

Megalyridia capensis (Hymenoptera: Megalyridae: Megalyridiini), a relict species endemic to South Africa

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(with 4 figures)

Received 11 June 2009. Accepted 25 August 2009

Numerous further specimens of the monotypical megalysid species *Megalyridia capensis* Hedqvist have recently been collected from diverse habitats encompassing a distributional range of more than 800 km in South Africa. The male of *M. capensis* is recorded for the first time. We provide high-quality images of both sexes and a key to genera of Megalyridae occurring in the Afrotropical region. Online keys are available at: <http://www.waspweb.org/Megalyroidea/Megalyridae/Keys/index.htm>. The biogeography of this relict species is discussed.

Key words: biogeography, distribution, description, identification key, *Megalyridia*, relict species, systematics.

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INTRODUCTION

The Afrotropical megalysid fauna is represented by two indigenous genera, *Megalyridia* Hedqvist and *Dinapsis* Waterston, and the genus *Megalyra* Westwood, represented by *Megalyra fasciipennis* Westwood, which was introduced from Australia, probably in infected eucalyptus lumber (Waterston 1922; Hedqvist 1959; Gess 1964; Shaw & van Noort 2009). *Dinapsis* includes seven described species, five of which are only known from Madagascar. *Dinapsis turneri* Waterston was described from South Africa (Waterston 1922) and more recently *D. centralis* from the Central African Republic (Shaw & van Noort 2009). The monotypical endemic South African genus *Megalyridia* was described from a single specimen collected on the Cape Peninsula Mountain chain at Skoorsteenkop above Hout Bay by the Swedish expedition to South Africa in 1951 (Hedqvist 1959). Megalyrids are rare with very few specimens represented in collections (Shaw 1990a). The majority of *Dinapsis* species, including the African mainland species, *D. turneri* and *D. centralis*, are known only from single specimens.

Biology of the indigenous African genera has yet to be elucidated. Based on known life histories of other megalysids, these two genera are likely to be idiobiont endoparasitoids of concealed insect larvae, possibly of wood-boring beetle larvae. *Megalyra fasciipennis* is a parasitoid of beetle larvae in the genus *Phoracantha* (Cerambycidae) (Froggatt 1906; Gess

1964; Shaw 1990b, Austin *et al.* 1994), which are wood borers of *Eucalyptus* species. However, another Australian species, *Megalyra troglodytes* Naumann, parasitizes mud-nesting Sphecidae (Naumann, 1983, 1987), and the relatively shorter ovipositor possessed by genera such as *Megalyridia* and *Dinapsis* suggests that they are not attacking deeply concealed hosts, but rather are targeting host insects feeding very near the surface (Shaw & van Noort 2009).

Since 1993, insect inventory surveys using a diversity of collecting methods in the Cape Floral Kingdom have produced 55 specimens of *Megalyridia capensis* associated with both the Fynbos and Albany Thicket biomes. A further nine specimens collected in 1999 are present in the Canadian National Collection and California Academy of Sciences collection. Specimens have mostly been recovered from Malaise trap samples, but have also been collected in yellow pan traps and by sweeping. We provide images of both sexes and discuss intra-specific variation and biogeography of this relict species. A key is included to genera occurring in the Afrotropical region.

MATERIALS AND METHODS

Images were acquired using the EntoVision multiple-focus imaging system. This system comprises a Leica M16 microscope with a JVC KY-75U 3-CCD digital video camera attached

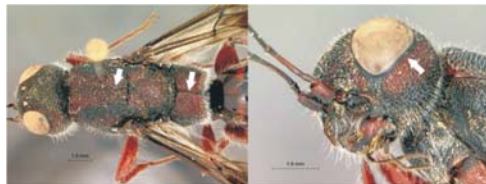
that fed image data to a notebook computer. The program Cartograph 5.6.0 was then used to merge an image series (representing typically 10 focal planes) into a single in-focus image. Lighting was achieved using techniques summarized in Buffington *et al.* (2005), Kerr *et al.* (2009) and Buffington & Gates (2009). The images included in this paper are available through <http://www.morphbank.net> and WaspWeb: www.waspweb.org/Megalyroidea/Megalyridae/index.htm

Codens of institutes holding specimens follow Arnett *et al.* (1993): CASC, California Academy of Sciences, San Francisco, U.S.A.; CNCI: Canadian National Collection of Insects, Ottawa, Canada; HIC, Hymenoptera Institute Collection, Department of Entomology, University of Kentucky, Lexington, U.S.A.; MZLU, Insect collection, Museum of Zoology, Lund University, Sweden; SAMC, Iziko South African Museum, Cape Town, South Africa; WARI, Waite Agricultural Research Institute, University of Adelaide, Australia.

Key to the Afrotropical genera of Megalyridae

(online keys available at:

<http://www.waspweb.org/Megalyroidea/Megalyridae/Keys/index.htm>)



- 1. Propodeum with a longitudinal median sulcus; mesonotum with a weak median sulcus. Eyes not surrounded by an orbital carina. Forewing with two cubital cells, second cell much longer than first cell *Megalyra fasciipennis* (introduced species)



- Propodeum without a median sulcus; mesonotum with a strong longitudinal median sulcus. Eyes surrounded by an orbital carina. Forewing with one or two cubital cells, if two then second cell no longer than first cell 2



- 2. Forewing with one cubital cell; first and second cross-veins absent; radial vein reduced, radial cell open; recurrent vein present . . . *Megalyridia capensis* (South African endemic).



- Forewing with two cubital cells and one closed radial cell; recurrent vein absent *Dinapsis* (Seven species: one from South Africa, one from the Central African Republic and five described and about 20 undescribed species from Madagascar).

Megalyridia Hedqvist

Megalyridia Hedqvist, 1959, pp. 487–488. Type species: *Megalyridia capensis*, Hedqvist 1959, by original designation.

Diagnosis

Forewing with one cubital cell; first and second cross-veins absent; radial vein reduced, radial cell open; recurrent vein present. The transverse frontal callosity situated just above the antenna is a synapomorphy of the genus.

Affinities

This genus is the most basal genus of the Old World Megalyroidea (Shaw 1990a). The Neotropical genus *Rigel* is the most basal of all extant genera and together with *Megalyridia* represent relicts of archaic megalayrid faunas.

Megalyridia capensis Hedqvist

Figs 1–3

Megalyridia capensis Hedqvist, 1959, pp. 489–490. Holotype ♀ (MZLU) SOUTH AFRICA, Cape Prov. Cape Peninsula, Hout Bay, Skoorsteenkop, 14.II.51, loc. No. 183, Swedish South Africa Expedition, 1950–1951, Brinck-Rudebeck.

Additional material examined

SOUTH AFRICA, *Western Cape Province*. 1♂, Cape Town, Constantiaberg, above Donkerboskloof, 460 m, 34°02.17'S 18°23.53'E, 28 Sept–5 Oct 1993, S. van Noort, Malaise trap, Mesic Mountain Fynbos, *Protea* dominated, SAM-HYM-P001226 (SAMC); 1♂, *ibid*, except 12–17 Sept 1993, SAM-HYM-P001227 (SAMC); 1♂, *ibid*, except 2–9 Feb 1994, SAM-HYM-P002700 (SAMC); 1♂, *ibid*, except 9–15 Feb 1994, SAM-HYM-P002737 (SAMC); 1♂, *ibid*, except 25 Jan–2 Feb 1994, SAM-HYM-P002815 (SAMC); 2♂, *ibid*, except 15–23 Feb 1994, SAM-HYM-P003012 (SAMC); 1♀, 1♂,

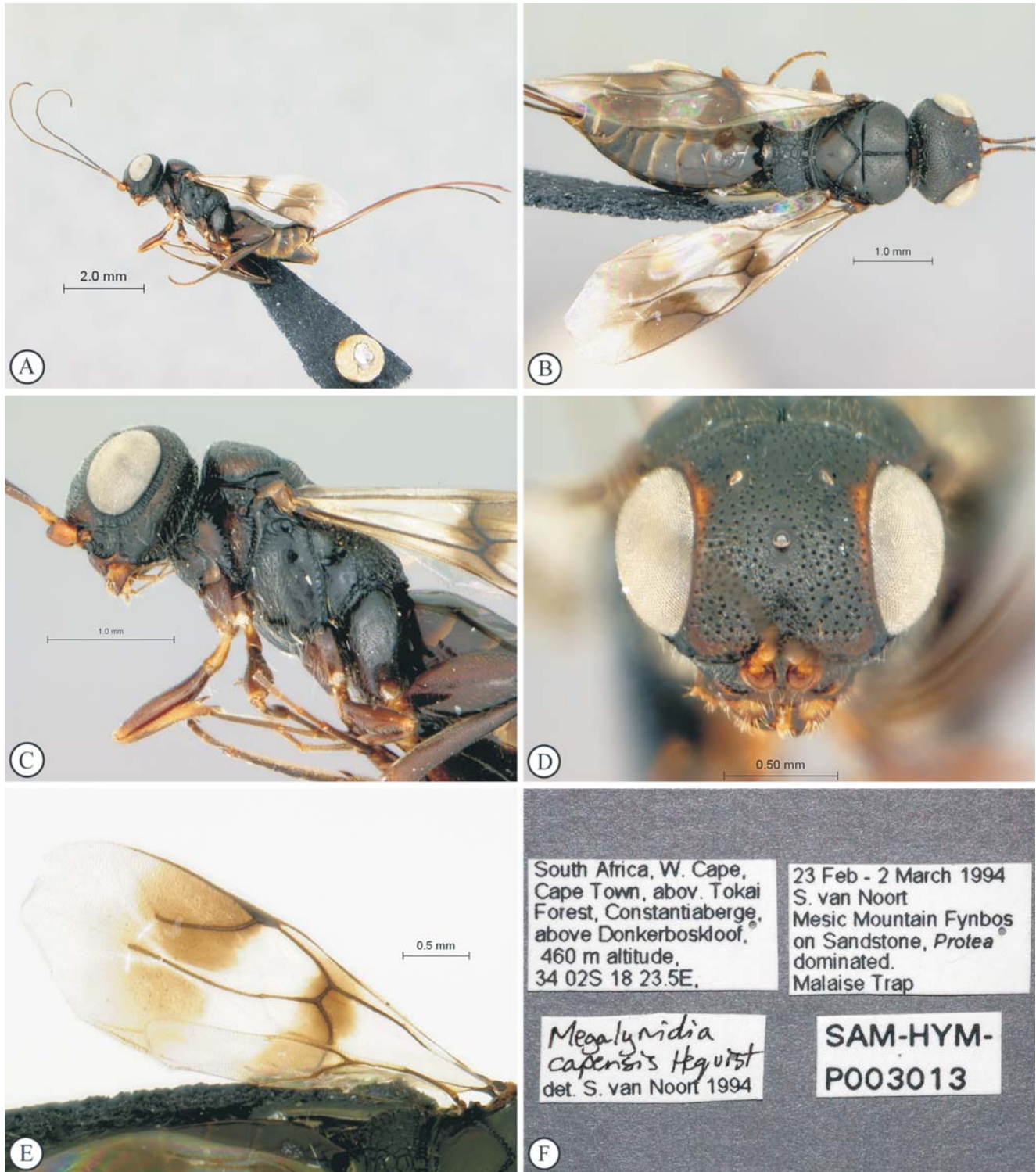


Fig. 1. *Megalyridia capensis* female dark form (type locality). **A**, Habitus, lateral view; **B**, body, dorsal view; **C**, head, mesosoma, lateral view; **D**, head, anterior view; **E**, forewing; **F**, data labels. Scale bars in millimetres.

ibid, except 23 Feb–2 Mar 1994, SAM-HYM-P003013 (SAMC); 1♂, *ibid*, except 2–14 Mar 1994, SAM-HYM-P005139 (SAMC); 2♂, *ibid*, except 14–23 Mar 1994, SAM-HYM-P005141 (WARI; SAMC); 1♂, *ibid*, except 13 June–7 July 1995, SAM-HYM-P008239 (SAMC); 1♂, *ibid*, except 5–13 Oct 1993, SAM-HYM-P030848 (SAMC); 1♂, *ibid*, except 10 Oct 1995, SAM-HYM-P030849 (SAMC); 1♂, *ibid*,

except 17–27 March 1995, SAM-HYM-P030887 (SAMC); 1♂, *ibid*, except 16 Oct–16 Nov 1995, SAM-HYM-P030888 (SAMC); 1♂, Constantiaberg, Donkerboskloof, 34°02.28'S 18°23.75'E, 370 m, 10 March 1995, S. van Noort, Sweep, Kloof forest, SAM-HYM-P030847 (SAMC); 1♂, Constantiaberg, above road to mast overlooking Hout Bay, 640 m, 34°02.50'S 18°23.50'E, 14–23 Mar 1994, Malaise trap, Mesic

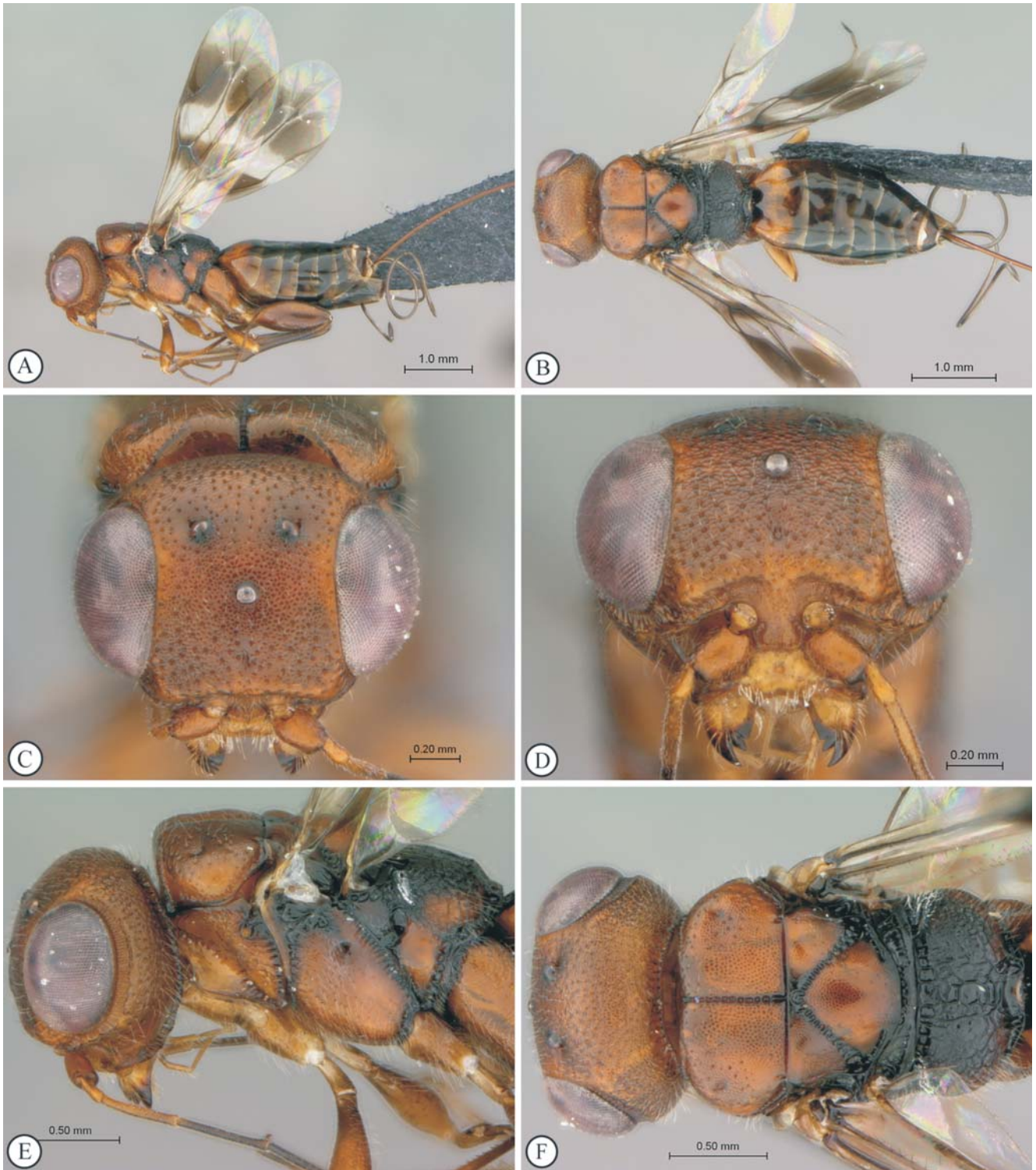


Fig. 2. *Megalyridia capensis* female light form (from Avontuur farm at extreme north of distribution). **A**, Habitus, lateral view; **B**, body, dorsal view; **C**, head, anterior view; **D**, head, anterior ventral view; **E**, head, mesosoma, lateral view; **F**, head, mesosoma, dorsal view. Scale bars in millimetres.

Mountain Fynbos, SAM-HYM-P005140 (SAMC); Tokai Forest, Constantiaberg, Pine plantation, 200 m, 34°02'S 18°23.5'E, 6–23 December 1994, S. van Noort, Malaise trap, SAM-HYM-P005142 (SAMC); 1♂, Koeberg Nature Reserve, 33°37.622'S 18°24.259'E, 13 June–11 July 1997, S. van Noort, Malaise trap, KO97-M03, West Coast Strandveld,

SAM-HYM-P030857 (SAMC); 1♀, 1♂, *ibid*, except 5 Sept–3 Oct 1997, KO97-M10, SAM-HYM-P030868 (SAMC); 4♂, *ibid*, except 8 Aug–5 Sep 1997, KO97-M08, SAM-HYM-P030873 (SAMC); 1♂, *ibid*, except KO97-M09, SAM-HYM-P030870 (SAMC); 1♂, *ibid*, except 3–31 Oct 1997, KO97-M11, SAM-HYM-P030871 (SAMC); 1♂, *ibid*, except 23

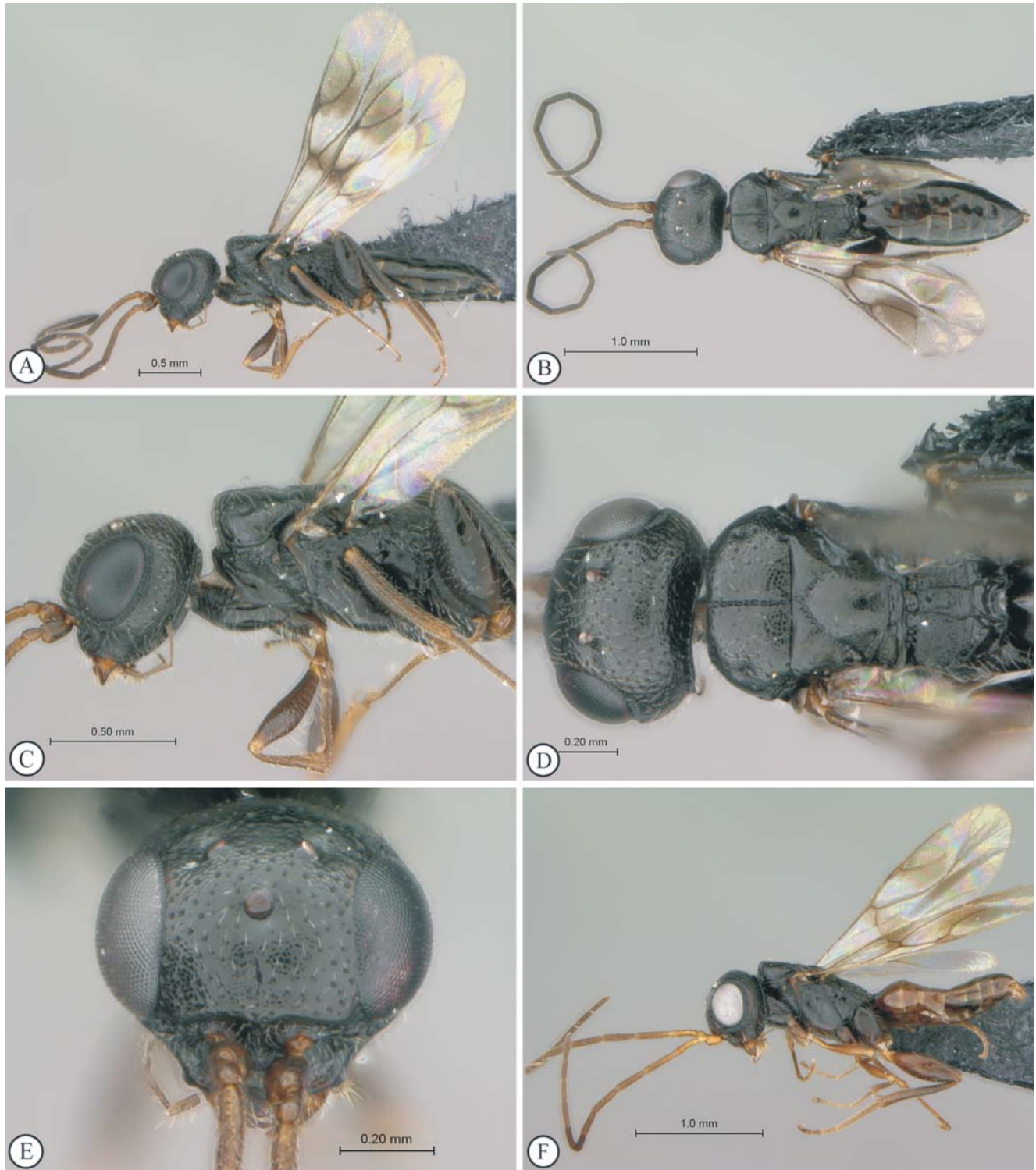


Fig. 3. *Megalyridia capensis* male. **A**, Habitus, lateral view; **B**, habitus, dorsal view; **C**, head, mesosoma, lateral view; **D**, head, mesosoma, dorsal view; **E**, head, anterior view; **F**, habitus, lateral view (type locality male). Scale bars in millimetres.

Jan–20 Feb 1998, KO97-M22, SAM-HYM-P030872 (SAMC); 1♀, 2♂, *ibid*, except 17 April–15 May 1998, KO97-M33, SAM-HYM-P030869 (SAMC); 1♂, Langberg Farm, (3 km 280° W Langebaanweg), 32°58.045'S 18°07.418'E, 9–16 Oct 2002, S van Noort, Malaise trap, LW02-N1-M86, Sand Plain Fynbos, SAM-HYM-P030859 (SAMC); 2♂, West Coast Fossil Park, (5.5 km 290° W Langebaanweg), 32°57.402'S

18°05.438'E, 4–11 Sept 2002, S van Noort, Malaise trap, LW02-R5-M12, Rehabilitated mine dump, SAM-HYM-P030860 (SAMC; HCI); 1♂, *ibid*, except (3 km 280° W Langebaanweg), 32°58.098'S 18°07.244'E, LW02-R2-M03, SAM-HYM-P030866 (SAMC); 1♂, *ibid*, except (5 km 290° W Langebaanweg), 32°57.732'S 18°05.985'E, 11–18 Sept 2002, LW02-R6-M32, SAM-HYM-P030861 (SAMC); 1♀, 1♂, *ibid*,

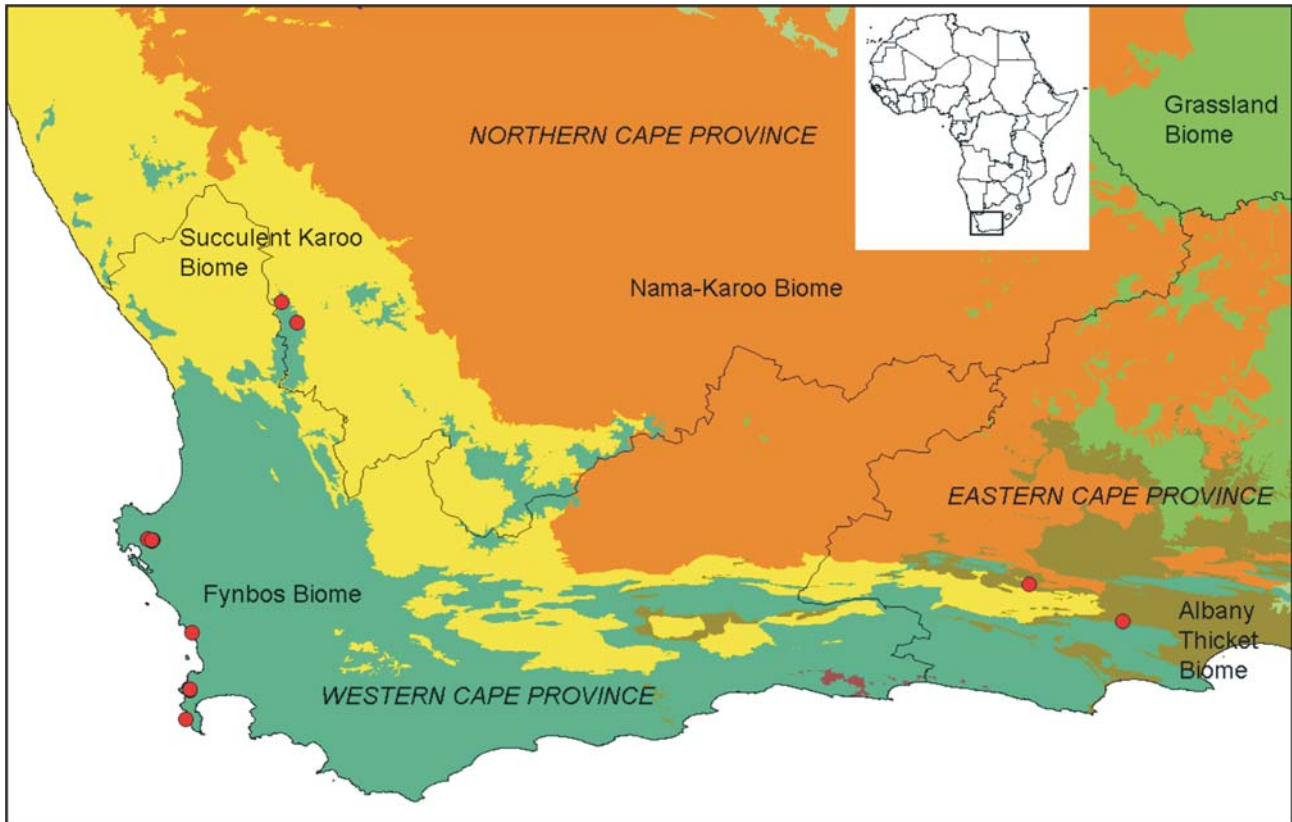


Fig. 4. Distribution and habitat association

except (3 km 270°W Langebaanweg) 32°58.445'S 18°07.236'E, LW02-N3-M22, Sand Plain Fynbos, SAM-HYM-P030862 (HIC, SAMC); 1♀, *ibid.*, except 32°57.732'S 18°05.985'E, 9–16 Oct 2002, LW02-R6-M100, Rehabilitated mine dump, SAM-HYM-P030863 (SAMC); 1♂, Anyskop Farm, (4 km 270° W Langebaanweg), 32°58.611'S 18°06.976'E, 2–9 Oct 2002, S van Noort, Malaise trap LW02-N4-M74, Fynbos on Limestone, SAM-HYM-P030864 (SAMC); 2♀, West Coast Fossil Park, (5.5 km 270° W Langebaanweg), 32°58.117'S 18°05.789'E, 23–30 Oct 2002, S van Noort, Malaise trap LW02-U1-M129, *Acacia cyclops* on slimes dam, SAM-HYM-P030865 (SAMC); 1♂, *ibid.*, except (4 km 290° E Langebaanweg), 32°57.512'S 18°06.728'E, 2–9 July 2003, LW02-R7-M208, Rehabilitated mine dump, SAM-HYM-P030867 (SAMC); 1♀, 6♂, Scarborough, Cape Pen., 5 m, 34°15'S 18°21.5'E, open coastal fynbos, 14–31.XII.1999, S. & J. Peck, 99–143, Malaise (CNCI); 1♂, *ibid.*, except 99–144, FIT (CNCI).

Northern Cape Province. 1♂, Hantam National Botanical Garden, 787m, 31°24.845'S 19°09.443'E, 22 Oct–18 Nov 2008, S. van Noort, Malaise trap, Nieuwoudtville Dolerite Koppie Renosterveld, GL07-KOP1-M55, SAM-HYM-P030853 (SAMC); 2♂, *ibid.*, except 21 April–22 May 2008, GL07-KOP1-M34, SAM-HYM-P030858 (SAMC); 1♂, *ibid.*, except 2–23 March 2009, GL07-KOP1-M89, SAM-HYM-P030889 (SAMC); 1♂, *ibid.*, except 755 m, 31°24.274'S 19°09.164'E, 18 Nov–25 Dec 2008, Nieuwoudtville-Roggeveld Dolerite Renosterveld, GL07-DOL1-M60, SAM-HYM-P030854 (SAMC); 2♂, *ibid.*, except 22 Oct–18 Nov 2008, GL07-DOL1-M53, SAM-HYM-P030856 (SAMC); 1♂, *ibid.*, except, 758m, 31°24.293'S 19°09.215'E, GL07-

DOL2-M61, SAM-HYM-P030855 (SAMC); 1♀, Avontuur Farm, 16 km NW Nieuwoudtville, 764 m, 31°16.249'S 19°02.900'E, 25 Dec 2008–27 Jan 2009, S. van Noort, Malaise trap, Bokkeveld Sandstone Fynbos, GL07-FYN1-M73, SAM-HYM-P030890 (SAMC).

Eastern Cape Province. 1♂, 5 km N. Steytlerville, 33°16.84'S, 24°22.78'E, 16–23.XI.1999, MT, 500 m, M.E. Irwin *et al.* SA-2005 (CASC); 1♂, Februarie Farm (39.9 km 268° W Kirkwood), 33°32.813'S 25°03.091'E, 8–10 Feb 2001, S van Noort, Malaise trap, VB01-R2N-M10, Valley Bushveld (non-trashed), SAM-HYM-P030850 (SAMC); 1♂, *ibid.*, except, 14–16 Feb 2001, VB01-R2N-M56, SAM-HYM-P030851 (SAMC).

Habitus (Figs 1–3)

The males are similar to the female, except for their much smaller size. Male body length varies from 1.6 mm to 4.0 mm. The male antenna has flagellomeres that are shorter and more compact than in the female. The median frontal groove ('weak longitudinal furrow') described by Hedqvist (1959) is more of a depression than a longitudinal groove and is very difficult to discern in the males where it is represented by a very faint impression. Colour is extremely variable with females in particular encompassing a range from dark brown, the colour form present at the type locality (Fig. 1), to a light rufous orange ground colour, but with dark metanotum, propodeum and posterior three-quarters of the metasoma (Fig. 2). The palest specimen (Fig. 2) was collected at the extreme north of the known distribution near Nieuwoudtville, but an intermediately coloured specimen was collected at Koeberg only 50 km north of the type locality from where the specimens are dark brown.

Diagnosis

See under genus.

Affinities

See under genus.

Distribution, habitat association and conservation status

Endemic to South Africa, occurring in the Western, Eastern and Northern Cape provinces and associated with the Fynbos and Albany Thicket biomes (Fig. 4) as defined in Rutherford *et al.* (2006). *Megalyridia capensis* occurs in a number of protected areas across the north–south range of its distribution: Table Mountain National Park, Koeberg Nature Reserve and Hantam National Botanical Garden. These protected areas are administered by various authorities: South African National Parks Board, Eskom and the South African National Biodiversity Institute, respectively. The species will also in all likelihood be recorded from provincial nature reserves, administered by Cape Nature, and hence is unlikely to be under threat from habitat degradation or destruction. It does, however, remain to be seen what effect climate change will have on the continued existence of this relict species.

DISCUSSION

The family Megalyridae has a pantropical, disjunct distribution pattern (Shaw 1988, 1990a). *Megalyridia* is probably a relict of an archaic fauna that likely included the extinct genera (*Prodinapsis* Brues and *Cretodinapsis* Rasnitsyn) of Prodinapsini that were distributed in Laurasia. A relationship between *Megalyridia* and the prodinapsine genera was previously proposed (Hedqvist 1959), with the conjecture that insects from Baltic amber may have living relatives in the southern hemisphere (Shaw 1990a). This hypothesis was borne out with the discovery of an extinct species of the Australian genus *Megalyra* Westwood in Baltic amber from the Kaliningrad Region of Russia (Poinar & Shaw 2007) and is also supported by other groups such as the hymenopteran genus *Ambositra* (Diapriidae) that has a contemporary distribution encompassing South Africa and Madagascar but is also known from Baltic amber. The recently discovered insect order Mantophasmatodea shows a similar pattern with representatives known from Baltic amber and a contemporary distribution in the east and southern African regions with the centre of species richness in South Africa (Picker *et al.* 2002; Damgaard *et al.* 2008).

Megalyridia capensis is associated with the Fynbos and Albany Thicket biomes and will probably also be found in association with the Succulent Karoo biome. The Fynbos and Succulent Karoo biomes form the major component of the Greater Cape Floristic region as defined by Born *et al.* (2007) and have been recognized as globally important biodiversity hotspots (Myers *et al.* 2000; Latimer 2005). The Cape region is a centre of species richness and endemism for plants (Cowling *et al.* 1998; Born *et al.* 2007), some vertebrate groups such as dwarf chameleons (Tolley *et al.* 2006), as well as numerous invertebrate taxa, including the Mantophasmatodea (Picker *et al.* 2002; Damgaard *et al.* 2008), hopliine monkey beetles (Scarabaeidae) (Péringuey 1902; Colville *et al.* 2002), cephaline plant hoppers (Cicadellidae) (Davies 1988a, 1988b), scorpions (Prendini

2005), pneumorid grasshoppers (van Staaden & Römer 1998), and various taxa of Hymenoptera. The latter include the southern African masarine pollen wasps (Gess 1992; Gess & Gess 2004), the figitid subfamily Pycnostigminae (Buffington and van Noort 2007), the braconid subfamily Khoikhoiinae (Sharkey *et al.* 2009), the cynipid genus *Rhoophilus* (van Noort *et al.* 2007), and the plesiomorphic platygastriid genus *Nixonia* (van Noort & Johnson 2009). Many of these taxa are likely to have diversified with the evolution and radiation of the Cape Floristic Region around 3–5 million years ago (Goldblatt 1997; Linder *et al.* 1992; Linder 2003). The southwestern region of South Africa is also a hotspot for relictual Gondwanan invertebrates (Picker & Samways 1996; Sharratt *et al.* 2000) and *Megalyridia* may fall into this category.

Why then did the megalyrids not diversify in the Cape Floristic region in a similar fashion to the Mantophasmatodea, another ancient group that was present in the middle Jurassic 165 Ma ago (Huang *et al.* 2008), but which, in contrast to the megalyrids, has a high extant species richness with at least 13 species known from South Africa (Damgaard *et al.* 2008). Megalyrids appear to be capable of adapting to modern habitat types and climate change as shown by the species-rich Australian fauna, which is probably a result of adaptation to the dry conditions of *Eucalyptus* woodlands and *Acacia* scrub habitats (Froggatt 1906; Fahringer 1928; Shaw 1990b). The Afrotropical genus *Dinapsis* has adapted to the Madagascan contemporary environment, having possibly radiated relatively recently with at least 20 undescribed species, in addition to the five described species known from the island (Shaw & van Noort 2009). It is, however, also possible that all these species are ancient relictual lineages. Nevertheless, *Megalyridia* is a monotypical genus and it appears that either this lineage does not have the genetic capacity to respond to the environmental niches and new selection pressures created by the relatively recent evolution of the Cape flora, or its host (whatever that may be) has remained at an evolutionary dead end. Whichever hypothesis may hold it has clearly constrained the evolution of the *Megalyridia* lineage, leaving behind a relict species that fortunately is under little threat as a result of its fairly wide distribution, including its presence in protected areas.

ACKNOWLEDGEMENTS

We thank Lars Vilhelmsen (University of Copenhagen) for valuable comments on the manuscript and Roy Danielsson (Curator of the Insect Collection, Museum of Zoology, Lund University) for providing information concerning the type. This work was supported by South African National Research Foundation grants GUN 61497, GUN 2068865 and GUN 2069377 awarded to S.v.N. and by a 2009 U.W. Faculty Grant-in-Aid awarded to S.R.S.

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