-17.3 mm, MW = 7.8-9.2 mm (n = 11); female TL = 12.9-13.3 mm, MW = 7.1-8.4 mm (n = 2).

Distribution. The only consistent and reliable data for this species reports as "Kookfontein" its type locality. This is the old name of the current Steinkopf, situated in the north-western corner of the Northern Cape, just south of the Richtersveld (Raper et al. 2014). It appears that although the renaming of this little town was already officialised around the middle of the 19th century, the popular and traditional name of Kookfontein remained in use at least until the early 1900s. The most recent record of this species, seems to confirm this Namaqualand locality as the "epicentre" of the species, although it is possible that other colonies may occur in its vicinities.

Biology. Although there is no data or other information on the biology of this species, it is reasonable to assume that it conforms to the well-known patterns that characterize the sister species within the genus *Mzansica.* The broader Steinkopf area is typically situated within the Succulent Karoo Biome and the vegetation in this region falls within the Namaqualand Hardeveld Bioregion type (Mucina & Rutherford 2006).

Data. Republic of South Africa: Holotype: ♂, "Kookfontein C.C., Dec 1908, S. Viljoen" [= Steinkopf] (TMSA- CPH7 928); Paratypes: 5♂, 1♀, *idem* (TMSA-CPH 7928, SANC- COLS-17217); 1♂, *ibidem* (ISAM-COLA 027363); 1♂, *ibdem* (ISAM-ENT-005551); 1♂, no data, "Harrison 25003" (ISAM-COL–A026363); 1♂, Northern Cape, Steinkopf, Dec 2005, AK Brinkman [data not confirmed] (BMPC); 1♂, "Cap, *Isch. luridipennis* Burm., R. Deguide vid. 1966" (RBIN); 1♂, "*Ischnostoma*, Riversdale, R. Deguide vid. 1966" [locality almost certainly erroneous] (RBIN).

***Mzansica falcipata* gen. et sp. nov.** (Figs 77-78, 85-87)

Diagnosis. As indicated above, this species could potentially be confused with *M. denticulata*, from which it differs by having a shorter clypeus, generally with weak sinuation at apex (Fig. 77). It also differs from the latter species in the shape of its parameres, which in dorsal view exhibit the widest extension towards the middle, rather than at the base like in *M. denticulata* (Fig. 78). The sausage-shaped incavations on the dorsal lobes of *M. falcipata* have the best developed baso-medial projections among all the species of the genus, while in frontal view the lobes of its parameres exhibit the least developed dorsal projections.

Description of holotype male (Figs 85 A-E, 87 A-C)
Size. Length 17.2 mm; width 8.7 mm.

Body. Black and matte, except elytra which are testaceous with darker infusions on sutural margins, around scutellum and on humeral umbones (Fig. 85 A); head, pronotum and scutellum exhibiting scattered but, long to medium black setae, and elytra with dark-brown setae on basal half of surface and along lateral and sutural margins; widespread ultra-fine sculpture and macrosculpture predominantly rugose on head but as small round punctures on pronotum (Fig. 85 A, C, D).

Head. Black, with scattered but long black setae and fine rugose sculpture across entire surface; clypeus with shape of narrow but elongate blade, with moderate sinuation at apical margin and markedly elevated at margins, forming wide concavity between frons and anterior margin; supra-ocular spines moderately diverging anteriorly and forming sharp apical points, lateral invaginations well developed and smoothly rounded; antennal club, flagellum and pedicel black to dark brown, club elongate but slightly shorter than flagellum and pedicel combined (Fig. 85 D).
Pronotum. Black and matte; covered in scattered black setae of medium length and exhibiting small round punctures across entire surface, mainly around setae; smoothly rounded at all margins and forming a wide convexity, but not proper tubercle, with lateral declivities at centre of anterior margin; basal or posterior margin smoothly rounded (Fig. 85 A, C).

Scutellum. Black and matte; triangular with sharply pointed apex but narrow and shallow lateral grooves; without any punctures or other types of macrosculpture, but with scattered, black setae of medium-long size throughout basal two-thirds of surface (Fig. 85 A).

Elytron. Testaceous and matte, with darker infusions on humeral umbones, sutural and peri-scutellar margins; without signs of costal and intercostal subdivisions, and apical umbones weakly pronounced; with dark brown, erect setae of medium size on basal half, becoming shorter and more scattered along outer margin and around suture; apices smoothly squared, not protruding; absence of macrosculture, except small, roundish punctures with elevated anterior margins around each seta (Fig. 85 A).

Pygidium. Black, matte and glabrous; as long as wide and lacking any macrosculpture but exhibiting weak symmetric depression areas on baso-lateral corners; with lining of scattered, short black setae along apical and lateral margins (Fig. 85 E).

Legs. All black and matte, with rugosity and irregular round punctures on most surfaces; tarsal segments hypertrophic, particularly on metalegs and showing progressively denser and longer brown setae from pro- to metatarsi; protibia tridentate, with proximal tooth drastically reduced and distal tooth most developed and sharply pointed; meso- and metatibia with external serrations forming irregular carina but not distinct denticle; apical spurs on both meso- and metatibia elongate and sharp (Fig. 85 A-C).

Ventral surface. Black, shiny and covered in dense, very long brown setae, except on abdominal sternites, coxal and femoral bases as well as mesometasternal lobes; mesometasternal process extremely reduced, not protruding and extensively covered in long, dark setae and exhibiting two anterior and two posterior shallow depressions; abdominal sternites forming weak concavity at middle in area of sternites 5–7 (Fig. 85 B).

Aedeagus. In dorsal view, parameres are widest at middle and then taper smoothly in both directions, towards base and apex; apex short and abruptly rounded, with dorsal projection on each lobe virtually obsolete in frontal view (Fig. 87 A-C); sausage-shaped incavations on dorsal lobes delimited on dorso-lateral side by finely serrated

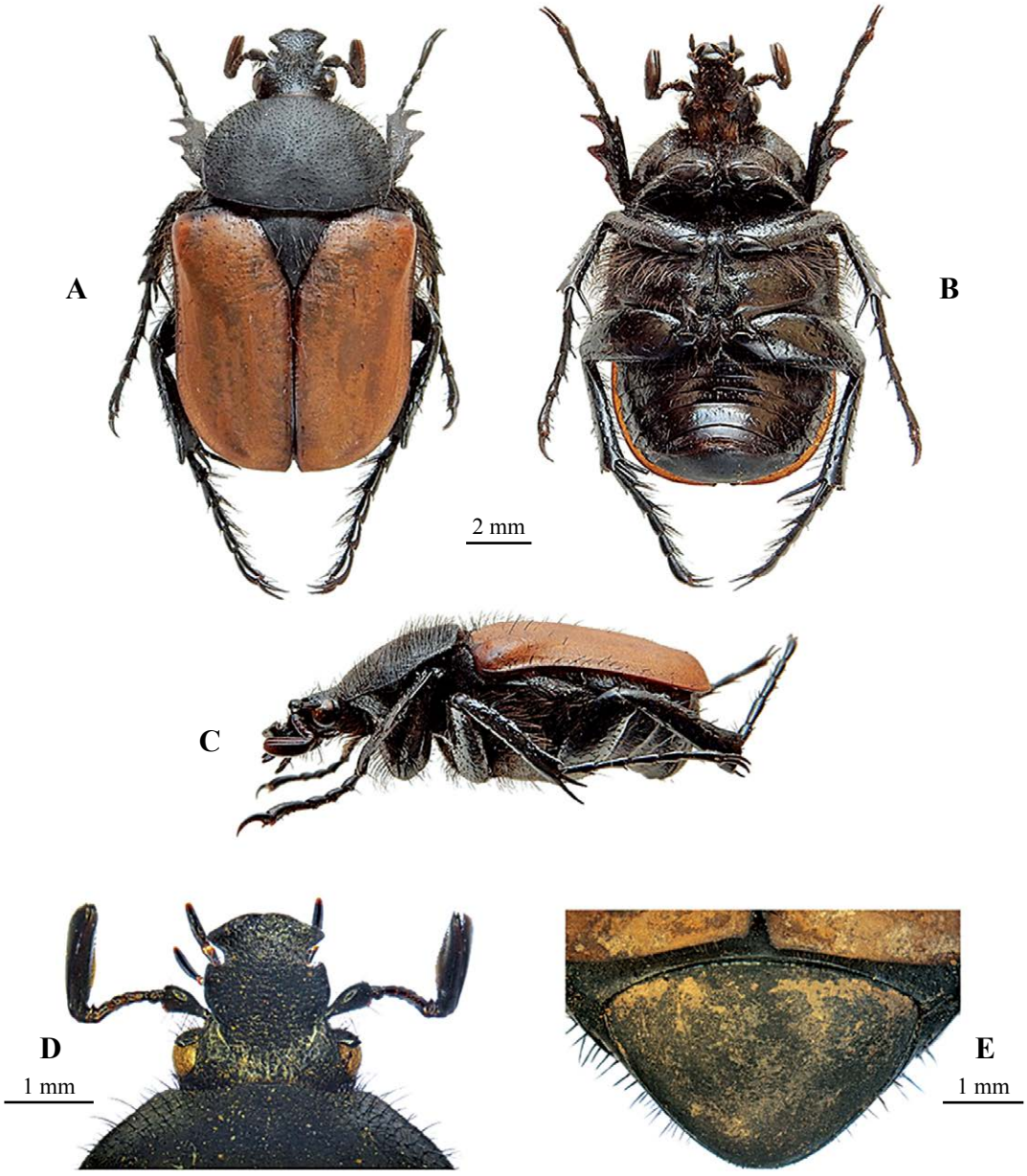

Fig. 85 – *Mzansica falcipata* gen. et sp. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

margin and exhibiting prominent, triangular projection on inner basal margin of same (Fig 87 A).

Derivatio nominis. The shape of the clypeus has once again inspired the name of this species, as in this case it resembles the narrow and elongate blade of a sickle, especially in those specimens that exhibit a very pointed lateral expansion (Fig 85 D).

Description of female (Figs 77, 86). Exhibiting typical female Ichnestomina habitus, with the following general characteristics. a) Body black to dark brown and matte, with setation extremely sparse and mainly on antero-lateral margins, rugosity and round punctures widespread across entire dorsal surface; b) clypeus black, expanding laterally from base to apex, with deep concavity and elevated margins but moderate to weak sinuation at apex; c) pronotum black, globose and densely covered in round, shallow punctures; d) scutellum black, equilateral triangular, with scattered round punctures and black setae; e) elytra dark brown, with weak costal markings, dense rugosity and scattered black setae on basal third; f) brachypterous, with wing size = 6.1 mm and W:E ratio = 0.64; g) pygidium black to dark brown, with dense but fine and shallow rugose sculpture and small symmetric baso-lateral depressions; h) tarsal segments much shorter than in male, but tibiae more robust and wider, protibia tridentate but proximal tooth extremely reduced, metafemora hypertrophic and metatibial apical spine and spur shorter and much wid-

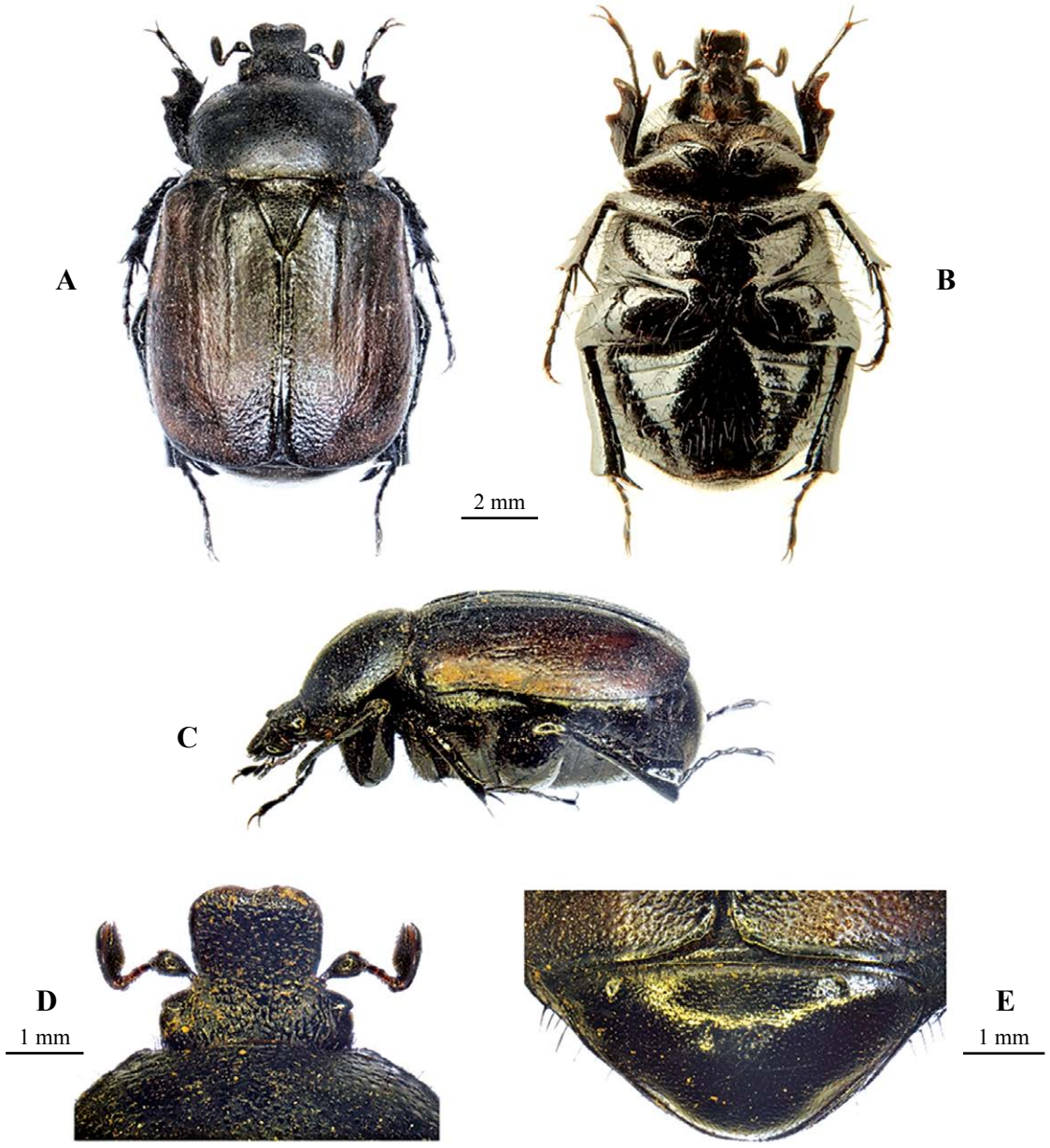

Fig. 86 – *Mzansica falcipata* gen. et sp. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

er than in male; i) ventral surface black to dark brown and shiny, with setation much sparser and shorter than in male, with abdominal sternites moderately convex.

Remarks. As with the previous species, the only variability of significance observed in *M. falcipata* lies in the shape of the male clypeus, which can range from short with laterally enhanced spinal projections to longer with less pronounced projections and weak apical sinuation. In the latter case, it may actually be difficult to separate males of this species from those of *M. denticulata*, without analysing their parameres. Within the type series analysed in this study, the size ranges as follows: male TL = 13.1-17.6 mm, MW = 7.6-9.3 mm (n = 28); female LT = 13.8-16.0 mm, MW = 8.9-10.1 mm (n = 13).

Distribution. The species is known mainly from two colonies adjacent to each other on the northern slopes of the Compassberg, in the Sneeuberge range of the Eastern Cape. Recently a male specimen was also collected in the Agter-Renosterberg, about 20 km north of Middelburg (Eastern Cape), indicating that the species may also occur in other mountain ranges within the same broader area, where some kind of habitat continuity or connection with the Sneeuberge exists.

Biology. *Mzansica falcipata* occurs at high altitude (1500-1800 m) in the Nama-Karoo Biome and at the interface between the Eastern Upper Karoo and the Upper Karro Hardeveld bioregions (Mucina & Rutherford 2006). The landscape is dominated by flat areas and gentle sloping plains,

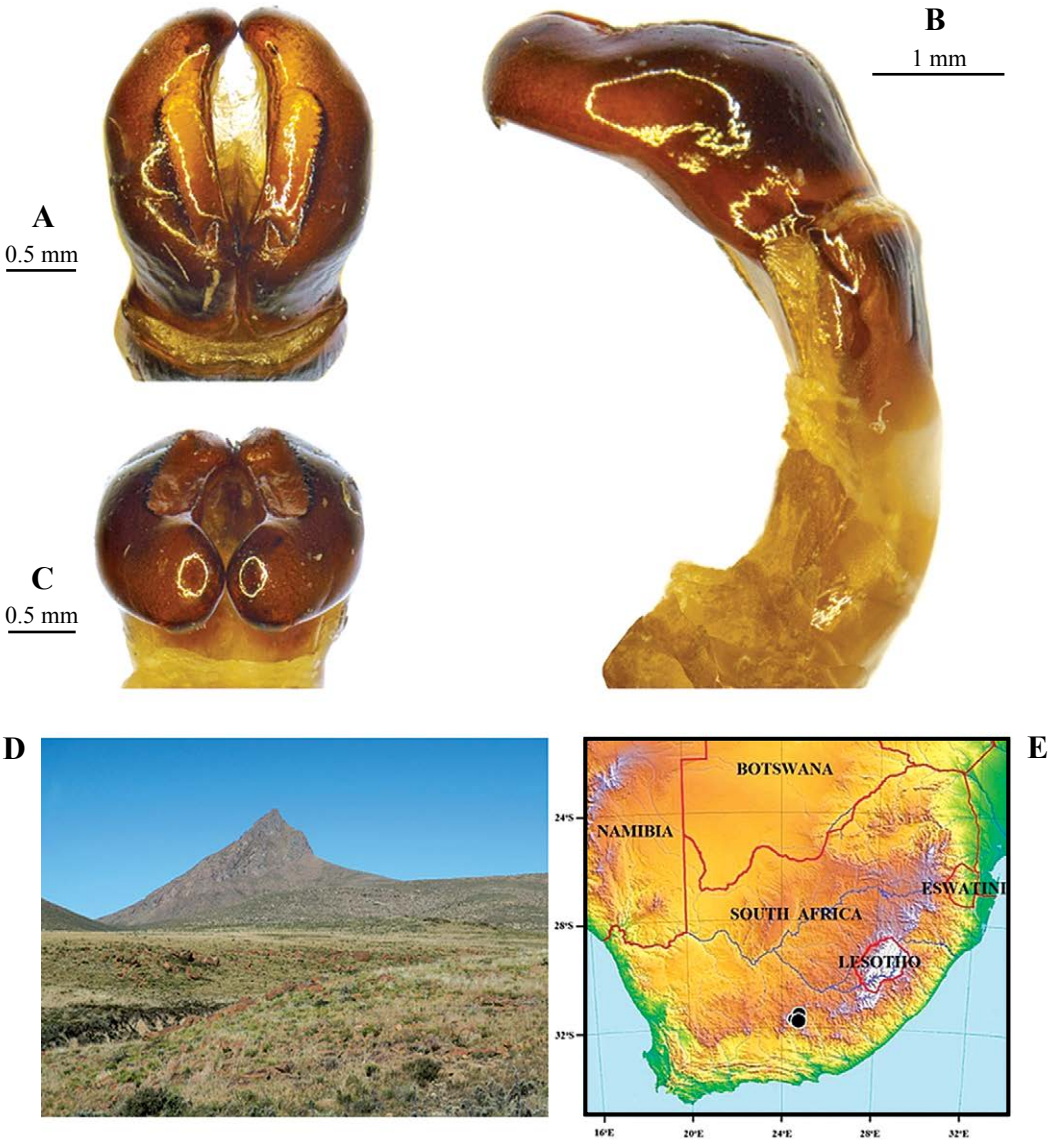

Fig. 87 – *Mzansica falcipata* gen. et sp. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat on the slopes of the Compassberg, Eastern Cape; **E**, known distribution range. Photographs by Lynette Clennell; map adapted from Mapsland (Copyright© 2019 Mapsland).

alternated with steep hills and rocky outcrops, while the vegetation consists mainly of dwarf Karoo scrub with white grasses (e.g. *Aristida* spp., *Eragrostis* spp.) proliferating rapidly during the rainy season (Mucina & Rutherford 2006).

Data. Republic of South Africa: Holotype: ♂, EC, Sneeuberge 20 Dec 1999, R Perissinotto & L Clennell [dead on ground] (ISAM). Paratypes: 12♂♂, *idem* (BMPC, TGPC, HMPC, EPPC); 2♂♂ 1♀, South Africa, EC, Compassberg 24 Jan 1996, K. McCabe (BMPC, EPPC); 19♂♂, 10♀♀, *ibidem* 27-29 Dec 1997, dead on ground, R Perissinotto & L Clennell (ISAM, BMNH-NHMUK014400062-63, BMPC, EPPC, GBPC, TGPC, DMPC, MDPC); 4♂, *ibidem* 22 Dec 1998 (EPPC); 8♂ 6♀, *ibidem* 17 Dec 1997, extracted from unearthed cocoons (BMPC, PMPC); 1♂, RSA, Sneeuberge, 20 Dec 2012, ex coll. A. Chaminade (HMPC); 2♂♂, 2♀♀, *ibidem* 7 Jan 2017 (BMPC); 1♂, RSA, prov. Eastern Cape, Carlton env. 20 km N of Middelburg (alt. 1560 m), 14 Dec 2019 (PMPC).

***Mzansica luridipennis* (Burmeister, 1842) comb. nov.**
(Figs 77-78, 88-90)

Ischnostoma luridipennis Burmeister, 1842: 608; Schoch 1897: 459; Peringuey 1907: 377; Schenkling 1921: 80; Allard 1991: 101.

Ichnestoma luridipennis Burmeister. Holm 1992: 372; Holm & Marais 1992: 26; Beinhundner 2017: 1149.

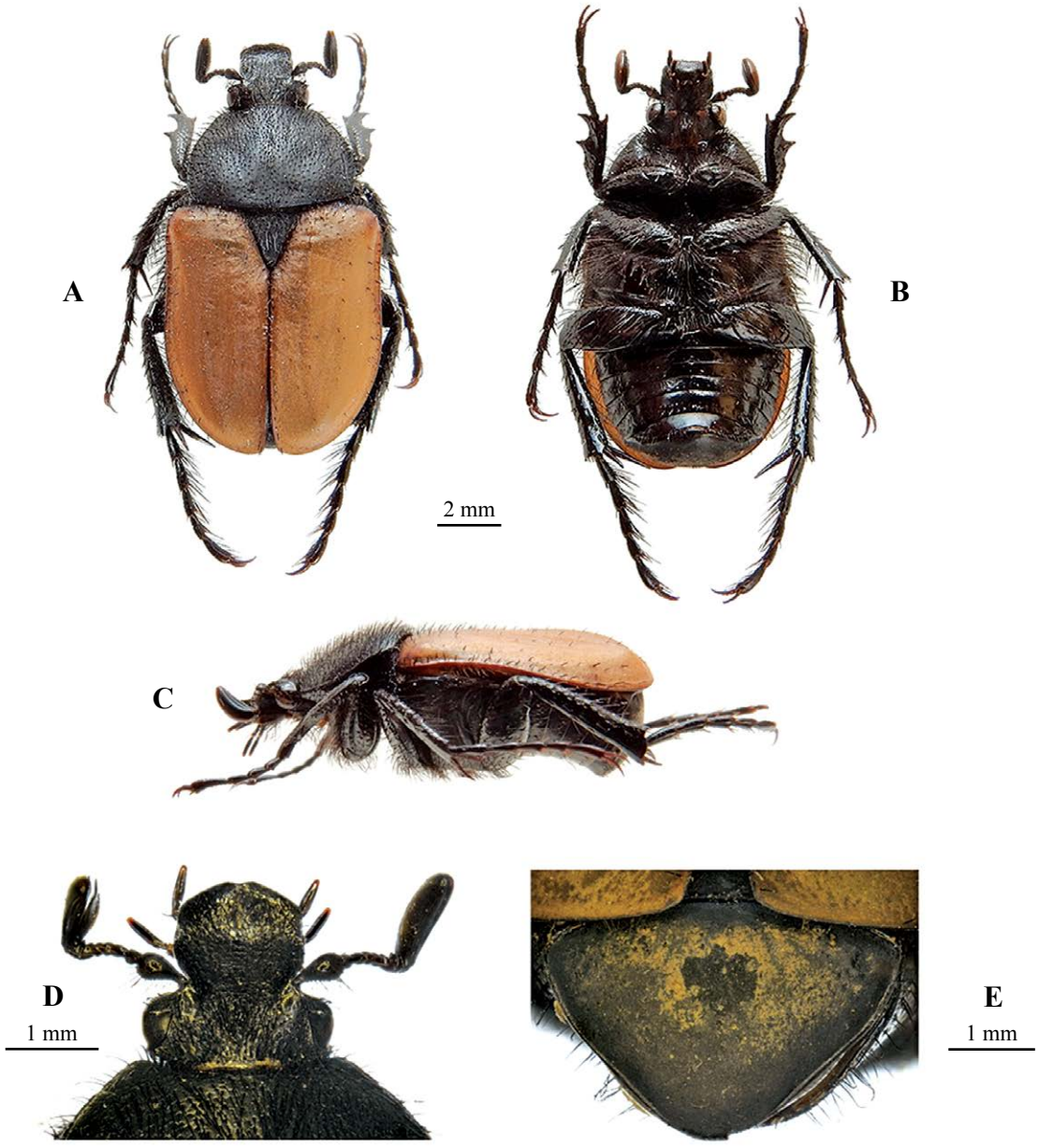

Fig. 88 – *Mzansica luridipennis* (Burmeister, 1842) comb. nov., male: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

Remarks. This species has also been regularly confused with the closely related *M. denticulata* and *M. falcipata* that are now described in this work. Its male clypeus is actually unique among the members of this species complex, as it does not exhibit any invagination anteriad of antennal insertion and is squarely shaped with very minor apical projections (Fig. 77). The aedeagus exhibits a distinct narrowing of the dorsal lobes of parameres towards the base (Fig. 78). Péringuey (1907) reported a length of 5 mm for this species, but this is almost certainly an editorial error, as all specimens analysed are at least twice that size. The W:E ratio in the female is 0.61, while the body size of male and female specimens is respectively: TL = 11.8-16.3 mm, MW = 7.2-9.1 mm (n = 23); TL = 12.3-15.4 mm, MW= 7.9-9.6 mm (n = 6).

Distribution. As already pointed out by Holm (1992), the locality of "Port Natal" reported in the label accompanying the holotype specimen is almost certainly erroneous. Recent records have identified a population of the species at Tarkastad in the Eastern Cape, but it is likely that other populations may exist in nearby localities within the same region, in the eastern part of that province.

Biology. At Tarkastad, the habitat of *M. luridipennis* is characterized by Queenstown Thornveld vegetation of the Sub-Escarpment Grassland Bioregion (Mucina & Rutherford 2006). The landscape is generally flat to gently sloping and situated between mountain ranges. The thornveld is dominated by *Vachellia natalitia* trees and scattered schrubs, while the grassland is composed mainly of

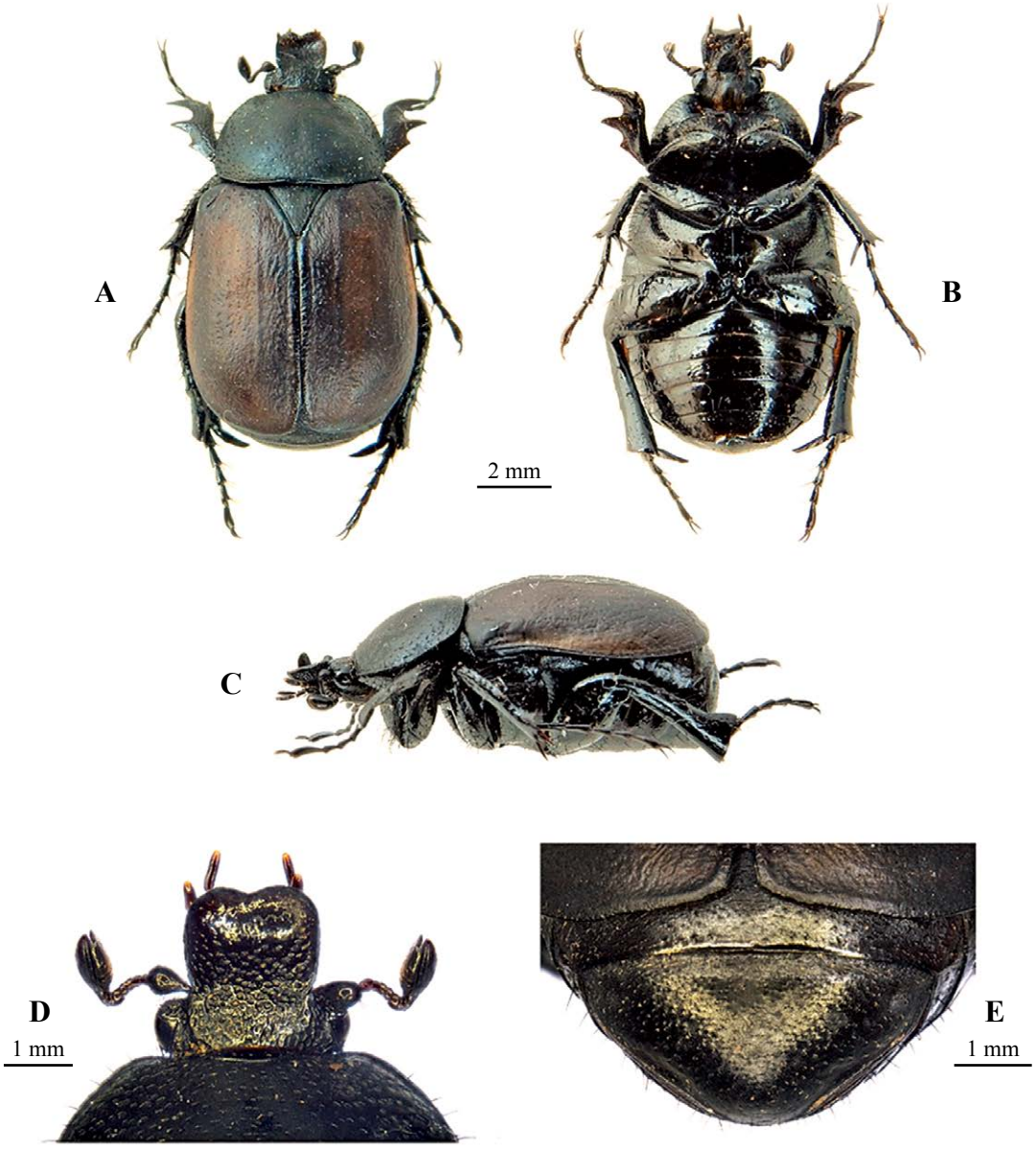

Fig. 89 – *Mzansica luridipennis* (Burmeister, 1842) comb. nov., female: **A**, dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, clypeus; **E**, pygidium. Photographs by Lynette Clennell.

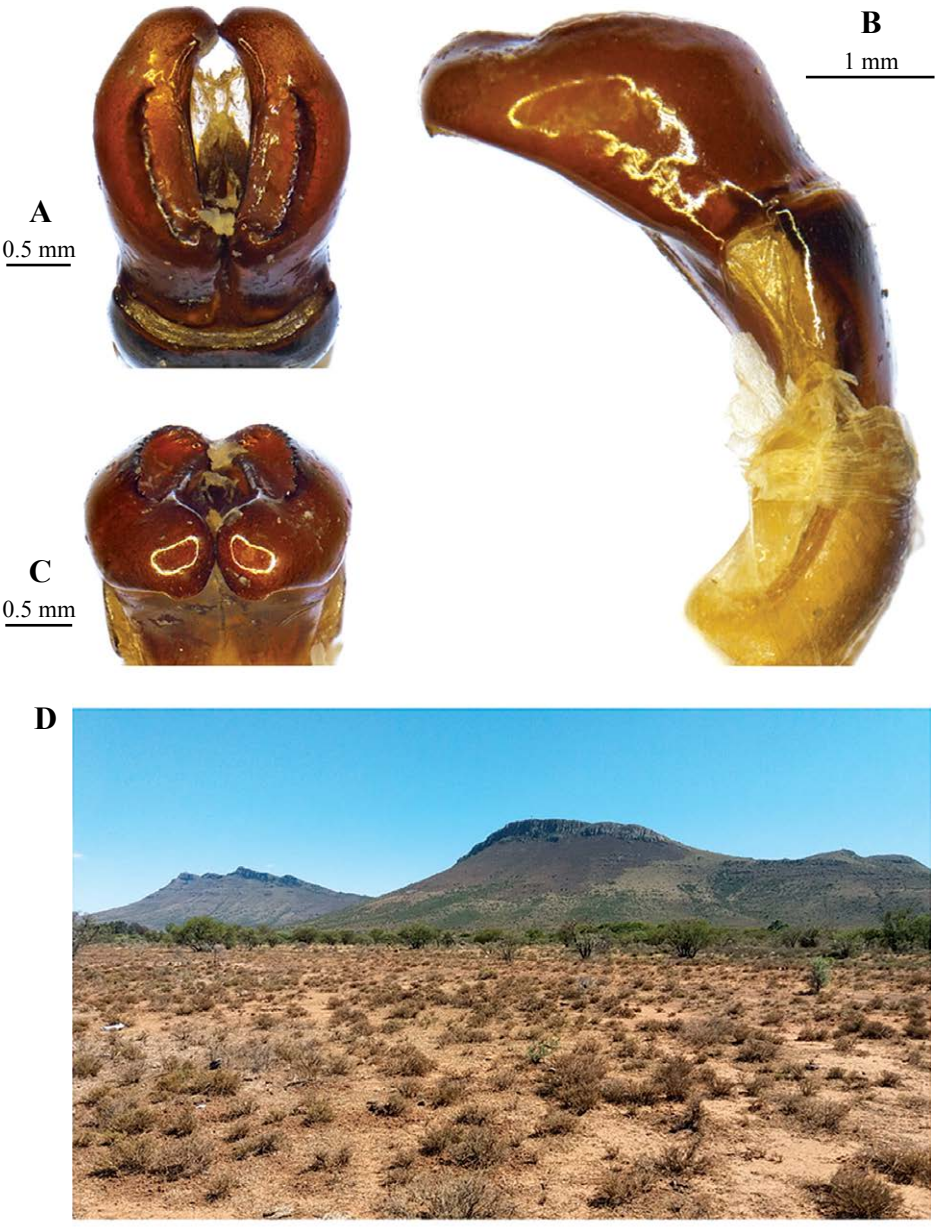

Fig. 90 – *Mzansica luridipennis* (Burmeister, 1842) comb. nov.: **A**, parameres, dorsal view; **B**, parameres, lateral view; **C**, parameres, frontal view; **D**, typical habitat in the environs of Tarkastad, Eastern Cape. Photographs by Lynette Clennell.

species like *Aristida congesta, Cymbopogon pospischilii, Eragrostis curvula* and *Tragus koelerioides* (Mucina & Rutherford 2006). As the *M. luridipennis* population is located in the close proximity of the residential development of the town, it is currently under serius threat, due to the uncontrolled grazing by communal goats and cattle, as well as refuse dumping.

Data. Republic of South Africa: Holotype: ♂, "*luridipenis** P. nat. Dry." (MLUH). Other material: 8♂, RSA, Eastern Cape Prov., Tarkastad 1318 m, 25 Dec 2013, H.C. Ficq (BMPC); 18♂ 7♀, *ibidem* 16 Jan 2016, dead on ground (EPPC, BMPC, UKCR).

Discussion

It is evident from the new data and descriptions reported here that the Ichnestomina have undergone a higher degree of radiation and speciation than previously assumed (Holm 1992; Holm & Marais 1992; Perissinotto et al. 1999; Holm & Perissinotto 2004; 2011). This is mainly due to a number of peculiar features, not usually encountered in the Goliathini. First of all is female brachyptery, which makes most members of this sex unable to fly and thereby restricted to crawling on the ground with limited dispersal potential. The distance covered is further restricted by their short life-span, due to the inability to renew

energy supplies through adult feeding (Perissinotto et al. 1999). Although the males are fully winged and capable of flying remarkably fast, their hypertrophic antennal clubs covered in feromonal receptors make them also range-bound to the immediate proximity of the colony, where female signals are strongest.

Unfortunately, fresh specimens for genetic analysis are poorly available and still being sourced. However, a preliminary DNA sample of seven hypotethical species from the Eastern Cape Province has recently been sequenced (cox1) and the results show that all of them can be defined as good species, with a genetic distance between each taxon oscillating between 11 and 18 %, which is extraordinarily large by any standard (D. Vondráček & P. Šípek, pers. comm.). Thus the current list of 27 species is set to grow further in the future, as the exploration of the vast and poorly investigated landscape of the southern African region progresses gradually.

Areas of particular interest in this regard include the vast arid and semiarid regions of southern Namibia, Botswana and the South African Northern Cape, where several isolated mountain ranges remain largely inaccessible and unexplored. Remote localities in the Limpopo and North-West provinces of South Africa have also previously been mentioned in the literature as origin of specimens not yet properly identified and/or described [e.g. Soutpansberg (Distant 1911), Sandspruit/Polokwane (Schein 1961) and Limpopo River (Boheman 1857)]. Furthermore, the Cape Fold Mountains of the Western and Eastern Cape have been shown to be hot-spots of diversity for the species of the genus *Ichnestoma*. New species will almost certainly be discovered in this region, particularly where substantial patches of renosterbos-dominated (*Dicerothamnus rhinocerotis*) vegetation are still found. Although much of the Cape renosterveld vegetation has been destroyed by land use change, especially agriculture, renosterbos itself does not seem to be threatened yet, thanks to its weedy nature. However naturally-occurring patches, where *Ichnestoma* species are most likely to occur, are progressively been eradicated, as the plant is unpalatable to stock and can become a serious weed on farmlands (Bergh 2006; pers. obs.).

Since adults of the various species across the four genera emerge in synchrony in the aftermath of a substantial rainfall event and are active for a few days only, their dead bodies may accumulate on the ground before being consumed by predators and scavengers, like lizards, rodents and ants (Perissinotto et al. 1999). Towards the end of their short life span, adults are often seen drowning in water bodies, such as streams, rain pools, farm dams and troughs. This may be due to accidental disorientation over the water reflective surface (sensu Holm & Marais 1992), but possibly also in response to the dehydration that their bodies experience during the frantic period of reproductive activity. As a result, drowned carcasses are observed in these water bodies, often in large numbers, and can provide a valuable indication of the presence of species in a given area, even long after the end of their period of activity.

Along with other southern African cetoniines, the Ichnestomina exhibit several plesiomorphic and atypical traits, These include a brachypterous female (except genus *Gariep*) with reduced and conservative morphology, a narrow and poorly developed mesometasternal process, wide scutellum and shallow subhumeral elytral emargination (Holm 1992; Holm & Marais 1992). This, combined with the fact that most species are microendemics restricted to small colonies and highly specialized habitats, makes them of special biodiversity and phylogenetic importance. Molecular and larval morphological studies are currently being undertaken on what is available of the members of this taxon and others associated in the same clade, in order to establish their position in the early cetoniine phylogeny (Šípek et al. 2016; Perissinotto & Šípek 2019). Investigations are also needed on the palaeoenvironmental and geological events that have led to the radiation and isolation of the species of this subtribe.

Related to isolation and microendemicity are often issues of conservation. Although none of the Ichnestomina species has yet been officially confirmed as extinct, to my knowledge *M. botswanica* has not been reported beyond the turn of the last century (last dated record: Ramoutsa, 1894) and *M. nasula* has not been collected or observed during the past 48 years (last dated record: P. Shepstone, 1972). Although most species occur in remote and relatively pristine areas, they are under increasing threat mainly from habitat destruction for agricultural (veld clearing, overgrazing), residential (housing, tourism) and communication (TV/phone masts and associated access roads) purposes. In the Eastern Cape town of Tarkastad, for instance, the only population currently known of *M. luridipennis* occurs mainly within a plot of communal land that is seriously degraded by stock overgrazing and refuse disposal (pers. obs.). Perhaps the best known case thus far is that of *M. stobbiai* in the Gauteng Province, where landscapes are being fragmented and transformed at a rapid rate. There, *M. stobbiai* occurs only in small fragments of grassland, mainly along the Magaliesberg range (Holm & Marais 1992; Deschodt et al. 2009). It has been established that approximately 30% of the 2171 km^2 of the species habitat has already been destroyed with consequent annihilation of four previously known local populations (Kryger & Scholtz 2008). To add to this, there is now the threat of climate change, with species globally undergoing poleward and higher-altitude migrations, in response to global warming (Hickling et al. 2006; Wilson et al. 2007). This is projected to escalate in the future, with global temperatures expected to increase by 2–11 °C over the next 50–100 years (Erasmus et al. 2002; Stainforth et al. 2005). Contrary to other species that have favourable climatic zones into which to expand their distribution range under shifting climatic conditions, members of the Ichnestomina are already living close to their thermo-physiological limits. This ap-

plies in particular to those that are restricted to the southernmost tip of the continent or the highest elevations. Thus, their survival may be compromised, if the current warming trend persists or escalates (Perissinotto et al. 2011).

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