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Parapanteles rooibos, n. sp. (Hymenoptera: Braconidae: Microgastrinae): the first record of the genus from the African continent

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Abstract

Currently *Parapanteles* Ashmead (1900) has been recorded only from the Australian and American continents. However, in this publication we describe *Parapanteles rooibos* n. sp. from the African continent. We also provide information about its ecology and biology. The species may ultimately prove to be an important natural enemy of *Isturgia exerraria* (Prout) (Lepidoptera: Geometridae: Ennominae), an herbivore of the commercially produced shrub *Aspalatus linearis* (Fabaceae), from which rooibos tea is made. A hyperparasitoid, *Pediobius* sp. (Hymenoptera: Eulophidae), is recorded. A key to the four currently known *Parapanteles* species is included to facilitate species identification.

Keywords: Braconidae, Microgastrinae, *Parapanteles*, taxonomy, Afrotropical region, host records, biology

Introduction

The present composition of *Parapanteles* Ashmead (1900) includes two Neotropical species: *Parapanteles aletiae* (Riley) and *P. paradoxus* (Muesebeck). During the decades following Ashmead's generic description, these species were typically assigned to the genus *Apanteles* until Mason's (1981) revision of the subfamily Microgastrinae; he revived Ashmead's generic name.

Parapanteles paradoxus was originally recorded from Costa Rica, and *P. aletiae* was recorded from the southeastern United States (Mason 1981, p. 104). *Parapanteles masoni*

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(Austin & Dangerfield 1992) was later described and reported as the only known species from the Australian continent.

Currently, species in *Parapanteles* are known to parasitize larvae in Notodontidae, Noctuidae, and Arctiidae (Riley 1869, Mason 1981, Jacobson 1991) but the overall knowledge of host utilization is poor. An ongoing study of caterpillars and their parasitoids in Costa Rica by D. Janzen, W. Halllwachs and associates has produced many more records and species, but mostly from undescribed species of *Parapanteles* currently being revised by the first author.

The objectives of the present paper are to describe the first recorded *Parapanteles* species from Africa (South Africa), to increase the biological knowledge of the genus with a review of the ecology and biology of this disjunct species, and to make the name available for ongoing studies of herbivores on rooibos and their parasitoids by the third author and others.

Material and Methods

The morphological terminology used in the species description is that of Huber & Sharkey (1993), Schuh (1989) and Mason (1981), except for that of the propodeum which is used *sensu* Townes (1969, Fig. E). The terminology for surface sculpture follows Harris (1979), and wing venation terminology is a variation of the Comstock-Needham system used by Sharkey and Wharton (1997, Fig. 15). All other morphological terminology used in the species description is that of Austin & Dangerfield (1992).

Photographs for the holotype were taken using a Philips XL30 ESEM-FEG electron microscope at the Beckman Imaging Technology Group Microscopy Suite (University of Illinois at Urbana-Champaign). Wing illustrations were traced in Adobe Illustrator 10 after digital photographs were taken using a JVC GC-QX5HD digital still camera mounted on a Leica MZ12.5 stereomicroscope.

Female genitalia were mounted in Euparal (BioQuip Products) after overnight immersion in 10% KOH and exposure to 80% and 99% alcohol. The mounted female genital capsule was projected using a microprojector and its image was traced on paper and later inked to create the final illustration.

Key to the known females of *Parapanteles* Ashmead

1) African; propodeum with a very inconspicuous posterior areola, the posterolateral areas and center of areola nitid, anterior portion of propodeum with a fine confused rugulose sculpturing (Fig. 1F); body mainly black ..*P. rooibos* Valerio, Whitfield & Kole, n. sp.
- Australian or New World 2
2) Australian; propodeal areola open anteriorly and propodeum devoid of other sculpture

except for areolar transversal carina and posterior 1/2 of spiracular carina; ovipositor sheaths short and mainly concealed by hypopygium; head and alitrunk black ....*P. masoni* Austin & Dangerfield

- New World; areola completely formed by carinae and well defined, if not obviously defined then areolar region slightly sunken and covered by confused rugulose sculpturing 3

3) Legs yellow except coxae, hind leg trochanters and proximal area of femur as well as proximal end of tibia brownish yellow, metasoma totally deep brown; palpus, tegula and pterostigma whitish; wings hyaline with veins whitish .....*P. aletiae* (Riley)

- Legs (except proximal 1/2 of hind coxae and tarsal claws brownish yellow) light yellow as most of metasoma (except anterior tergites and distal end of metasoma); wings hyaline with veins brownish-yellow ..... *P. paradoxus* (Muesebeck)

Description

***Parapanteles rooibos* n. sp. Valerio, Whitfield & Kole**
(Figs. 1A–H, 2A & B)

Female. Body length = 2.05–2.40 mm.

Body color. Palpus yellowish (except basal segment) as distal 1/2 of fore femur, fore tibia and tarsomeres, distal tip of mid femur as well as basal 1/5 of mid tibia, hind tibia basal tip, distal half of mandibles and ovipositor; tarsal claws dark brown; compound eyes silver; ocelli dark orange; spurs of hind tibia and anterior pleura of metasoma whitish yellow; remainder body as black as ovipositor sheaths. Wings hyaline; forewing with veins translucent except pterostigma, 2RS, 2M, r and C+SC+R (basal 1/4 whitish yellow) brownish-yellow; hindwing veins translucent except basal area of C+SC+R, as well as distal tip of R1, brownish yellow.

Head. Head height/width = 1.28–1.30; compound eye height/width = 1.55–1.75; tentorial pit distance/distance from tentorial pit to compound eye = 1.83–1.86; clypeus width/height = 1.88–2; vertex width/distance between anterior ocelli and edge of torulus = 2.54–2.57; first flagellomere length/width = 2.00–2.24; length of first flagellomere/length second flagellomere = 1; length of first flagellomere/length of third flagellomere = 1; distal flagellomere length/subdistal flagellomere length = 1.33; distal flagellomere length/width = 1.50–1.60; malar space height/basal width of mandible = 1.25–1.43; ocell-ocular distance/lateral ocelli distance = 0.90.

Clypeus and face with shallow, fine and dense punctation, upper area of face with punctures more shallow and broad than other areas; frons and vertex with scrobal areas nitid, lateral and distal area with fine, shallow and dense punctate sculpture; genae (except ocular ring) and basal 2/3 of postgena with coarser and more confused punctate sculpture than vertex; rest of postgena nitid.

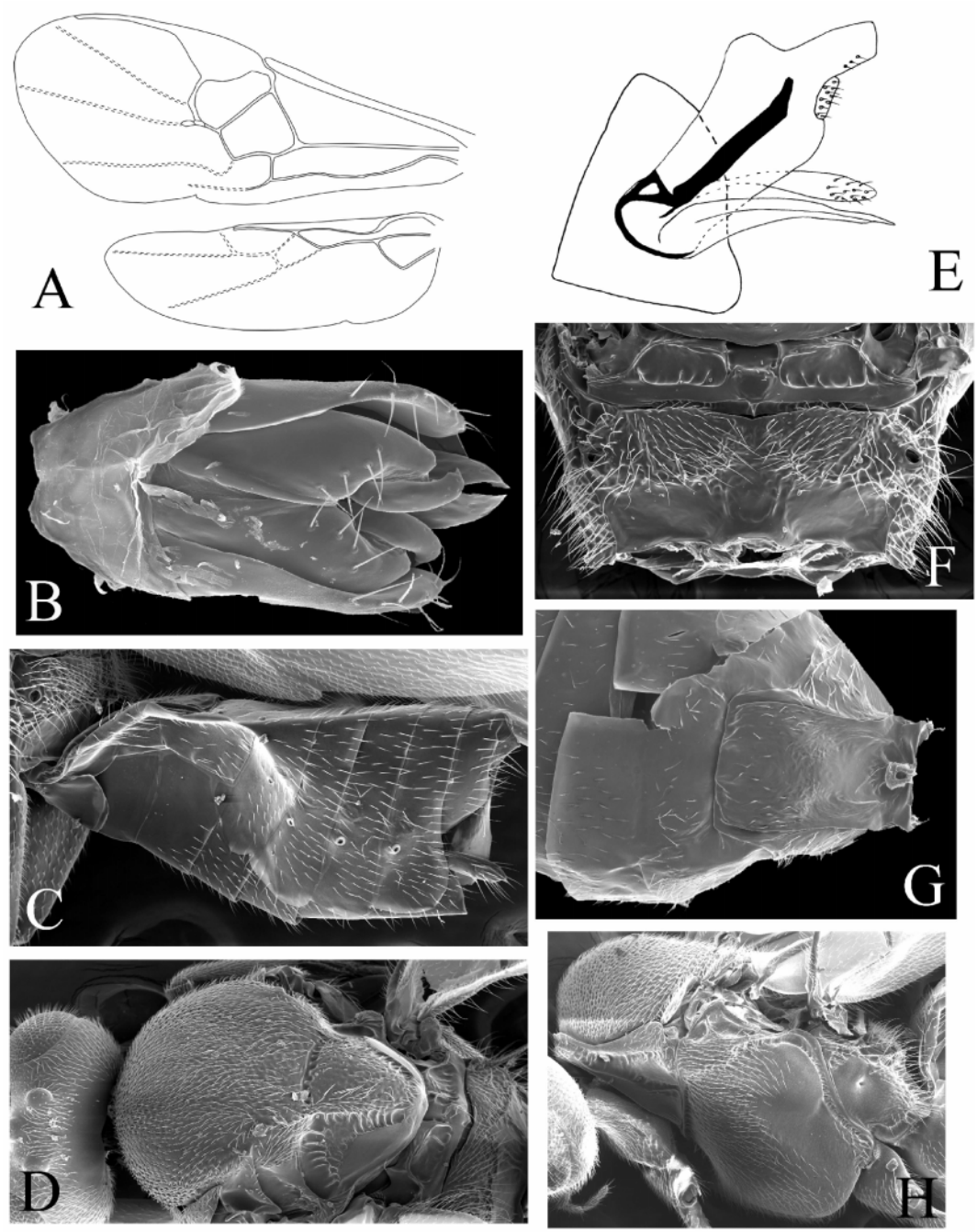

FIGURE 1. *Parapanteles rooibos* n.sp. wing venation (A), male genitalia (B), metasoma lateral view (C), mesosoma dorsal view (D), female genitalia (E), propodeum dorsal view (F), metasomal tergites dorsal view (G) and mesosoma lateral view (H).

Mesosoma. Mesosoma length/width = 1.28. Propleuron with scattered punctate sculpturing on anterior 1/4, central 1/2 with dense punctate sculpture, posterior 1/4 with few punctations but mainly nitid; pronotum anterolaterally with sparse well defined scro-

biculate sculpture, lateral upper groove with fine well defined scrobiculate sculpture, ventral lateral groove with more confused scrobiculate sculpture and narrower than upper groove, distal edge at midheight and dorsal edge with confused punctate sculpturing, area between grooves nitid; mesonotum (fig. 1D) with dense and well defined punctate sculpturing which almost reaches the scutellar groove, scutellar groove crossed by 13 to 16 small and poorly defined costulae of approximately same width except shorter at extreme lateral edges; scutellum with dense and well defined punctate sculpturing, lateral areas with well defined costulate sculpture becoming coarser towards posterior edge; anterior edge of lunules with short and poorly defined ridges some of which do not cross entirety of trough; mesopleuron (Fig. 1H) with anterior 1/2 and posterior edge punctate and most of posterior 1/2 nitid, dorsal area with less defined and bigger punctate sculpture mesally, sternaulus appearing as a nearly smooth longitudinal depression; metanotal axillae mainly nitid and with a few short and narrow ridges emerging from distal edge; metapleuron with conspicuous central pit, sculptured peripherally but mostly nitid; propodeum (fig. 1F) with posterolateral areas and most of areola nitid, areola weakly cristate and visible although poorly defined by carinae, anterior mediolongitudinal carinal area and transverse carinae weakly cristate and with confused rugulose sculpturing extending from them to anterior lateral areas, spiracular carina poorly defined, spiracular area mainly nitid except for some punctate sculpture.

Legs. Hind femur length/width = 3.07–3.30; hind tibia length/hind femur length = 1.16–1.26.

Fore telotarsus shorter than basitarsus in length, with thick elongate hook-like seta ventrally on posterior 1/2, with smooth and bare concave area underneath seta; hind telotarsus ventrally with a set of elongate and conspicuous setae; tarsal claws simple with long and thin seta just basal to tarsal hook.

Wings (Fig. 1A). Forewing length = 2.10–2.25 mm; 1CUa length/2Cub length = 0.81–0.92; 1M length/ m-cu length = 1.60–1.77; pterostigma length/height = 0.98–1.00. Hindwing: 1M length/2M length = 1.64–1.73; 1M length/M+CU length = 1.20–1.30; length r-m/length Cua = 0.66–0.75; 1RSa length/2r-m = 1.50–1.57.

Metasoma. First tergum length/distal width = 1.20–1.27; second tergum length/distal width = 0.3–0.36; third tergum length/distal width = 0.34–0.35. Hypopygium length = 0.31–0.40 mm.

First metasomal tergum with very faint confused punctate sculpturing throughout except anterior 1/2 almost nitid medially (Fig. 1G); second metasomal tergum with little sculpturing present, mainly as smooth as remaining terga; ovipositor approximately 0.6x as long as hind tibia length (Figs. 1C, 1 E).

Male. Similar to females in general size, coloration and features. Male genitalia shown in Fig. 1B.

Material examined. Holotype, female, “South Africa, Cederberg region, October 2003, Col. M. Kole.” Paratypes: six females and one male with same data as holotype.

Holotype deposited in South African National Collection of Insects, ARC-Plant Protection Research Institute, Pretoria; paratypes in South African National Collection and in U. S. National Museum (NMNH).

Comments. There is substantial color variation within our limited sample. Palpi and legs can be almost entirely black in coloration. Sometimes the mid tarsomeres are brownish yellow; antennae are usually mostly black but in some cases the distal flagellomeres are brownish yellow.

Etymology. The species name rather obviously refers to the common name of the host plant.

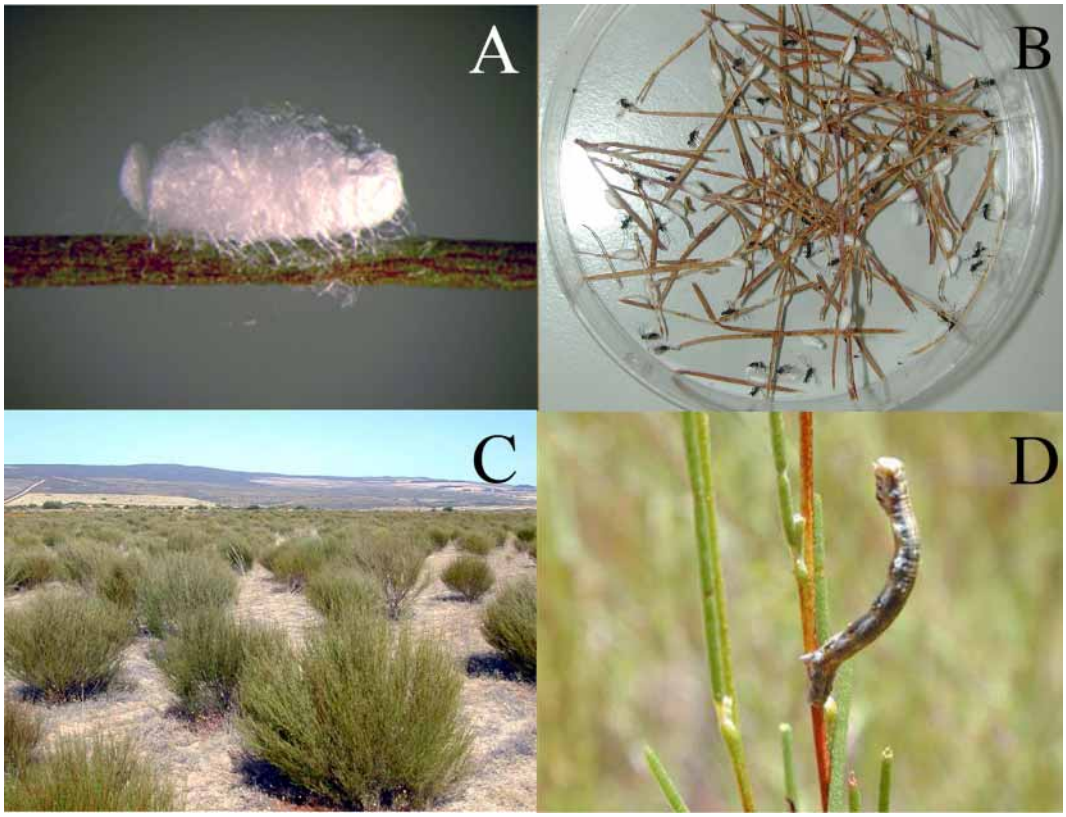

FIGURE 2. *Parapanteles rooibos* n.sp. cocoon close up (A) and among needles of host plant (B), rooibos plantation (C) and host *Isturgia exerraria* (Prout) caterpillar on rooibos plant (D). Photo A by Alejandro Valerio; B from field collection by Dr. Justin Hatting (ARC-SGI, South Africa); C & D copyright ENTOCARE and used with permission.

Rearing records and biology. *Parapanteles rooibos* was reared from *Isturgia exerraria* (Prout) (Geometridae: Ennominae) feeding on the legume *Aspalathus linearis* (commonly known as the rooibos tea plant) in South Africa. The life cycle in rearing conditions

(25 °C, L:D= 14h:10h) was 16 days. An alternative host, *Spodoptera exigua* (Prout), was not accepted. The parasitoid seems to have a strong preference for L2 larvae of the host. After 10 days (25 °C) a small, white cocoon is formed. In the field, cocoons can be found individually glued to the needle-like leaves of the plant (Figs. 2A, B) with mostly more than one cocoon per plant. The cocoons were normally observed on the perimeter of the upper parts of the host plant. Average day temperature in the observation field rises from 23°C in October to 35°C in February. Average night temperature is about 15–20°C lower than daylight temperatures. Adult parasitoid emergence in the observed field was 86% in October but rapidly decreased later in the season due to hyperparasitism by *Pediobius* sp. near *bruchicida* (Rondani) (Hymenoptera: Eulophidae). Hyperparasitism in November reduced the emergence levels of *P. rooibos* to 25 % and 5–10 % in December-January. The first *P. rooibos* cocoons can be found in the field as soon as the *I. exerraria* begins development early in the season (beginning of October). Further investigation on parasitoid behavior in the field started in October 2004.

Discussion

With the description of *P. rooibos*, *Parapanteles* shows a more extensively Gondwanan distribution: America (especially South and Central), Africa and the Australasian region. However, the faunal composition for the genus still appears to be far from completely known (Mason 1981; Shaw 1995). We have seen a number of additional species from Central America that will be included in a revision being prepared by the first author.

Species of *Parapanteles* were previously recorded as only attacking larvae in Noctuidae and Notodontidae (Riley 1869; Mason 1981), but the current recording from larvae in Geometridae demonstrate a wider breadth of host range. Notodontids and noctuids are macrolepidopterans feeding externally on plant tissue and the larvae are typically characterized by dense protective setae. The newly recorded geometrid larva on rooibos plants is devoid of conspicuous setae, but the wasp ovipositor and tarsal claws (often differently modified in parasitoids of hairy and smooth hosts) are essentially the same observed in other *Parapanteles* species.

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