



## Woody plant communities of southern South Africa and new distribution records for the rare dung beetle species *Sarophorus punctatus* Frolov & Scholtz, 2003 (Coleoptera: Scarabaeidae: Scarabaeinae)

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The southern and southeastern seaboard of South Africa is characterised by an indigenous floral mosaic of natural forest patches and Fynbos or Renosterveld shrublands, some of which are now highly threatened (Mucina & Rutherford 2006). These plant communities harbour a number of endemic dung beetle species many of which are derived along the basal branches of a global phylogeny of scarabaeine dung beetles (Tarasov & Dimitrov 2016). Many of these basal groups show restricted known distributions that may be under threat due to widespread clearance of woody vegetation for farming and urban expansion (Mucina & Rutherford 2006; Davis *et al.* 2020). The present communication describes new distribution records for one of these dung beetle species that illustrates the current, poor state of knowledge of endemic dung beetle distribution in this region of threatened vegetation communities.

*Sarophorus punctatus* Frolov & Scholtz, 2003 (Coleoptera: Scarabaeidae: Scarabaeinae) is a small tunnelling dung beetle and one of twelve species in the genus *Sarophorus* Erichson, 1847. It belongs to the *tuberculatus* group of species which is characterised by the following diagnostic traits: (1) elytral intervals with developed tubercles, especially on intervals 3, 5 and 7; (2) pygidium with a small longitudinal carina; (3) relatively narrow metepisterna and (4) internal sac of aedeagus without armature. For a detailed treatment of the genus, see Frolov & Scholtz (2003) and Frolov (2004).

Until now, *S. punctatus* was known from a single locality on the coastline of the Western Cape Province of South Africa, having been described from eight individuals collected in a disturbed patch of podocarp forest (34°00'S 23°27'E) in 1976 (Fig. 5). In January of 2021, during a field excursion to the Eastern Cape Province, South Africa, we collected 21 specimens of *S. punctatus* at three different new locations: Zuurberg Pass, Olifantskop Pass, and Signal Hill (Makhanda) (Fig. 5). These new records expand the known distributional range of this rare species considerably to the east by about 300 km beyond its previous single known locality in the Western Cape (Fig. 5). All new individuals were collected in patches of indigenous Southern Mistbelt forests (FOz 3; Mucina & Rutherford 2006) as opposed to the Southern Afrotropical forest (FOz 1) of the type locality.

The beetles were caught using pitfall traps baited with a composite of pig dung and fresh chicken livers that were left out in the field for 48 hours. Interestingly, no individuals of *Sarophorus* were attracted to any traps set in the same area/habitat that were baited only with pig dung. These observations provide further support that some *Sarophorus* species may be more attracted to carrion rather than fresh dung as was also previously reported by Frolov & Scholtz (2003), Frolov (2004) and Roets *et al.* (2017).

Below, we report details of the new locality data for *S. punctatus* in the Eastern Cape Province, including additional information on the distribution, habitat, and conservation status of this species. Lastly, we include a checklist of the species of *Sarophorus* recorded from the African continent.

The voucher specimens are deposited in the Ditsong National Museum of Natural History, Pretoria, South Africa (TMSA) and the National Museum, Bloemfontein, South Africa (BMSA). The new material was compared directly with the type material housed in the TMSA and the South African National Collection of Insects, Pretoria, South Africa

(SANC). Label data of type specimens are given verbatim between quotation marks (“”), a vertical bar (|) separates subsequent lines on a single label; subsequent labels are separated by a double vertical bar (||). Handwritten information is underlined; remarks and additional comments are in square brackets ([ ]). The label data of non-type specimens are presented in a standardised format.

### *Sarophorus punctatus* Frolov & Scholtz, 2003

(Figs 1–5)

**Type locality.** Keurboomstrand [Garden Route District Municipality, Western Cape Province, South Africa].

**Type material examined.** Holotype, male (TMSA, aedeagus extracted): “S.Afr., S. Cape [Western Cape Province] | Keurboomstrand | 34[°].00[']S-23[°].27[']E” || “8.12.1976,E-Y:1301| groundtraps [pitfall traps] 8days | leg.Endrödy-Younga” || “*SAROPHORUS* | *tuberculatus* | Cast. | det.Y.Camberfort” || “HOLOTYPUS | *Sarophorus* | *punctatus* | A. Frolov det. 2002” || “TM SOUTH Africa | TMSA08252”. Paratypes, 5 females (TMSA): same data as holotype.

Frolov & Scholtz (2003) originally described this species from two males and six females, all with the same data. We studied five female paratypes as well as the holotype male.

**Material examined representing new distribution records (21 specimens). SOUTH AFRICA. Eastern Cape Province.** 3♂, 1♀ Olifantskop Pass, 33°19'08"S 25°56'23"E, 25-27.i.2021, GM Daniel & WP Strümpher, site 1, forest (deep valley), pitfall trap baited with pig dung + chicken livers, (BMSA; BMSA(C) 121989, 121990, 121993, 121998). 6♂, 2♀ Zuurberg Pass, 33°22'46"S 25°42'37"E, 25-27.i.2021, GM Daniel & WP Strümpher, site 1, forest (deep valley), pitfall trap baited with pig dung + chicken livers (BMSA; BMSA(C) 117000–11705, BMSA(C) 122112). 4♂, 1♀ *idem* (TMSA, preserved in 99% ethanol). 2♂, 2♀ Makhanda [formerly Grahamstown], Signal Hill, 33°19'57"S 26°32'27"E, 26-28.i.2021, GM Daniel & WP Strümpher, site 2, indigenous forest (deep valley), pitfall trap baited with pig dung + chicken livers (TMSA).

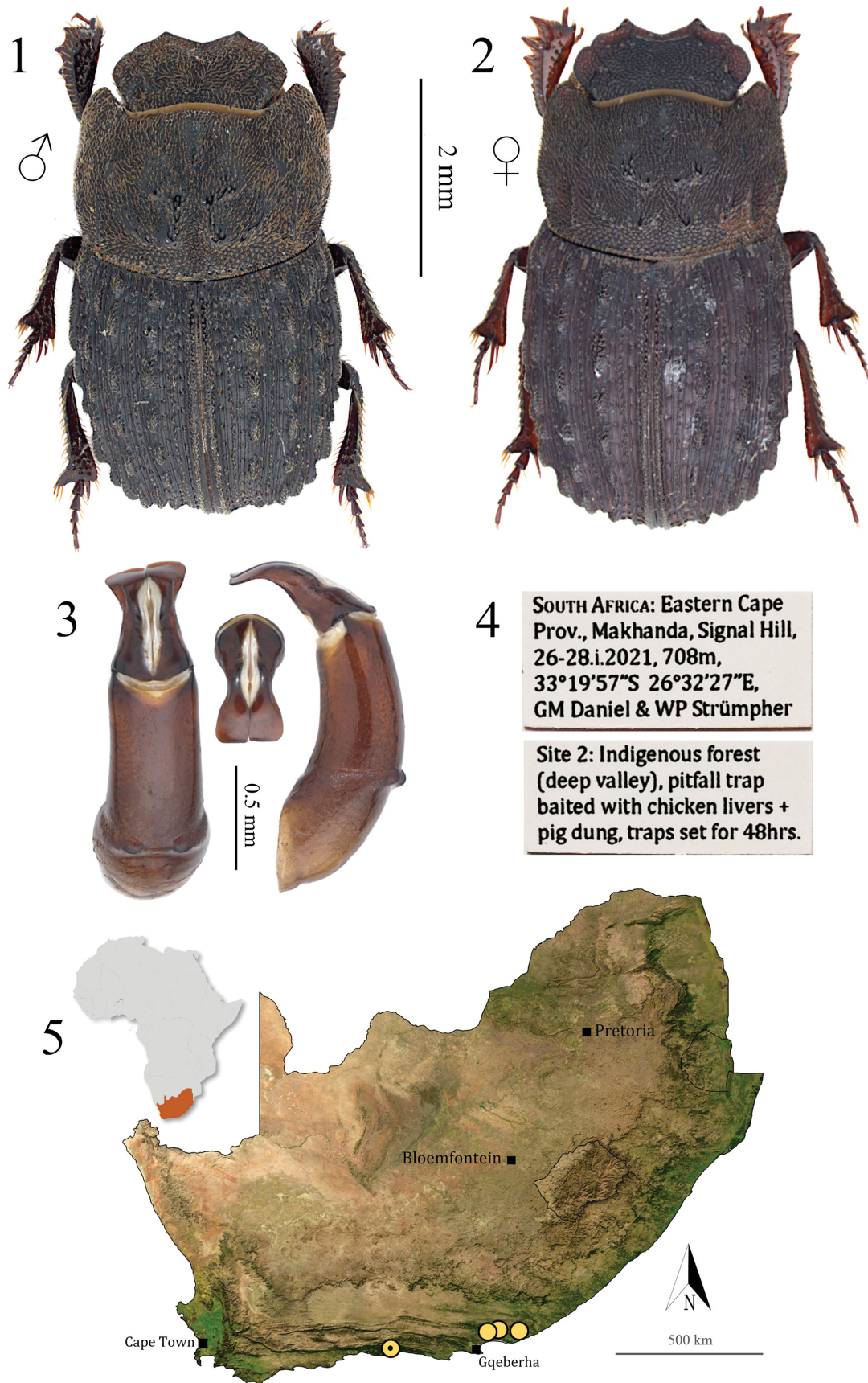
**Distribution and broad habitat associations.** The new distribution records show that *Sarophorus punctatus* is more widespread than previously thought with a disjunct range that now comprises Keurboomstrand (Western Cape Province - type locality), Olifantskop Pass, Zuurberg Pass, and Makhanda (Eastern Cape Province - new provincial distribution records) (Fig. 5). The considerable expansion of the species' known range, further inland to the east of the type locality, suggests that forest patches of the Western and Eastern Cape have been under sampled. Such under sampling of isolated forest fragments could explain the apparent rarity of *S. punctatus* and some other forest associated members of the genus (e.g., *S. frolovi* Roets, 2017). Additional sampling is needed in the two provinces to get a better understanding of its distribution, rarity and habitat preferences. These efforts may help to retrieve critical data on additional dung beetle species, which are known to be associated with woody vegetation, in the Forest, Fynbos and Renosterveld biomes.

**Biological notes.** As a generality, species of the genus *Sarophorus* seem to show a bias to vegetation offering shade (Davis *et al.* 2020). Over 12 months in Gauteng, quantitative data for the widespread *S. costatus* (Fåhraeus in Boheman, 1857) (*costatus* group) recorded 271 individuals in shaded thickets but only seven in grassland (Davis 1996). Several, other, poorly-known species of the *tuberculatus* group have only been recorded from type- or other localities within patches of dense, shaded, savanna woodland (*S. carinatus* Frolov & Scholtz, 2003), renosterveld (*S. diabolus* Roets, 2017) or forest (*S. frolovi* Roets, 2017) (Davis *et al.* 2020). As regards *S. punctatus*, it may be particularly cool-adapted as it was recorded in coastal areas or in deep forested valleys (new records) under cool, rainy conditions.

**Conservation status.** For many of the *Sarophorus* species in South Africa, basic information on their distributions, biology, ecology, and natural history is severely lacking. Therefore, from a conservation standpoint, it is important to document such baseline data through further field work. For instance, *S. punctatus* was recently assessed as endangered (EN) (Davis *et al.* 2020) based on its known occurrence at a single, disturbed forest patch and no further records over a period of 44 years. This assessment may remain valid as the Extent of Occurrence (EOO) is still less than 5000 km<sup>2</sup> at less than five localities. However, addition of further localities might demand a reassessment although this should be tempered by any increased threat to the woody vegetation of the Western and Eastern Cape.

### **Additional *Sarophorus* material used for comparison:**

*Sarophorus carinatus* Frolov & Scholtz, 2003. Holotype, female (TMSA): “Z.A.49 | Lydenburg D. [district] | Ohrigstad [24°45'S 30°34'E]” || “Humus | III-1962” || “N. LELEUP leg.” || “HOLOTYPUS | *Sarophorus* | *carinatus* | A. Frolov det 2002” || “TM SOUTH Africa | TMSA08181”.



**FIGURES 1–5.** *Sarophorus punctatus* Frolov & Scholtz, 2003 (TMSA). 1, male, dorsal view; 2, female, dorsal view; 3, aedeagus, dorsal and lateral views; 4, specimen labels; 5, distribution of *S. punctatus* (yellow circles; circle with black point indicates type locality - “Keurboomstrand”).

*Sarophorus frolovi* Roets, 2017. Holotype, male (SANC: SANC-TYPH-02478, aedeagus extracted): “SOUTH AFRICA: KwaZulu- Natal Province, Midlands, | Weza forestry plantations, | –30.61680 29.683626, | 02-2011, F. Roets & J. Pryke” || “100 ml pig dung and | chicken liver mix (8:1 ratio) | left in the field for 2 days” || “HOLOTYPE | *Sarophorus frolovi* | Roets 2017”.

*Sarophorus tuberculatus* (Laporte de Castelnau, 1840). SOUTH AFRICA: *Eastern Cape Province*: Algoa Bay, Brauns (2 specimens, TMSA); Addo Park, 16-20.xii.1996, R. Wolmarans (2 specimens, TMSA). *Western Cape Province*: Swartberge Hagas Farm, 33°24'S 22°46'E, 2.iii.1979, sandy valley, S. Endrödy-Younga (1 specimen, TMSA); Little Karoo, Raubenheimer Dam, 33°25'S 22°19'E, 21.x.1993, donkey dung, S. Endrödy-Younga (2 specimens, TMSA); 8 km W of Ysterfontein, 33°15'S 18°11'E, 28.viii.1983, groundtraps, 70 days, Endrödy-Younga and Penrith (1 specimen, TMSA); Ysterfontein, 14.ix. 1976, N.J. Duke (5 specimens, TMSA).

## Checklist of species of *Sarophorus*

### *Sarophorus tuberculatus* species group

*Sarophorus bidentatus* Frolov & Scholtz, 2003: 187

Type locality: Namaqualand, Kamieskroon [30°12'S 17°56'E, Northern Cape, South Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

*Sarophorus carinatus* Frolov & Scholtz, 2003: 187

Type locality: Lydenburg Distr., Ohrigstad [24°45'S 30°34'E, Mpumalanga, South Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

*Sarophorus diabolus* Roets, 2017: 266

Type locality: Riebeeck-Kasteel, Porseleinberg, –33.45995[°], 18.88627[°] (Western Cape, South Africa).

Distribution: South Africa (Roets *et al.* 2017; Davis *et al.* 2020).

*Sarophorus frolovi* Roets, 2017: 268

Type locality: Midlands, Weza forestry plantations, –30.61680[°] 29.683626[°] (KwaZulu-Natal, South Africa).

Distribution: South Africa (Roets *et al.* 2017; Davis *et al.* 2020).

*Sarophorus punctatus* Frolov & Scholtz, 2003: 186

Type locality: Keurboomstrand [34°00'S 23°27'E, Western Cape Province, South Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

*Sarophorus tuberculatus* (Laporte de Castelnau, 1840: 88)

Type locality: Afrique [Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

### *Sarophorus costatus* species group

*Sarophorus angolensis* Frolov, 2004: 95

Type locality: Tchivinguire Huíla [15°10'S 13°21'E], SE 1513Ab [Huíla, Angola].

Distribution: Angola, Namibia (Frolov 2004; Davis *et al.* 2020).

*Sarophorus cicatricosus* (Péringuey, 1901: 280)

Type locality: Mashunaland, Salisbury [Harare: Zimbabwe].

Distribution: Democratic Republic of the Congo, Zambia, Zimbabwe (Frolov & Scholtz 2003).

*Sarophorus costatus* (Fåhraeus in Boheman, 1857: 204)

Type locality: Terra Natalensi [KwaZulu-Natal, South Africa].

Distribution: Botswana, South Africa, Zimbabwe (Frolov & Scholtz 2003; Davis *et al.* 2020).

*Sarophorus latus* Frolov & Scholtz, 2003: 195

Type locality: Farm Rhenosterpoort [25°43'S 28°56'E, Gauteng, South Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

*Sarophorus nitidus* Frolov & Scholtz, 2003: 96.

Type locality: Tanganyika Terr., Longido, Masai Distr., [Arusha Region, Tanzania].

Distribution: Kenya, Tanzania (Frolov & Scholtz 2003; Frolov 2004).

*Sarophorus striatus* Frolov & Scholtz, 2003: 193

Type locality: 23 km S of Avontuur [Eastern Cape, South Africa].

Distribution: South Africa (Frolov & Scholtz 2003; Davis *et al.* 2020).

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