JHR 96: 667–696 (2023)
doi: 10.3897/jhr.96.104038
https://jhr.pensoft.net

RESEARCH ARTICLE

JOURNAL OF Hymenoptera RESEARCH
A peer-reviewed open-access journal
The International Society of Hymenopterists

Two new species of the genus *Cryptopimpla* Taschenberg (Hymenoptera, Ichneumonidae, Banchinae) with an updated key to African species

Terry Reynolds[1], Simon van Noort[1,2]

1 *Research and Exhibitions Department, South African Museum, Iziko Museums of South Africa, P.O. Box 61, Cape Town, 8000, South Africa* **2** *Department of Biological Sciences, University of Cape Town, Private Bag, Rondebosch, 7701, South Africa*

Corresponding author: Simon van Noort (svannoort@iziko.org.za)

Academic editor: T. Spasojevic | Received 24 March 2023 | Accepted 15 August 2023 | Published 24 August 2023

https://zoobank.org/12C02F38-A9F6-4BCA-AEEB-A7155829867C

Citation: Reynolds T, van Noort S (2023) Two new species of the genus *Cryptopimpla* Taschenberg (Hymenoptera, Ichneumonidae, Banchinae) with an updated key to African species. Journal of Hymenoptera Research 96: 667–696. https://doi.org/10.3897/jhr.96.104038

Abstract

A revised illustrated key to Afrotropical species of the genus *Cryptopimpla* Taschenberg is provided, with the inclusion of two new South African species, *C. orenji* Reynolds & van Noort, **sp. nov.** and *C. hoerikwagga* Reynolds & van Noort, **sp. nov.**, which are described and illustrated. The recovery of the first female specimens of *Cryptopimpla goci* Reynolds & van Noort in samples from Fernkloof and Grootbos nature reserves, and subsequent morphological reassessment of generic affinity based on female characters, no longer supports the placement of this species in *Cryptopimpla*. The transfer of *C. goci* to *Lissonota* Gravenhorst is proposed here: *Lissonota goci* (Reynolds & van Noort), **comb. nov.**, and the female is described. New Afrotropical distributional records for the previously described *Cryptopimpla* species are presented and notes on the distribution and diversification of the species are also provided. Online interactive Lucid keys to the 11 Afrotropical *Cryptopimpla* species are available at: http://www.waspweb.org.

Keywords

Afrotropical region, Atrophini, distribution, Ichneumonoidea, Lucid identification keys, South Africa, species diversity, taxonomy

Introduction

Afrotropical *Cryptopimpla* Taschenberg, 1863 represent 17% of the world's *Cryptopimpla* species (Reynolds Berry and van Noort 2016; Yu et al. 2016; Kang et al. 2019) and are restricted to three of the nine provinces of South Africa, namely Northern, Eastern and Western Cape. This narrow distribution is largely concordant with the Fynbos biome of the Greater Cape Floristic Region (CFR) encompassing the south-western part of South Africa (Reynolds Berry and van Noort 2016). No species are known from elsewhere in Africa despite recent intensive sampling effort having been conducted in other parts of southern Africa and in the tropical areas of central and eastern Africa.

The hosts of *Cryptopimpla* species that occur in the Afrotropical region remain unknown. Members of the tribe Atrophini generally attack semi-concealed hosts such as lepidopteran leaf rollers (Momoi et al. 1975; Quicke 2015). A couple of Atrophini genera including *Cryptopimpla* and *Spilopimpla* have short ovipositors and utilize exposed hosts (Townes 1969; Gauld et al. 2002). There is some evidence to suggest British species of *Cryptopimpla* are parasitoids of Geometridae larvae feeding in low vegetation, a habitat association appearing to be typical for the genus (Townes and Townes 1978; Brock 2017; Broad et al. 2018).

Although *Cryptopimpla* has a worldwide distribution, its species richness in the temperate regions of South Africa (and elsewhere) support relative affinities of the genus to specific biogeographic areas defined by habitat and climate (Sheng and Zheng 2005; Kuslitzky 2007; Reynolds Berry and van Noort 2016; Yu et al. 2016). African *Cryptopimpla* species are predominately distributionally centred in the fynbos biome, a temperate shrubland vegetation that is fire-adapted, occurring in the southwestern region of South Africa. Ten of the species are fynbos associates but several of these extend into the neighbouring Succulent Karoo and Grassland biomes, or into relict forest patches within fynbos. Only one species occurs in Albany thicket.

In this paper, we update the species key to African *Cryptopimpla*, reassess the generic affinities of *Cryptopimpla goci* Reynolds & van Noort, 2016, describe two new species, and provide links to the revised online interactive Lucid pathway and Lucid matrix keys available on WaspWeb at http://www.waspweb.org (van Noort 2023a).

Materials and methods

Photographs

Images were acquired at the Iziko South African Museum (**SAMC**) with a Leica LAS 4.9 imaging system, comprising a Leica Z16 microscope with a Leica DFC450 Camera and 0.63× video objective attached. The imaging process, using an automated Z-stepper, was managed using the Leica Application Suite V 4.9 software installed on a desktop computer. Diffused lighting was achieved using a Leica LED 5000 Dome. All images presented in this paper as well as images of all the African *Cryptopimpla* species are available on WaspWeb (van Noort 2023a).

Mapping

The distribution maps for the African *Cryptopimpla* species were produced using SimpleMappr (Shorthouse 2010).

Specimen acquisition

Specimens were extracted from bulk inventory survey samples preserved in 96% ethanol and housed in the Iziko South African Museum entomology wet collection that had been sorted to family level. These samples emanate from continuous inventory surveys using a range of collecting methods including Malaise traps, yellow pan traps, yellow funnel traps, pitfall traps, sweeping, Winkler bag extraction of leaf litter and UV light trapping conducted in Africa over the last 31 years by the second author (van Noort 2019, 2022, 2023b). By June 2019; Malaise trapping effort equated to 73 000 trap days (van Noort 2019), increasing to 87 147 trap days as at June 2022 (van Noort 2022), but the surveys are ongoing and the current effort at February 2023 sits at 94 000 Malaise trap days (= 257 Malaise trap years) (van Noort 2023b).

Digitization

All specimen data has been digitized into the Iziko South African Museum Specify 6 database.

Depositories

SAMC Iziko South African Museum, Cape Town, South Africa (Curator: Simon vanNoort).

Nomenclature and abbreviations

The morphological terminology follows Wahl and Sharkey (1993), but the wing venation nomenclature follows Gauld (1991). Most morphological terms are also defined on the HAO website (http://portal.hymao.org/projects/32/public/ontology/). The following morphometric abbreviations are used (in order of appearance in the descriptions):

B	body length, from toruli to metasomal apex (mm);
A	antenna length, from base of scape to flagellar apex (mm);
F	fore wing length, from tegula to wing apex (mm);
CT (clypeus transversality index)	maximum width of clypeus: median height;
ML (malar space length index)	malar space (shortest distance between mandible base and compound eye): basal mandibular width;
IO (inter-ocellar index)	shortest distance between posterior ocelli: ocellus diameter;

OO (oculo-ocellar index)	shortest distance between eye and posterior ocellus: ocellus diameter;
Fl_n (length index of flagellomere n)	length: width of flagellomere n;
OT (ovipositor sheath-tibia index)	length of ovipositor sheath: length of hind tibia.

The first three measurements (absolute measures) were measured on all specimens in the type series, with measurements from the primary type reported separately in brackets if necessary.

Identification keys

Lucid pathway and Lucid matrix keys were developed using Lucid Builder version 4.0.37. Character matrices were generated and edited using Microsoft Excel; matrices were then used as input into Lucid matrix key production (Penev et al. 2009). The online interactive keys were produced using Lucid, meeting the requirements of publishing both static and dynamic interactive keys under an open access model (Penev et al. 2009). All keys were illustrated using high quality annotated images, highlighting diagnostic characters. The images are integrated into the key below each couplet resulting in a user-friendly output. This key format reduces the requirement of familiarity with morphological terminology associated with a particular taxonomic group, because the characters are visually illustrated, making the keys usable by a wide range of end-users including ecologists and conservationists. Online identification keys are presented in two different formats on WaspWeb: traditional static dichotomous keys where a choice needs to be made at each key couplet to continue, which are also presented as an interactive Lucid pathway (dichotomous) key; and Lucid matrix keys where relevant states from multiple character features can be selected independently until identification is achieved. For more information concerning Lucid keys visit http://www.lucidcentral.org.

Results

Specimen acquisition and distribution maps

Historically there were two *Cryptopimpla* specimens in the Iziko South African Museum collection: the holotype of *C. rubrithorax* Morley, 1916 (collected in 1914) and a specimen of the recently described species *C. zwarti* Reynolds Berry & van Noort, 2016 (collected in 1990). The remaining 60 specimens were collected by the second author over the last thirty years from many diverse vegetational localities. The majority of the resultant bulk samples have yet to be sorted and we expect that numerous further specimens reside in the unsorted samples, probably at least tripling the number of known specimens. Most of the mobilized specimens were collected in Malaise traps, with a single specimen collected by sweeping and two specimens recovered from yellow pan trap samples. A summary of the abundance and distribution of the species treated here is provided in Table 1.

Distribution maps are provided depicting the overall distribution of the genus in South Africa (Fig. 1), the individual species distributions plotted on a topographical map (Fig. 2), and species distributions plotted on a biome vegetation map (Fig. 3).

Digitization

The output of specimen data digitized into the Iziko South African Museum Specify 6 database is included as a supplementary excel file (Suppl. material 1).

Table 1. Number of known specimens, the known provincial distribution and vegetation biome association of African *Cryptopimpla* species.

Cryptopimpla species	Known specimens	Recorded distribution	Biome association
C. elongatus	1	Northern Cape	Fynbos
C. fernkloofensis	1	Western Cape	Fynbos
C. hantami	2	Western Cape	Fynbos
C. hoerikwagga	1	Western Cape	Fynbos
C. kogelbergensis	6	Northern & Western Cape	Fynbos; Succulent Karoo
C. neili	1	Western Cape	Fynbos
C. onyxi	13	Eastern & Western Cape	Fynbos; Grassland
C. orenji	1	Western Cape	Fynbos
C. parslactis	1	Northern Cape	Fynbos
C. rubrithorax	34	Northern & Western Cape	Forest; Fynbos
C. zwarti	1	Eastern Cape	Albany Thicket
Total	**62**		

Figure 1. Distribution map depicting the known African *Cryptopimpla* locality records. In the Afrotropical region *Cryptopimpla* species are currently only known from South Africa.

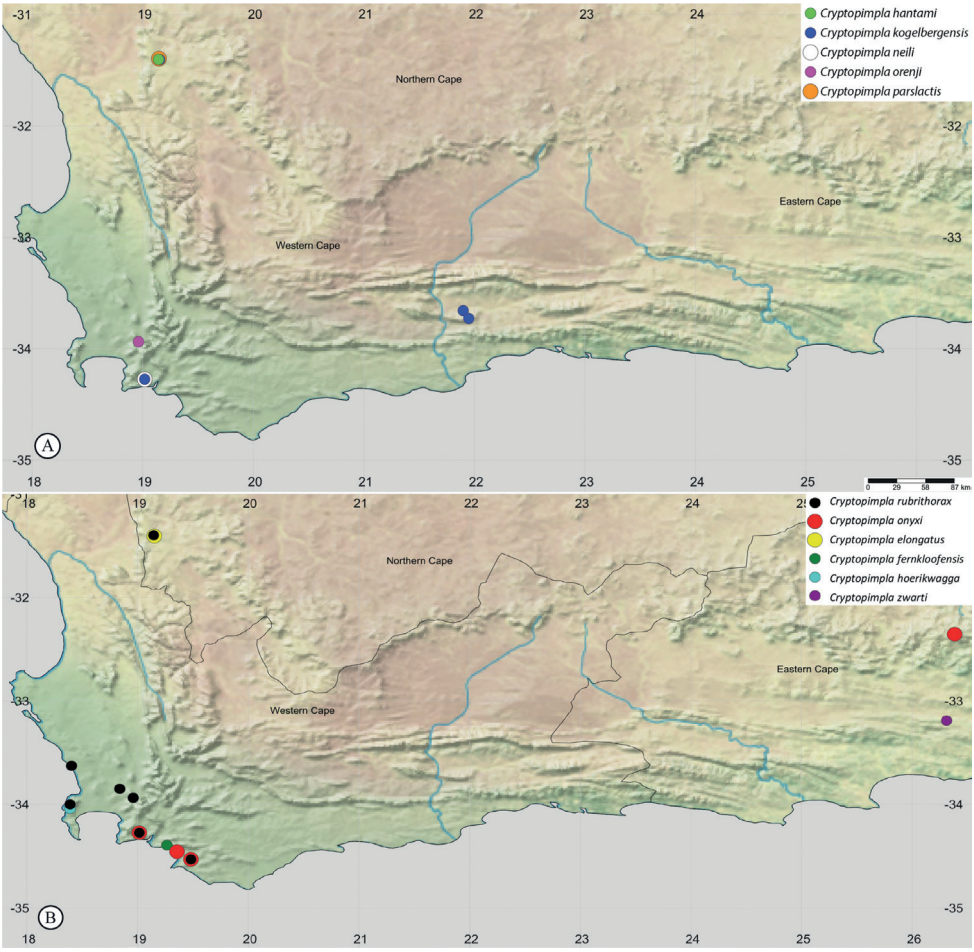


Figure 2. Recorded distribution for each *Cryptopimpla* species plotted on topographical maps. The genus is currently only recorded from the Eastern, Northern and Western Cape provinces within South Africa. Note that when two species are present in a single locality one of the species icons is larger, but centrally covered by the second species icon **A** *C. hantami*, *C. kogelbergensis*, *C. neili*, *C. orenji*, and *C. parslactis* **B** *C. elongatus*, *C. fernkloofensis*, *C. hoerikwagga*, *C. onyxi*, *C. rubrithorax* and *C. zwarti*.

Identification keys

A standard dichotomous key to the African species of *Cryptopimpla* is presented below. Online interactive Lucid pathway and Lucid matrix keys are available on WaspWeb (van Noort 2023a). The LIF3 file for the online Lucid matrix key to the African species is provided as Supplementary Material (Suppl. material 2). Lucid Interchange Format v. 3 (LIF3) files are XML based files that store all the Lucid3 key data, allowing exchange of the key with other key developers such as Intkey (DELTA), or MX. The provision of this LIF3 data set allows future workers to edit the key and to add newly described taxa. The data file for the published key that is stored on the publisher's

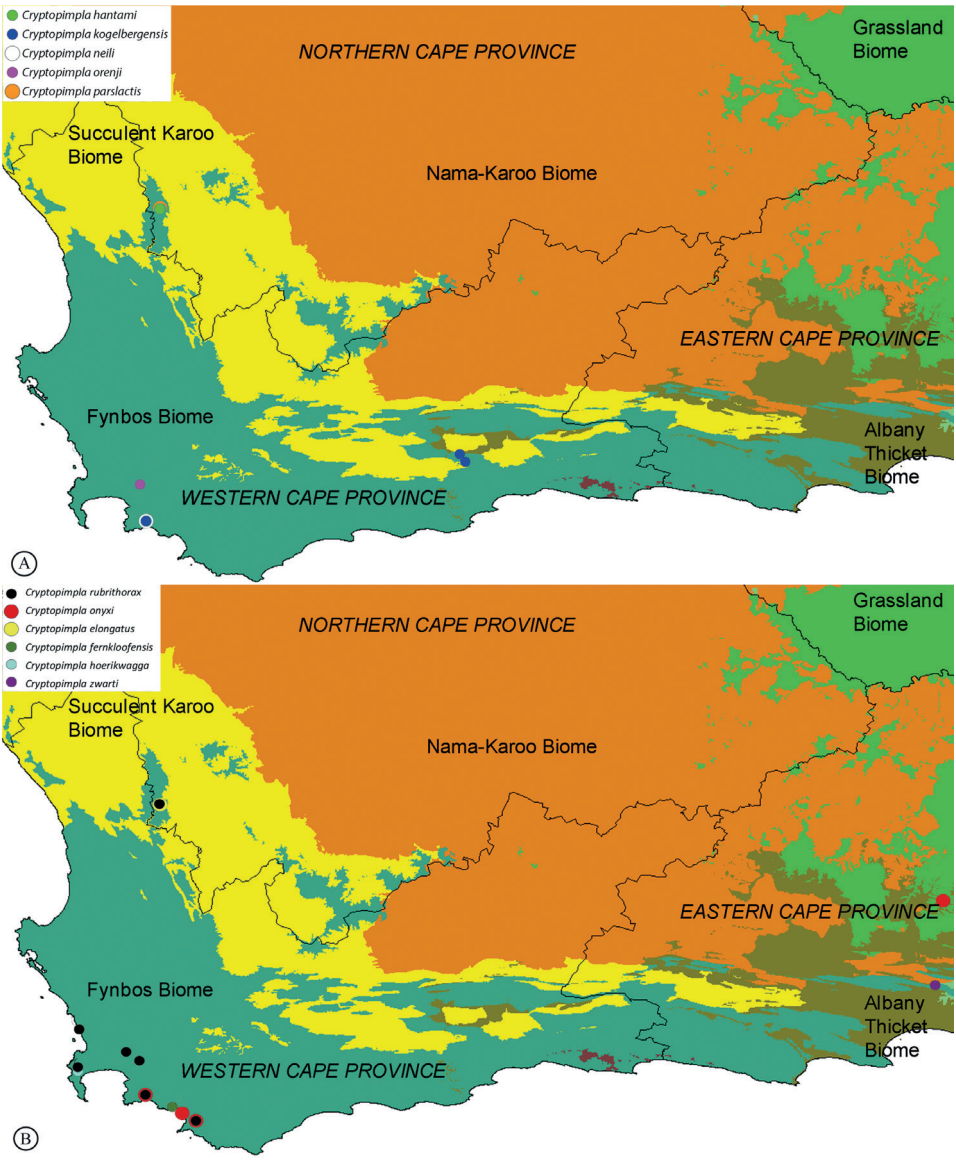
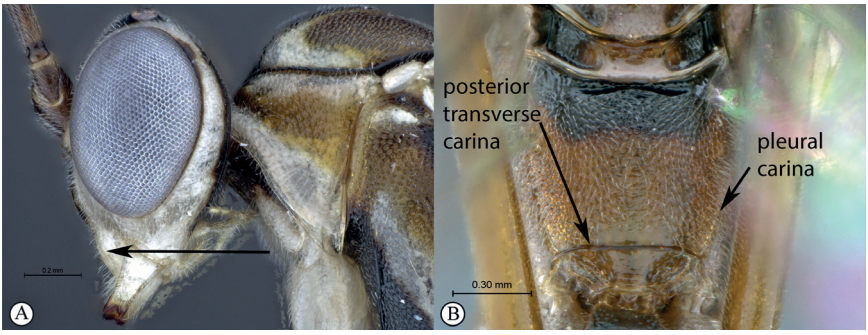


Figure 3. Recorded distribution for each *Cryptopimpla* species plotted on biome maps. Note that when two species are present in a single locality one of the species icons is larger, but centrally covered by the second species icon **A** *C. hantami*, *C. kogelbergensis*, *C. neili*, *C. orenji*, and *C. parslactis* **B** *C. elongatus*, *C. fernkloofensis*, *C. hoerikwagga*, *C. onyxi*, *C. rubrithorax* and *C. zwarti*.

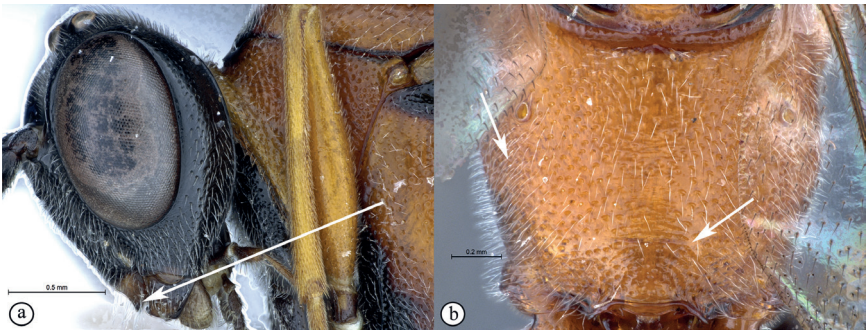
website and in e-archives has the rights of "first publication" identified by its bibliography data, location, and citation (Sharkey et al. 2009). The concept of publication, citation, preservation, and re-use of data files to interactive keys under the open access model is detailed in Penev et al. (2009).

Key to African species of the genus *Cryptopimpla* Taschenberg, 1863

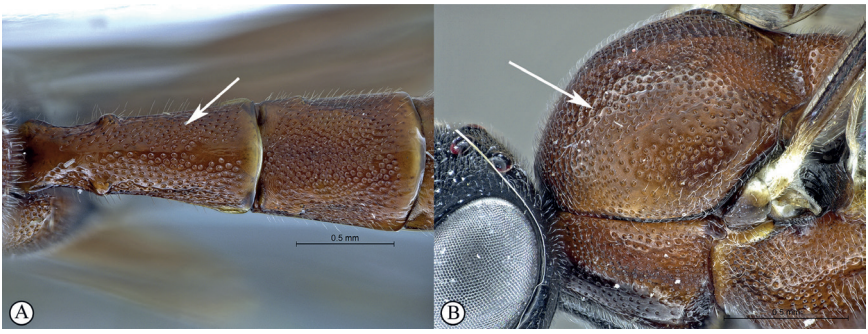
1 Clypeal profile distinctly convex and bulbous (A). Pleural carinae of propodeum present, but may be weak; posterior transverse carina present and well-defined (B).....***C. kogelbergensis***



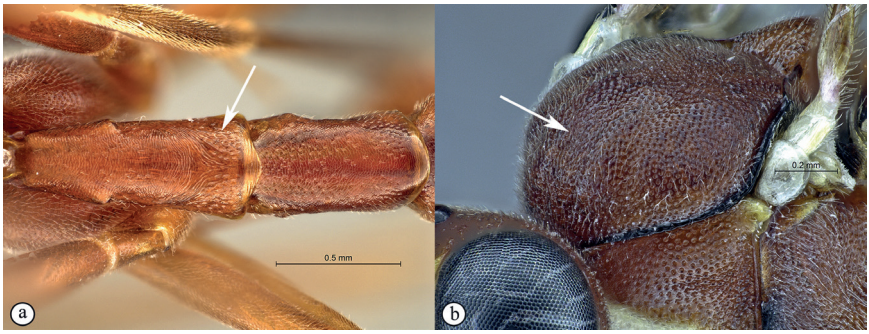
– Clypeal profile weakly convex with a curved lip on ventral margin (a). Pleural carinae absent and posterior transverse carina of propodeum, if present, weak or reduced to a wrinkle (b)..... **2** (*rubrithorax* species-group)



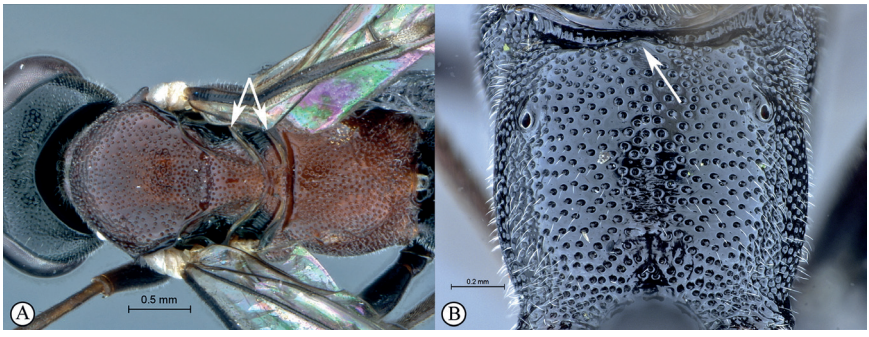
2 Metasomal tergite I punctate over most of surface (A). Median lobe of the mesocutum not raised above lateral lobes (B).....**3**



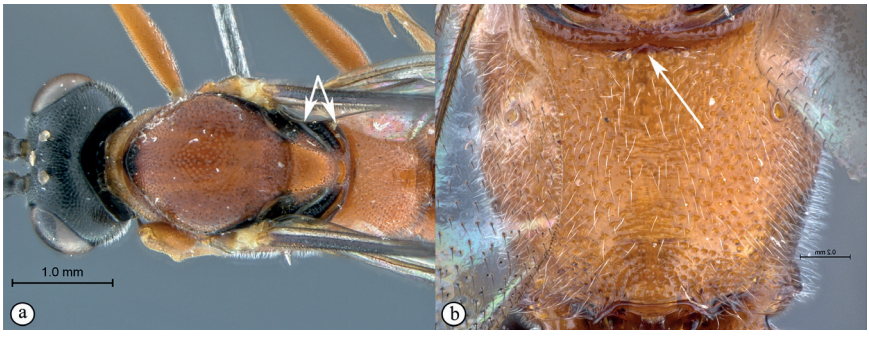
– Metasomal tergite I punctate posteriorly, strigate over anterior three-quarters (a). Median lobe of the mesosocutum distinctly raised (b) .... ***C. orenji* sp. nov.**



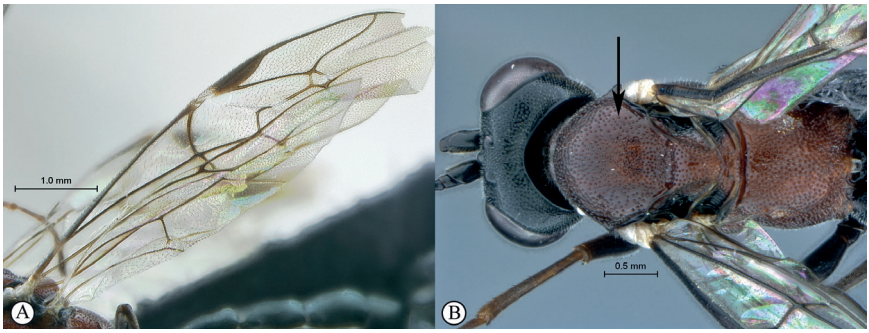
3 Mesosoma with axillar and metanotal struts subparallel, not strongly converging towards medial area (A). Propodeal anterior margin without defined medial tooth, but may have a blunt medial projection (B) **4**



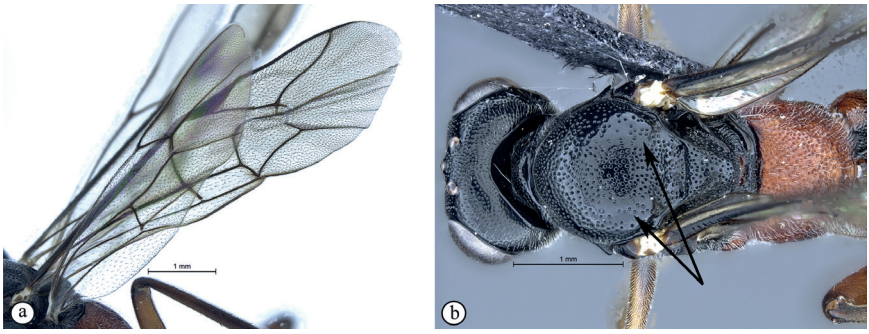
– Metanotum with axillar and metonotal struts converging towards medial area (a). Propodeal anterior margin with medial tooth (b)..... ***C. fernkloofensis***



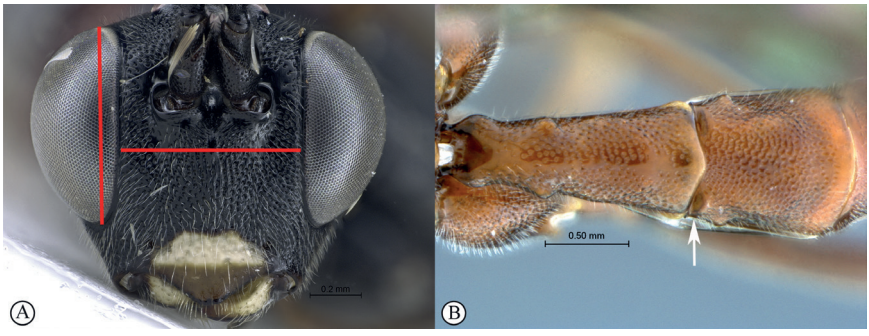
4 Wings with pale microtrichia (A). Mesoscutum evenly punctate (B).....**5**



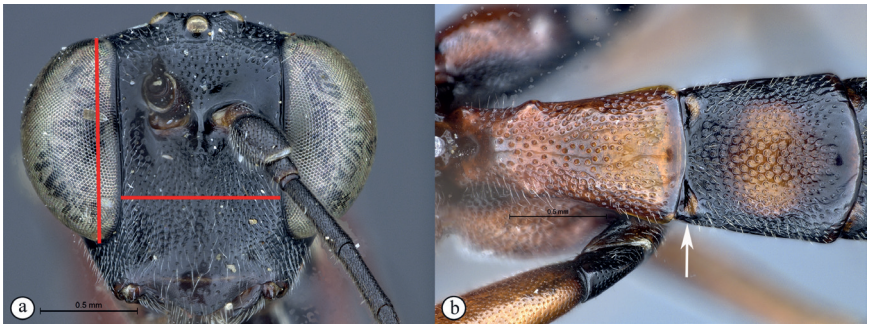
– Wings with dark microtrichia, venation darker (a). Mesoscutum with fewer punctures inward of wing bases, resulting in polished areas (b) ....***C. parslactis***



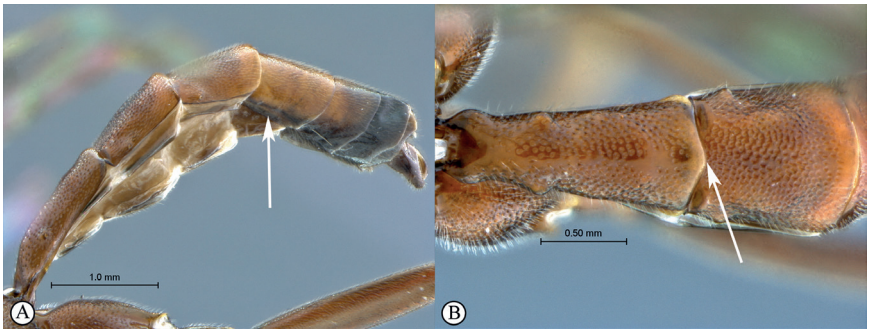
5 Inter-ocular distance broad, equivalent to eye height in anterior view (A). Thyridia small and indistinct (B) **6**



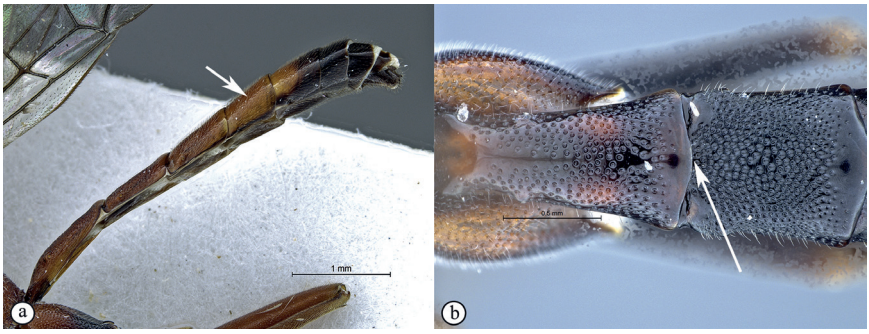
– Inter-ocular distance narrow, shorter than eye height in anterior view (a). Thyridia moderately large and distinct, elongate to circular (b) **8**



6 Male tergite IV dorso-laterally compressed (A). Posterior margin of tergite I medially projected as a blunt angle (B)..... ***C. neili***

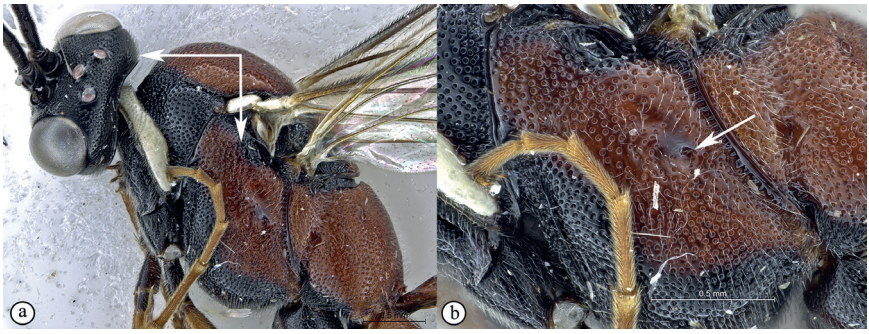


– Male tergite IV dorso-ventrally depressed (a). Posterior margin of tergite I weakly convex to straight (b)..... 7

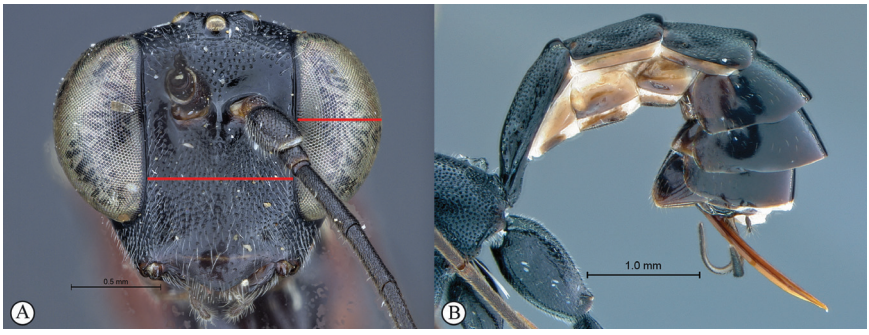


7 Mesosoma uniformly brownish orange (A). Head and mesosoma matt, moderately covered in short setae (A). Mesopleural pit shallow with surrounding area punctate (B) ..... ***C. hantami***

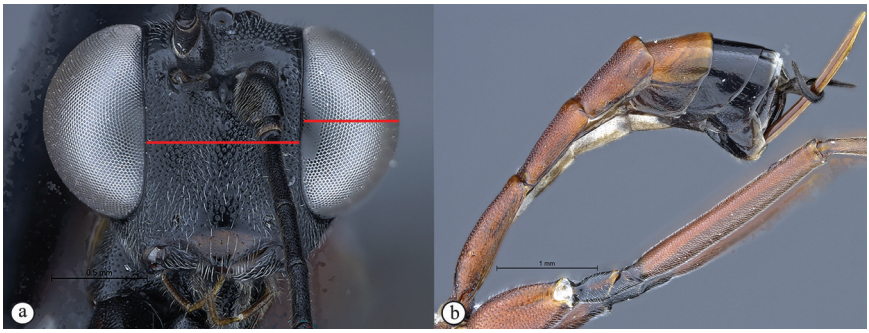
– Mesosoma tricoloured with a distinct white pronotal collar; pronotum, propleuron, posterior mesoscutal border, ventral parts of mesopleuron and lateral areas of scutellum and metanotum black, with remaining mesosoma dark reddish brown (a). Head and mesosoma subpolished, sparsely covered in short setae (a). Mesopleural pit distinct with surrounding polished area (b) .... ***C. hoerikwagga* sp. nov.**



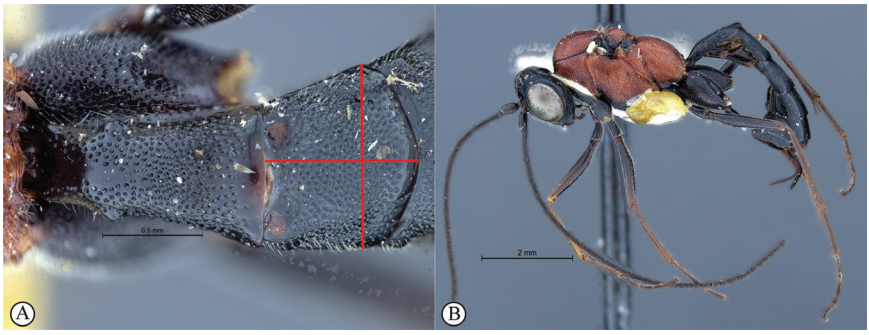
8 Eye in anterior view narrow to moderately-sized: eye maximum width in anterior view 0.4–0.66× shortest inter-ocular distance (A). Female metasomal tergites IV–VIII slightly compressed; metasoma black (B), legs brown to black..... **9**



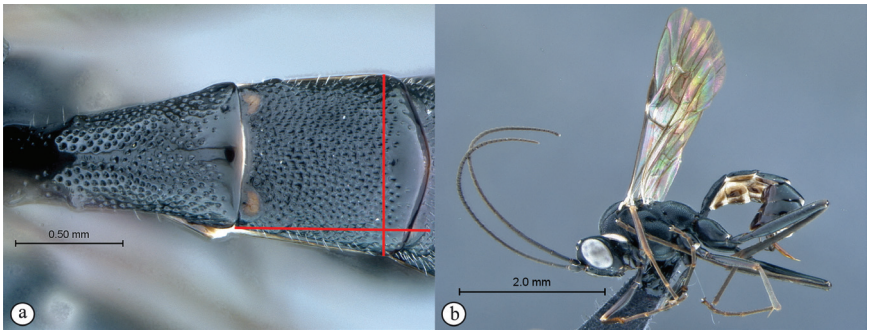
– Eye in anterior view larger, bulbous: eye maximum width in anterior view 0.73× shortest inter-ocular distance (a). Female metasoma elongated, depressed; metasoma and legs mostly rufescent (b) ..... ***C. elongatus***



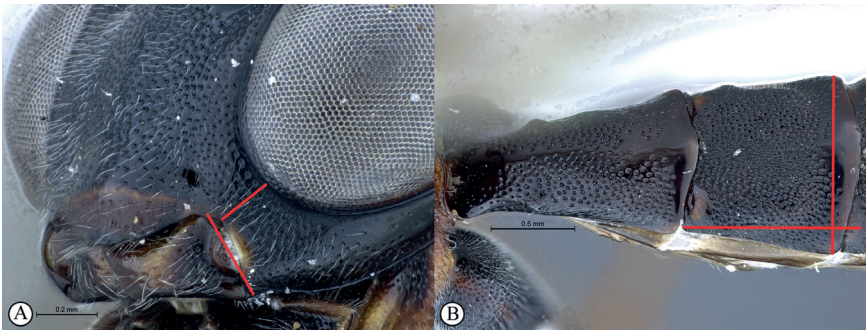
9 Metasomal tergite II 1.1–1.25× wider than long (A). Mesosoma predominantly rufous with some small black markings, with or without white pronotal collar (B) **10**



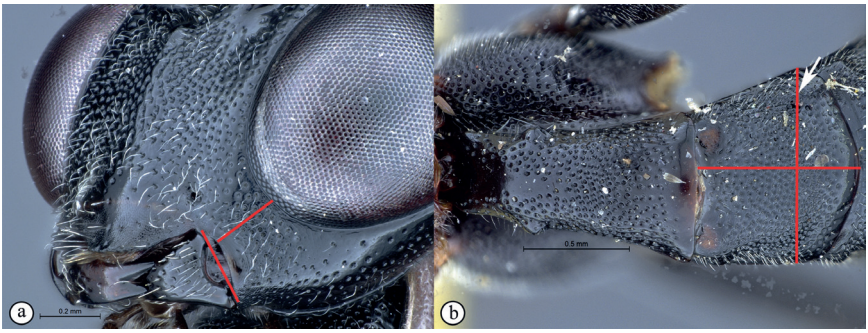
– Metasomal tergite II 1.09–1.25× longer than wide (a). Mesosoma black with white pronotal collar (b) ..... ***C. onyxi***



10 Malar space 0.6× as long as basal mandibular width (A). Second tergite posteriorly 1.25× wider than long (B) ..... ***C. zwarti***



– Malar space 0.9–1.3× as long as basal mandibular width (a). Tergite II posteriorly no more than 1.1× wider than long (b)..... ***C. rubrithorax***



Cryptopimpla Taschenberg, 1863

Cryptopimpla Taschenberg, 1863. Zeitschrift für die Gesammten Naturwissenschaften, 21: 292. Type-species *Phytodietus blandus* Gravenhorst, 1914.

Complete diagnosis. Provided in Reynolds Berry and van Noort (2016).

Summary diagnosis. Afrotropical representatives of the genus can be distinguished by a combination of traits: a flagellum that tapers to a slender apex; a complete occipital carina, that joins the hypostomal carina distant from the base of the mandible; a longer upper mandibular tooth than lower tooth; absence of the epomia; a truncate-shaped fore wing areolet; the hind wing with Cu1 longer than cu-a; presence of a glymma; a strongly anteriorly narrowed first tergite, and an ovipositor that is 0.5–0.7× as long as the hind tibia (Reynolds Berry and van Noort 2020).

Species-groups

The Afrotropical species cluster in two morphological species-groups:

- *rubrithorax* species-group (*C. elongatus*, *C. fernkloofensis*, *C. hantami*, *C. hoerikwagga* sp. nov., *C. neili*, *C. onyxi*, *C. orenji* sp. nov., *C. parslactis*, *C. rubrithorax*, and *C. zwarti*) is defined by the presence of a weakly convex clypeus with a curved lip on the ventral margin, small tentorial pits, absence of the pleural carinae, and absence of the posterior transverse carina on the propodeum.
- *kogelbergensis* species-group (*C. kogelbergensis*) is defined by the presence of a convex and bulbous clypeus with large tentorial pits, pleural carinae, and a distinct and well-defined posterior transverse carina on the propodeum. This species group was referred to as the *goci* species-group in Reynolds Berry and van Noort (2016), but with the current transfer of *C. goci* to *Lissonota* Gravenhorst, 1829 in this paper the name has had to be changed to that of the single species remaining in this species-group.

***Cryptopimpla hoerikwagga* Reynolds & van Noort, sp. nov.**
https://zoobank.org/7E25DED0-03D1-4457-8901-593D15688BD8
Fig. 4

Type material. ***Holotype*** ♂: South Africa, W. Cape, Constantiaberge, 640 m, 34°02.5'S, 18°23.5'E, above road to mast overlooking Hout Bay, 23 Feb–2 March 1994, S. van Noort, Mesic Mountain Fynbos, Malaise trap, SAM-HYM-P00591 (SAMC).

Description. Body overall subpolished. Colour. Body mostly fulvous. Head black, clypeus and mandibles white to brown. Propleuron, fore and mid coxae, dorso-posterior margin of mesoscutum, axillary troughs of mesonotum and metanotum, submetapleural carina black. Pronotum black, pronotal collar and tegula white. Trochanters, trochantellus and tergite V brown to fulvous. Remainder of metasoma brown with tergites VII and VIII white at posterior margins. Head densely punctate. Frons unarmed. Clypeus profile weakly convex with curved lip on ventral margin. Clypeus edge convex. Upper tooth of mandible longer than lower. Setae on head and clypeus short and sparse. Tentorial pits small and indistinct. Flagellum tapered to a slender apex. Eye in lateral view 1.03 times as long as wide, maximum width in anterior view 0.55 times shortest inter-ocular distance. Mesosoma not compressed. Scuto-scutellar sulcus broad with dorso-lateral indentations. Mesoscutum evenly punctate. Epicnemial carinae present ventrally and dorsally, dorsally converging toward anterior edge of mesopleuron; mesopleural pit distinct, surrounding area polished. Propodeum without carinae, its anterior margin straight. Wings hyaline. Fore wing with two bullae close together appearing as one; vein 2m-cu sinuate; areolet truncate-shaped. Hind wing with two basal hamuli and seven distal hamuli. Metasomal tergite I with dorso-lateral wrinkles, densely punctate, with posterior margin weakly convex; tergite II 1.2 times as long as wide posteriorly, spiracle situated at anterior 0.28 of tergite (measured in lateral view), thyridia small.

CT 2.5; ML 0.9; IO 1.9; OO 1.3; Fl_1 3.3; body length 9.7 mm; flagella length 9.5 mm; fore wing length 7.5 mm.

Figure 4. *Cryptopimpla hoerikwagga* Holotype **A** habitus, lateral view **B** head and mesosoma, lateral view **C** head, anterior view **D** propodeum, dorsal view **E** metasoma, lateral view (inset: data labels) **F** metasomal terga 1 and 2, dorsal view.

Diagnosis. This species belongs to the *rubrithorax* species-group and is the most strikingly coloured species of African *Cryptopimpla*. The mesosoma is tricoloured with a distinct white pronotal collar; a black pronotum, propleuron, posterior mesoscutal border, ventral parts of mesopleuron and lateral areas of scutellum and metanotum, with remaining mesosoma dark reddish brown. The head and mesosoma is subpolished, sparsely covered in short setae; the mesopleural pit is distinct with a surrounding polished area; axillar and metanotal struts are subparallel, not strongly converging towards the medial area; the propodeal anterior margin lacks a defined medial tooth;

the metasomal tergite I is punctate over most of the surface, posterior margin weakly convex; and the thyridia are small and distinct.

Differential diagnoses. The propodeal anterior margin is straight, distinguishing the species from several members of the *rubrithorax* species-group (except for *C. rubrithorax*, *C. parslactis* and *C. orenji*) where the margin may have a blunt medial projection or medial tooth. A broad scuto-scutellar sulcus with deep lateral indentations separates the species from *C. fernkloofensis*, *C. neili*, *C. hantami*, *C. kogelbergensis*, *C. parslactis*, and *C. orenji* where the dorso-lateral indentations and/or sulcus is absent. The densely punctate tergite I distinguish this species from *C. kogelbergensis* and *C. orenji* where punctation is reduced to absent. Dorso-lateral carinae of the metasomal tergite I substituted with wrinkling separates *C. hoerikwagga* from *C. fernkloofensis* and *C. neili* where one or no carinae are present. Small thyridia on tergite II distinguishes this species from all other members of the *rubrithorax* species-group, (except for *C. neili* and *C. hantami*), where the thyridia can be elongate or moderately large and circular.

Etymology. Named after the Khoisan word for Table Mountain "hoerikwagga" which directly translates to "mountain of the sea". Noun in apposition.

Distribution. South Africa (Western Cape) (Fig. 2).

Comments. A rare species known only from one specimen. Intensive sampling in the type locality as well as other areas of the Cape region have so far produced no further specimens, there is, however, a major backlog of unsorted samples (van Noort 2023b), which may produce further specimens.

Cryptopimpla orenji Reynolds & van Noort, sp. nov.

https://zoobank.org/C43A1AE4-1774-4B3D-8A2F-FD70A2407943
Fig. 5

Type material. ***Holotype*** ♀: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 25 April–16 May 2013, S. van Noort, Malaise trap, BH12-FYN3-M08, Burnt Mesic Mountain Fynbos, SAM-HYM-P063260 (SAMC).

Description. Body subpolished, covered in short setae. Colour. Body mostly fulvous. Epicnecium, submetapleural carinae and dorso-lateral corners of axillary troughs of meso- and metanotum black. Paraocular area of eyes, malar space, clyeus and mandibles yellow. Head densely punctate. Frons unarmed. Clypeus profile weakly convex with a curved lip on the ventral margin. Clypeus edge convex. Upper tooth of mandible longer than lower. Setae on head and clypeus short and sparse. Tentorial pits small and indistinct. Flagellum tapered to a slender apex. Eye in lateral view 1.3 times as long as wide, maximum width in anterior view 0.75 times shortest inter-ocular distance. Mesosoma not compressed. Scuto-scutellar sulcus without dorso-lateral indentations. Mesoscutum densely punctate, median lobe distinctly raised. Epicnemial carinae present ventrally and dorsally, dorsally converging toward anterior edge of mesopleuron; area surrounding mesopleural pit punctate. Propodeum with posterior transverse carinae present but weak, its anterior margin straight, spiracle elongate. Wings hyaline.

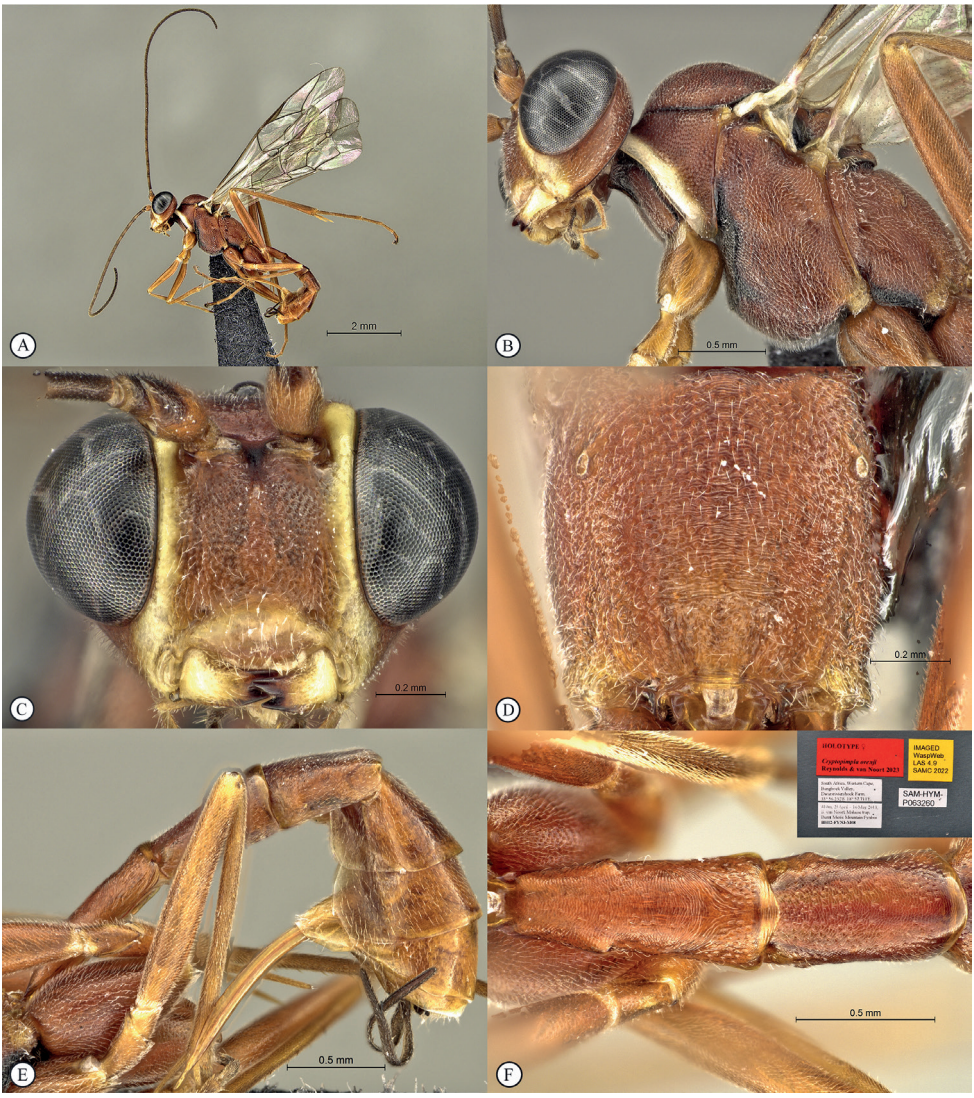


Figure 5. *Cryptopimpla orenji* Holotype **A** habitus, lateral view **B** head and mesosoma, lateral view **C** head, anterior view **D** propodeum, dorsal view **E** metasoma, lateral view **F** metasomal terga 1 and 2, dorsal view (inset: data labels).

Fore wing with two bullae close together appearing as one; vein 2m-cu sinuate; areolet truncate-shaped. Hind wing with two basal hamuli and six distal hamuli. Metasoma with first tergite punctate posteriorly, strigate anteriorly, with posterior margin weakly convex; tergite II of metasoma 1.8 times as long as wide posteriorly, spiracle situated at anterior 0.30 of tergite (measured in lateral view), thyridia indistinct. Tergite IV–VIII not compressed; tergite VI as wide as tergite V. Hypopygium strongly sclerotized. Ovipositor upcurved; sheath striations present.

CT 2.2; ML 0.8; IO 1.6; OO 1.6; Fl_1 5; OT 0.5; body length 6.5 mm; flagella length 9.4 mm; fore wing length 6.9 mm.

Diagnosis. *Cryptopimpla orenji* is immediately distinguishable from all other Afrotropical *Cryptopimpla* by possessing a distinctly raised median lobe on the mesoscutum, and by having tergite I distinctly strigate in anterior three-quarters and only punctate posteriorly. The head coloration is fulvous; and the paraocular area of the eyes, malar space, clypeus and mandibles are yellow, a colour pattern that is unique to this species.

Differential diagnoses. The area surrounding the mesopleural pit is punctate distinguishing *C. orenji* from *C. hoerikwagga* and *C. fernkloofensis* where the area surrounding the pit is polished. The propodeal anterior margin is straight distinguishing the species from several members of the *rubrithorax* species-group (excluding *C. rubrithorax*, *C. parslactis* and *C. orenji*) where the margin may have a blunt medial projection or medial tooth. A scuto-scutellar sulcus without dorso-lateral indentations separates *C. orenji* from several closely related species (excluding *C. fernkloofensis*, *C. parslactis* and *C. hoerikwagga*) where the dorso-lateral indentations are present and/or the sulcus is absent. Indistinct thyridia on tergite II distinguishes the species from several members of the *rubrithorax* species-group (excluding *C. neili*, *C. hantami* and *C. hoerikwagga*) where the thyridia can be elongate to moderately large and circular.

Etymology. So named owing to the colour of this species. Orenji is the Xhosa name for orange. Noun in apposition.

Distribution. South Africa (Western Cape) (Fig. 2).

Comments. A rare species known only from one specimen. Intensive sampling in the type locality and in other areas of the Cape region have so far produced no further specimens, there is, however, a major backlog of unsorted samples (van Noort 2023b), which may produce further specimens.

Lissonota goci **(Reynolds Berry & van Noort, 2016), comb. nov.**
Fig. 6

= *Cryptopimpla goci* Reynolds Berry & van Noort, 2016.

Type material examined. ***Holotype*** ♂: South Africa, Western Cape, Koeberg Nature Reserve, 33°37.622'S, 18°24.259'E, 741 m, 3–31 October 1997, S. van Noort, KO97-M12, Malaise trap, West Coast Strandveld, SAM-HYM-P0474345 (SAMC).

Additional material examined for description of female. 5♀: South Africa, Western Cape, Grootbos Private Nature Reserve, site LEU, 305 m, 34.531500°S, 19.482723°E, 6 Dec 2018–1 Feb 2019, S. van Noort, Malaise trap, Agulhas Limestone Fynbos, GPNR18-LEU-M09, SAM-HYM-P096893, SAM-HYM-P096967, SAM-HYM-P097347, SAM-HYM-P099594, SAM-HYM-P099621 (SAMC). 1♀: South Africa, Western Cape, Fernkloof Nature Reserve, Mosselberg, 60 m, south slope, 14 May–16 June 1995, S. van Noort, Malaise trap, Mesic Mountain Fynbos, SAM-HYM-P006315.

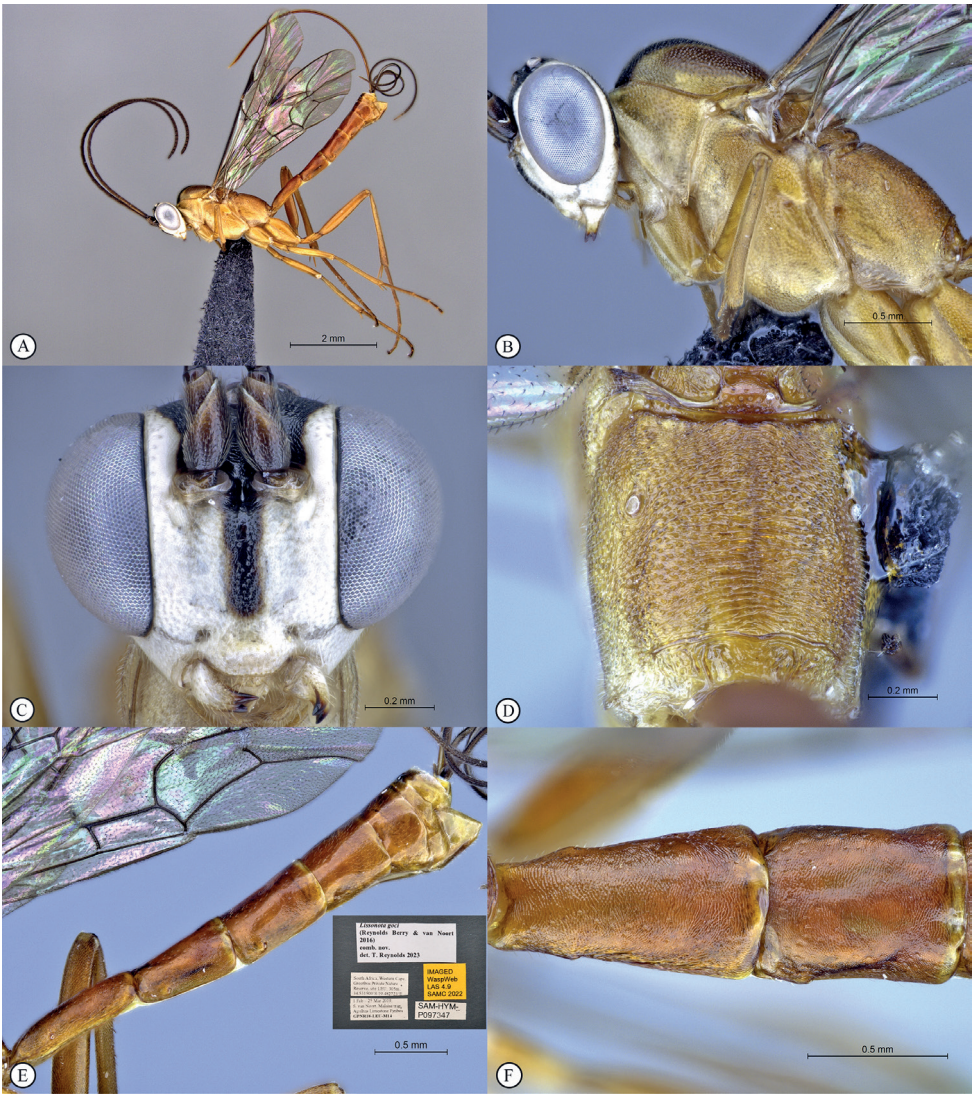


Figure 6. *Lissonota goci* (Reynolds Berry & van Noort, 2016) comb. nov. non-type female **A** habitus, lateral view **B** head and mesosoma, lateral view **C** head, anterior view **D** propodeum, dorsal view **E** metasoma, lateral view (inset: data labels) **F** metasomal terga 1 and 2, dorsal view.

Additional material of males newly recorded. 3♂: South Africa, W. Cape, Hermanus, Fernkloof Nature Reserve, Mosselberg, 60 m, south slope, 34°24.46'S, 19°18.00'E, 14 May–16 June 1995, S. van Noort, Malaise trap, Mesic Mountain Fynbos, SAM-HYM-P006415a-c (SAMC). 36♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site LEU, 305 m, 34.531500°S, 19.482723°E, 6 Dec 2018–1 Feb 2019, S. van Noort, Malaise trap, Agulhas Limestone Fynbos, GPNR18-LEU-M09, SAM-HYM-P096887, SAM-HYM-P096888, SAM-HYM-P096892, SAM-

HYM-P096895–P096899, SAM-HYM-P096901, SAM-HYM-P097300, SAM-HYM-P097305, SAM-HYM-P097307, SAM-HYM-P097335, SAM-HYM-P097336, SAM-HYM-P097340, SAM-HYM-P097341, SAM-HYM-P097346–P097348, SAM-HYM-P097351, SAM-HYM-P097353, SAM-HYM-P097394, SAM-HYM-P099598, SAM-HYM-P099617–P099620, SAM-HYM-P099622–P099624, SAM-HYM-P099626–P099631 (SAMC). 21♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site LEU, 305 m, 34.531500°S, 19.482723°E, 6 Dec 2018–1 Feb 2019, S. van Noort, Malaise trap, Agulhas Limestone Fynbos, GPNR18-LEU-M14, SAM-HYM-P098708, SAM-HYM-P098715, SAM-HYM-P099730, SAM-HYM-P099734–P099737, SAM-HYM-P099741–P099744, SAM-HYM-P099745–P099747, SAM-HYM-P099749–P099751, SAM-HYM-P099753, SAM-HYM-P099754–P099756 (SAMC). 1♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site FOR, 340 m, 34.54133°S, 19.43876°E, 25 Mar–31 May 2019, S. van Noort, Malaise trap, Afromontane Forest, GPNR18-FOR-M17, SAM-HYM-P099498 (SAMC). 1♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site MILK, 240 m, 34.52831°S, 19.48496°E, 25 Mar–1 June 2019, S. van Noort, Malaise trap, Milkwood Scrub Forest, GPNR18-MILK-M20, SAM-HYM-P099485 (SAMC).

Description of female. Colour, sculpture and proportions as in male with the following exceptions: head with flagellum not tapered. Eye in lateral view 0.69–0.74 times as long as wide; in anterior view with maximum width slightly broader, 0.48–0.56 times shortest inter-ocular distance. Hind wing with one-two basal hamuli and seven-eight distal hamuli. Metasoma with tergite I impunctate, wrinkles or a single carina present dorsolaterally with no secondary carina leading from the single carina to the spiracle; second tergite 0.98–1.39 times longer than broad, spiracle situated more anteriorly at 0.27–0.3 of tergite (measured in lateral view), ovipositor 2.31–2.36 times longer than hind tibia.

Body length 7.1–8.7 mm; antenna length 7.1–8.1 mm; fore wing length 5.3–6.1 mm.

Distribution. South Africa (Western Cape) (Fig. 2).

Cryptopimpla elongatus Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♀: South Africa, Northern Cape, Hantam National Botanical Garden, 31°24.274'S, 19°09.164'E, 755 m, 22 May–12 June 2008, S. van Noort, GL07-DOL1-M39, Malaise trap, Nieuwoudtville-Roggeveld Dolerite Renosterveld, SAM-HYM-P047468 (SAMC).

Cryptopimpla fernkloofensis Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♂: South Africa, Western Cape, Fernkloof Nature Reserve, 33°39.941'S, 21°53.505'E, 300–340 m, 13 May 1995, S. van Noort, Sweep, Mesic Mountain Fynbos, SAM-HYM-P008237 (SAMC).

Cryptopimpla hantami Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♀: South Africa, Northern Cape, Hantam National Botanical Garden, 31°24.182'S, 19°08.587'E, 741 m, 17 March–21 April 2008, S. van Noort, GL07-REN3-M24, Malaise trap, Nieuwoudtville Shale Renosterveld, SAM-HYM-P047467 (SAMC).

Cryptopimpla kogelbergensis Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♀: South Africa, Western Cape, Kogelberg Nature Reserve, 34°16.481'S, 19°01.033'E, 118 m, 16 May–16 June 1999, S. van Noort, KO98-M23, Malaise trap, Mesic Mountain Fynbos, last burnt c. 1988, SAM-HYM-P047475 (SAMC).

Additional material newly recorded. 1♀: South Africa, Northern Cape, Hantam National Botanical Garden, 31°24.274'S, 19°09.164'E, 23 March–06 May 2008, S. van Noort, GL07-REN3-M38, 741 m, Malaise trap, Nieuwoudtville-Roggeveld Dolerite Renosterveld, SAM-HYM-P064320 (SAMC).

Cryptopimpla neili Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♂: South Africa, Western Cape, Kogelberg Nature Reserve, 34°16.481'S, 19°01.033'E, 118 m, 16 March 1999–16 April 1999, S. van Noort, KO98-M18, Malaise trap, Mesic Mountain Fynbos, last burnt c. 1988, SAM-HYM-P047436 (SAMC).

Cryptopimpla onyxi Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♀: South Africa, Western Cape, Walker Bay Nature Reserve, 34°27.414'S, 19°21.393'E, 57 m, 14 May–14 June 1997, S. van Noort, WB97-M01, Malaise trap, South coast Strandveld, SAM-HYM-P047460 (SAMC).

Additional material newly recorded. 1♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site LEU, 305 m, 34.531500°S, 19.482723°E, 25 March–31 May 2019, S. van Noort, Malaise trap, Agulhas Limestone Fynbos, GPNR18-LEU-M19, SAM-HYM-P098730 (SAMC). 1♂: South Africa, Western Cape, Grootbos Private Nature Reserve, site MILK, 240 m, 34.52831°S, 19.48496°E, 1 June–7 Aug 2019, S. van Noort, Malaise trap, Milkwood Scrub Forest, GPNR18-LEU-M24, SAM-HYM-P101469 (SAMC). 1♀: South Africa, Eastern Cape, Winterberg, The Hoek farm, 31°21.260'S, 26°23.001'E, 1879 m, 6.x.2010–18.i.2011, S. van Noort, Malaise trap, Amathole Mistbelt Grassland, WTB09-GRA1-M05, SAM-HYM-P062421 (SAMC).

Cryptopimpla parslactis Reynolds Berry & van Noort, 2016

Type material examined. ***Holotype*** ♂: South Africa, Northern Cape, Hantam National Botanical Garden, 31°23.802'S, 19°08.799'E, 752 m, 23 July–23 Aug 2008, S. van Noort, GL07-REN1-M43, Malaise trap, Nieuwoudtville Shale Renosterveld, SAM-HYM-P044547 (SAMC).

Cryptopimpla rubrithorax Morley, 1916

Type material examined. ***Holotype*** ♀: South Africa, Western Cape, Elsenberg, 11 October 1914, Mally and Petty, SAM-HYM-P000874 (SAMC).

Additional material newly recorded. 3♂: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 28 Aug–28 Sept 2012, S. van Noort, Malaise trap, Mesic Mountain Fynbos, BH12-FYN3-M02, SAM-HYM-P063982, SAM-HYM-P064071, SAM-HYM-P097386 (SAMC). 4♀,3♂: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 3–25 April 2013, S. van Noort, Malaise trap, Burnt Mesic Mountain Fynbos, BH12-FYN3-M03, SAM-HYM-P063159, SAM-HYM-P063497, SAM-HYM-P093877–P093878, SAM-HYM-P093879–P093881 (SAMC). 3♂: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 28 Sept–24 Oct 2012, S. van Noort, Malaise trap, Mesic Mountain Fynbos, BH12-FYN3-M07, SAM-HYM-P063492, SAM-HYM-P063537 (SAMC). 3♂: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 8 Aug–2 Oct 2013, S. van Noort, Malaise trap, Burnt Mesic Mountain Fynbos, BH12-FYN3-M12, SAM-HYM-P063516, SAM-HYM-P063704, SAM-HYM-P063716 (SAMC). 3♀,1♂: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 25 April–16 May 2013, S. van Noort, Malaise trap, Burnt Mesic Mountain Fynbos, BH12-FYN3-M08, SAM-HYM-P063076, SAM-HYM-P063278, SAM-HYM-P093875–P093876 (SAMC). 2♀: South Africa, W. Cape, Koeberg Nature Reserve, 33°37.622'S, 18°24.259'E, 8 Aug–5 Sept 1997, S. van Noort, Malaise trap, KO97-M07, West Coast Strandveld, SAM-HYM-P047476 (SAMC). 1♀: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 2–22 October 2013, S. van Noort, Malaise trap, Mesic Mountain Fynbos, BH12-FYN3-M13, SAM-HYM-P064020 (SAMC). 1♀,1♂: South Africa, Western Cape, Banghoek Valley, Grootbos Private Nature Reserve, site LEU, 305 m, 34.531500°S, 19.482723°E, 25 March–31 May 2019, S. van Noort, Malaise trap, Agulhas Limestone Fynbos, GPNR18-LEU-M19, SAM-HYM-P098731, SAM-HYM-P098765 (SAMC). 1♀: South Africa, Western Cape, Banghoek Valley, Dwarsriviershoek Farm, 33°56.232'S, 18°57.711'E, 410 m, 24 Oct–10 Dec 2012, S. van Noort, Malaise trap, Mesic Mountain Fynbos, BH12-FYN3-M04, SAM-HYM-P064919 (SAMC). 1♀: South Africa, Western Cape, Table Mountain National Park, Orangekloof, Disa River, 34°0.035'S, 18°23.492'E, 136 m, 11 Nov–11 Dec 2014, S. van Noort, Malaise trap, Afromontane Forest, OGK13-FOR1-M27, SAM-HYM-P062973 (SAMC).

***Cryptopimpla zwarti* Reynolds Berry & van Noort, 2016**

Type material examined. ***Holotype*** ♀: South Africa, Eastern Cape, Grahamstown, Faraway Farm 33.19'S, 19°26.31'E, April 1990, I. Crampton, Malaise trap, SAM-HYM-P005220 (SAMC).

Discussion

Species-groups

The two newly described species (*C. orenji* sp. nov. and *C. hoerikwagga* sp. nov.) both belong to the *rubrithorax* species-group. In addition to possessing the morphological characters that distinguish members of the *rubrithorax* species-group, these two new species also have larger fore wings (length = 5.8–7.5 mm) compared to the *kogelbergensis* species-group where the fore wing lengths are smaller (length = 4.6–5.1 mm). *Cryptopimpla hoerikwagga* sp. nov. is the largest African *Cryptopimpla* species (body length 9.7 mm; fore wing length 7.5 mm) and *C. kogelbergensis* is the smallest African *Cryptopimpla* species (body length 4.2–5.6 mm; fore wing length 4.6–5.1 mm). The remaining species have sizes ranging between these two extremes (body length 6.5–9.4 mm; fore wing length 5.8–7.2 mm).

The maximum length of the ovipositor sheath relative to the hind tibia for the genus ranges from 0.7× for Afrotropical species (Reynolds Berry and van Noort 2016) to 1.0× (Townes 1969; Sheng 2011; Takasuka et al. 2011; Kang et al. 2019) for world species. However, the newly discovered female specimens of *Lissonota goci* comb. nov. possess an ovipositor sheath relative to the hind tibia that is up to 2.4× as long. *Cryptopimpla* has morphological affinities with the banchine genus *Lissonota* (Broad 2022) and without females to confirm the presence of the diagnostic generic character of a shortened ovipositor sheath, male *Cryptopimpla* may be incorrectly determined as the cosmopolitan banchine genus *Lissonota* (e.g. Holmgren 1860; Fig. 4), corroborated by the fact that the type species for *Cryptopimpla* was originally described as *Lissonota caligata* Gravenhorst, 1829. Within a global context both genera appear to be paraphyletic (Reynolds Berry 2019) and may warrant splitting up.

The discovery of the female of *Lissonota goci* comb. nov. has allowed us to reassess generic affinities of this species and based on female characters this species is better placed within *Lissonota*. The apical 0.3–0.4 portion of the flagellum is tapered to a slender apex in *Cryptopimpla* whereas the female flagellum in this species, as typical for *Lissonota*, is only weakly tapered at the apex (Townes 1969; Takasuka et al. 2011; Reynolds Berry and van Noort 2020). Besides the ovipositor length, which is more than 1.4× as long as the hind tibia confirming placement in *Lissonota* (Reynolds Berry and van Noort 2020), the general habitus is also typical of *Lissonota*, and tergite I is very flat in profile (Fig. 6, A, E), lacking the anteriorly "humped" appearance of *Cryptopimpla* (as shown in identification key image 8B and 8b). In addition, the areolet is barely truncate anteriorly, i.e. veins 2rs-m and 3rs-m are barely separated. we have here proposed that this species is transferred to the genus *Lissonota* as *Lissonota goci* comb. nov. (Fig. 6) and

the *goci* species-group (Reynolds Berry and van Noort 2016) will by resultant default be referred to as the *kogelbergensis* species-group. Phylogenetic analyses, using both morphological and genetic data, of Afrotropical Banchinae separates *C. kogelbergensis* from *C. onyxi* and *C. rubrithorax* with robust support, reinforcing the morphological distinction of these two species-groups (Reynolds Berry 2019). Unfortunately, attempts to extract DNA from specimens of *Lissonota goci* comb. nov. to provide additional support for the revised placement of this species in *Lissonota* were unsuccessful.

Distribution and diversity

Cryptopimpla hoerikwagga sp. nov. and *C. orenji* sp. nov. are described based on single specimens that were collected from the western slopes of the Constantiaberg mountain, and Banghoek Valley adjacent to the Helshoogte mountain, of Western Cape South Africa, respectively. These are areas with no previous records for *Cryptopimpla*. Both have been collected in Mesic Mountain Fynbos, a vegetation type that is a habitat association for most of the previously described species (i.e. *C. fernkloofensis*, *C. neili*, *C. onyxi*, *C. rubrithorax* and *C. kogelbergensis*). Approximately 55% of Afrotropical *Cryptopimpla* species have been described based on a single specimen, and 90% of the overall Afrotropical *Cryptopimpla* species diversity is currently recorded from fynbos (Fig. 3), suggesting that the Fynbos biome may be the centre of species richness for African *Cryptopimpla* species. The remarkable floristic richness, endemism (fauna and flora) and major climatic features of the Fynbos biome has identified it as a global biodiversity hotspot (Myers et al. 2000). It is likely that the fynbos associated species specialise on host Lepidoptera species that are specific to hostplants also endemic to the Fynbos biome. A relatively recent (5–3 million years before present) rapid radiation of the flora of the CFR has been proposed (Linder 2003). Although originally hypothesized that banchine species occurring in the Cape region would be more derived because of their association with the climatically and environmentally unique and much younger CFR compared to forest-associated species, this hypothesis was subsequently refuted with the phylogenetic dating of the origin of the African *Cryptopimpla* clade to the early Eocene (56 million to 47.8 mya, Reynolds Berry 2019). *Cryptopimpla* has a much broader worldwide temperate distribution (Yu et al. 2016), suggesting that *Cryptopimpla* species may have been more widespread in Africa during temperate epochs and that their distribution has subsequently retracted to the CFR. Interestingly, species of *Lissonota* occurring within the Afrotropical region are also largely restricted to the temperate regions of South Africa (Reynolds Berry 2019). Future evolutionary assessments of *Cryptopimpla* should be considered in relation to this genus, to which it is morphologically similar, with both genera showing paraphyly at a global scale (Broad et al. 2018; Reynolds Berry 2019).

Due to the relatively limited availability of specimens for several species within *Cryptopimpla*, any assessments of the distribution and diversification of the different species are still likely to be biased. This is corroborated by unique locality records for the newly described species presented in this paper. While sustained continuous inventory surveys over the last three decades has revealed the genus to be increasingly species rich, it is still rare in terms of abundance with more than half of the Afrotropical spe-

cies represented by a single specimen. Further specimens will no doubt be recovered from the backlog of unsorted samples resulting from 31 years of continuous inventory surveys run by Simon van Noort, using a range of collecting methods (Malaise traps, yellow pan traps, yellow funnel traps, pitfall traps, sweeping, Winkler bag extraction of leaf litter and UV light trapping) (van Noort 2019, 2022, 2023b). The large backlog of unsorted samples (94 000 Malaise trap days = 257 Malaise trap years as at February 2023) housed in the Iziko South African Museum entomology collection is a function of capacity constraints – we simply do not have the human and financial resources to process the backlog of the estimated 39 million specimens in the Malaise trap samples alone, which requires R7,5 billion to achieve (van Noort 2023b).

Cryptopimpla rubrithorax is the most common Afrotropical species, occurring across various vegetation types within the Cape Floristic Region, including Strandveld, Mesic Mountain Fynbos, Agulhas Limestone Fynbos, Renosterveld, and Afromontane forest (Reynolds Berry and van Noort 2016). *Cryptopimpla rubrithorax* may have adapted to a wider range of lepidopteran hosts by shifting to related host species that are more polyphagous, and hence potentially associated with host plant species that are only present in the neighbouring biomes; alternatively, *C. rubrithorax* is historically polyphagous, and the *Cryptopimpla* species with narrower distributional ranges that are associated with the Cape Floristic Region have evolved higher levels of host specialisation, as hypothesized for *Aloeides* species where host specialisation appears to have driven species evolution (Shaw 2022). Parasitoids require several basic habitat needs, such as a stable host population with sufficient host foodplant presence, shelter and mating sites etc., but parasitoids don't always occur across their entire host insect range due to functional refugia and divisions of space (Shaw 2006), suggesting that the rare *Cryptopimpla* species may either be specialists on hosts with narrow distributional ranges, or alternatively constrained by lack of suitable habitat needs. Nevertheless, the hypothesised potential host polyphagy of *C. rubrithorax* may possibly account for the species' wider distribution, broader habitat association and higher abundance. *Cryptopimpla kogelbergensis* is the only other species to occur in three different vegetation types and is the only species to have been collected from Gamka Thicket, a vegetation type very different to both Fynbos and to Renosterveld in which the species also occurs. Five of the eleven species (*C. rubrithorax*, *C. parslactis*, *C. kogelbergensis*, *C. hantami* and *C. elongatus*) have been collected in the Hantam National Botanical Garden (NBG) in Nieuwoudtville Shale Renosterveld and Nieuwoudtville-Roggeveld Dolerite Renosterveld vegetation (Fig. 2), where sampling effort by Simon van Noort has been high (258 trap months) with many of the Hantam samples processed, suggesting that with further processing of the backlog of the other South African samples present in SAMC a better assessment of distribution will be attained. Hantam NBG, however, is florally extremely rich, particularly with respect to geophytes (Snijman and Perry 1987, van Wyk and Smith 2011), and the high local *Cryptopimpla* species richness at this locality may suggest a host correlation with Lepidoptera species associated with geophytes as their hostplants. Of concern is the fact that Renosterveld is a highly endangered habitat with only 10% left (von Hase et al. 2003; Topp and Loos 2019), threatening the continued survival

of taxa such as the African clade of *Cryptopimpla*. Loss or degradation of Renosterveld and the resultant demise of the host lepidopteran species which are likely to be specific to host plants only occurring in this vegetation type will result in the potential extinction of the associated parasitoids, not to mention the plethora of other invertebrate taxa dependent on this vegetation type. Habitat transformation or even minor degradation of habitat quality (Habel et al. 2023) can have major ramifications for biodiversity conservation (Cardoso et al. 2011, 2019, 2022; Ceballos 2015). Given that only 10% of Renosterveld remains it is likely that we have already lost *Cryptopimpla* species to extinction before we have been able to discover and describe them.

Acknowledgements

Cape Nature, the Eastern Cape Department of Environmental Affairs, and the Northern Cape Department of Nature and Environmental Conservation provided collecting permits. SANParks provided a research permit. SvN was funded by South African NRF (National Research Foundation) grants: GUN 2068865; GUN 61497; GUN 79004; GUN 79211; GUN 81139. Part of the South African field work conducted by SvN was funded by the National Science Foundation under PlatyPBI grant No. DEB–0614764 to N.F. Johnson and A.D. Austin. Thanks to Gavin Broad and Niklas Johansson for their valuable reviews of the manuscript.

Project conceptualization (SvN, TR); funding (SvN); field work (SvN); data curation (TR, SvN); taxonomy – species descriptions and species delimitation assessments (TR, SvN); imaging (TR); figure plates and identification key plate production (TR, SvN); production of identification keys (TR, SvN); manuscript production and editing (TR, SvN).

References

Broad GR, Shaw MR, Fitton MG (2018) Ichneumonid wasps (Hymenoptera: Ichneumonidae): their classification and biology. Handbooks for the Identification of British Insects 7. Royal Entomological Society, 418 pp.

Broad GR (2022) Presentation: Large-scale species revisions. Darwin wasp Conference, Öland. July 2022.

Brock JP (2017) The banchine wasps (Ichneumonidae: Banchinae) of the British Isles. Handbooks for the identification of British insects 7. Royal Entomological Society, 150 pp.

Cardoso P, Erwin T, Borges P, New T (2011) The seven impediments in invertebrate conservation and how to overcome them. Biological Conservation 144: 2647–2655. https://doi.org/10.1016/j.biocon.2011.07.024

Cardoso P, Leather SR (2019) Predicting a global insect apocalypse. Insect Conservation and Diversity 12: 263–267. https://doi.org/10.1111/icad.12367

Cardoso P, Barton PS, Birkhofer K, Chichorro F, Deacon C, Fartmann T, Fukushima CS, Gaigher R, Habel JC, Hallmann CA, Hill MJ, Hochkirch A, Kwak ML, Mammola S,

Noriega JA, Orfinger AB, Pedraza F, Pryke JS, Roque FO, Settele J, Samways MJ (2020) Scientists' warning to humanity on insect extinctions. Biological Conservation 242: e108426. https://doi.org/10.1016/j.biocon.2020.108426

Ceballos G, Ehrlich PR, Barnosky AD, García A, Pringle RM, Palmer TM (2015) Accelerated modern human-induced species losses: Entering the sixth mass extinction. Science Advances 1(5): e1400253. https://doi.org/10.1126/sciadv.1400253

Gauld ID (1991) The Ichneumonidae of Costa Rica 1. Memoirs of the American Entomological Institute 47: 1–589.

Gauld ID, Gomez J, Godoy C (2002) Subfamily Banchinae. In: Gauld ID (Ed.) The Ichneumonidae of Costa Rica, 4. Memoirs of the American Entomological Institute 66: 263–746.

Habel J, Schmitt T, Gros P, Ulrich W (2023) Breakpoints in butterfly decline in Central Europe over the last century. Science of The Total Environment 851: e158315. https://doi.org/10.1016/j.scitotenv.2022.158315

Holmgren AE (1860) Forsok till uppstallning och beskrifning af Sveriges Ichneumonider. Tredje Serien. Fam. Pimplariae. (Monographia Pimplariarum Sueciae). Kongliga Svenska Vetenskapsakademiens Handlingar 3: 1–76.

Kang GW, Kolarov J, Lee JW (2019) *Cryptopimpla* (Hymenoptera, Ichneumonidae, Banchinae) of South Korea, with description of two new species. ZooKeys 830: 99–109. https://doi.org/10.3897/zookeys.830.31974

Kuslitzky WS (2007) 12. Subfamily Banchinae. In: Lelej AS (Ed.) A Key to the Insects of Russian Far East (Vol. 4). Neuropteroidea, Mecoptera, Hymenoptera. Part 5.: Dal'nauka, Vladivostok 433–472. [in Russian]

Linder HP (2003) The radiation of the Cape flora, southern Africa. Biological Reviews 78: 597–638. https://doi.org/10.1017/S1464793103006171

Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403 (6772): 853–858. https://doi.org/10.1038/35002501

Momoi S, Sugawara H, Honma K (1975) Ichneumonid and Braconid parasites of Lepidopterous leaf-rollers of economic importance in horticulture and teaculture. In: Yasumatsu K, Mori H (Eds) Approaches to Biological Control 7: 47–60.

Penev L, Sharkey M, Erwin T, van Noort S, Buffington M, Seltmann K, Johnson N, Taylor M, Thompson C, Dallwitz M (2009) Data publication and dissemination of interactive keys under the open access model. ZooKeys 21: 1–17. https://doi.org/10.3897/zookeys.21.274

Quicke DLJ (2015) The braconid and ichneumonid parasitoid wasps: Biology, systematics, evolution and ecology. Wiley Blackwell: 1–704. https://doi.org/10.1002/9781118907085

Reynolds Berry T (2019) Systematics of the parasitoid wasp subfamily Banchinae (Hymenoptera; Ichneumonidae) in the Afrotropical region. PhD thesis. Stellenbosch University (South Africa). http://hdl.handle.net/10019.1/106917

Reynolds Berry T, van Noort S (2016) Review of Afrotropical *Cryptopimpla* Taschenberg (Hymenoptera, Ichneumonidae, Banchinae), with description of nine new species. Zookeys 640: 103–137. https://doi.org/10.3897/zookeys.640.10334

Reynolds Berry T, van Noort S (2020) Revision of the endemic Afrotropical genus *Tetractenion* (Hymenoptera, Ichneumonidae) with an identification key to genera of Banchinae for the region. ZooKeys 1007: 49–84. https://doi.org/10.3897/zookeys.1007.55543

Sharkey M, Yu D, van Noort S, Seltmann K, Penev L (2009) Revision of the Oriental genera of Agathidinae (Hymenoptera, Braconidae) with an emphasis on Thailand and interactive keys to genera published in three different formats. ZooKeys 21: 19–54. https://doi.org/10.3897/zookeys.21.271

Shaw M (2006) Habitat considerations for parasitic wasps (Hymenoptera). Journal of Insect Conservation 10: 117–127. https://doi.org/10.1007/s10841-006-6288-1

Shaw MR (2022) Host ranges of *Aleiodes* species (Hymenoptera: Braconidae), and an evolutionary hypothesis. In: Melika G, Thuróczy C (Eds) Parasitic Wasps: Evolution, Systematics, Biodiversity and Biological Control. Agroinform, Budapest, 321–327.

Sheng ML (2011) Five new species of the genus *Cryptopimpla* Taschenberg (Hymenoptera, Ichneumonidae) with a key to species known from China. ZooKeys 117: 9–49. https://doi.org/10.3897/zookeys.117.1302

Sheng ML, Zheng H (2005) The genus *Cryptopimpla* from China (Hymenoptera, Ichneumonidae). Acta Zootaxonomica Sinica 30: 415–418.

Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. https://www.simplemappr.net [Accessed 2022/07/28]

Snijman D, Perry P (1987) A floristic analysis of the Nieuwoudtville Wild Flower Reserve, north-western Cape. South African Journal of Botany 53: 445–454. https://doi.org/10.1016/S0254-6299(16)31378-3

Takasuka K, Watanabe K, Konishi K (2011) Genus *Cryptopimpla* Taschenberg new to Sulawesi, Indonesia, with description of a new species (Hymenoptera, Ichneumonidae, Banchinae). Journal of Hymenoptera Research 23: 65–75. https://doi.org/10.3897/jhr.23.1595

Taschenberg EL (1863) Die Schlupfwespenfamilie Pimplariae der deutschen Fauna, mit besonderer Rücksicht auf die Umgegend von Halle. Zeitschrift für die Gesammten Naturwissenschaften 21: 245–305.

Topp EN, Loos J (2019) Fragmented landscape, fragmented knowledge: a synthesis of renosterveld ecology and conservation. Environmental Conservation 46: 171–179. https://doi.org/10.1017/S0376892918000498

Townes HK (1969) Genera of Ichneumonidae, Part 3 (Lycorininae, Banchinae, Scolobatinae, Porizontinae). Memoirs of the American Entomological Institute 13: 1–307.

Townes HK, Townes M (1978) Ichneumon-flies of America north of Mexico: 7. Subfamily Banchinae, tribes Lissonotini and Banchini. Memoirs of the American Entomological Institute 26: 1–614.

van Noort S (2019) Assessing the status quo of Afrotropical ichneumonid knowledge. Conference: identifying the next challenges in ichneumonid systematics and evolutionary ecology. Basel, Sweden, 24–29 June 2019. https://doi.org/10.5281/zenodo.3395821

van Noort S (2022) Keynote presentation: Darwin wasps for Africa: Status quo of Afrotropical Ichneumonidae. #HYMATHON2022 A 24-hour virtual symposium from the International Society of Hymenopterists. 31 March–1 April 2022.

van Noort S (2023a) WaspWeb: Hymenoptera of the Afrotropical region. www.waspweb.org [Accessed on 24 March 2023]

van Noort S (2023b) Thirty years of sampling effort and status quo of African Darwin wasp diversity (Ichneumonidae, Hymenoptera). 23rd Congress of the Entomological Society of Southern Africa (ESSA), 12–14 July 2023, Stellenbosch University, Stellenbosch, South Africa.

van Wyk AE, Smith GF (2001) Regions of floristic endemism in southern Africa: A review with emphasis on succulents. Umdaus Press (Hatfield, South Africa), 199 pp.
Von Hase A, Rouget M, Maze K, Helme N (2003) A fine-scale conservation plan for Cape lowlands renosterveld: technical report. Report CCU [www document]. http://bgis.sanbi.org/clr
Wahl DB, Sharkey MJ (1993) Chapter 10. Superfamily Ichneumonoidea. In: Goulet H, Huber JT (Eds) Hymenoptera of the World: An Identification Guide to Families. Agriculture Canada: 358–509.
Yu DSK, van Achterberg C, Hortsmann K (2016) Taxapad 2016, Ichneumonidae 2011. www.taxapad.com [Accessed on 30/11/2018]

Supplementary material 1

The output of *Cryptopimpla* (Ichneumonidae, Hymenoptera) specimen data digitized into the Iziko South African Museum Specify 6 database provided as a supplementary excel file

Authors: Terry Reynolds, Simon van Noort

Data type: xls

Link: https://doi.org/10.3897/jhr.96.104038.suppl1

Supplementary material 2

Lucid Interchange Format version 3 (LIF3) files to the WaspWeb online Lucid matrix identification key to Afrotropical species of Cryptopimpla (Ichneumonidae, Hymenoptera)

Authors: Terry Reynolds, Simon van Noort

Data type: lif3

Explanation note: The LIF3 file is an XML-based file that stores all the Lucid3 key data, allowing exchange of the key with other key developers.

Link: https://doi.org/10.3897/jhr.96.104038.suppl2