Entomofauna

ZEITSCHRIFT FÜR ENTOMOLOGIE

Supplement 13, 96 Seiten ISSN 0250-4413 Ansfelden, 15. Mai 2007

Bees of the genus *Ceratina* LATREILLE in southern Africa (Hymenoptera, Apoidea)

C. EARDLEY & H.V. DALY

Abstract

This article provides keys for the identification of the 29 valid species of *Ceratina* that occur in southern Africa, and descriptions, the taxonomic history, collection records and biological notes for these species. Eight new species are here described and thirty new synonyms are proposed. The new species are: *C. ballotae*, *C. hexae*, *C. whiteheadi*, *C. barbarae*, *C. gnoma*, *C. stuckenbergi*, *C. braunsi* and *C. namibensis.* The new synonymies are (senior synonyms first): *C. perpolita* = *C. perpolita rowlandi*; *C. citrinifrons* = *C. subulatella*; *C. liliputana* = *C. subulata; C. aliceae* = *C. pondoensis*; *C. subquadrata* = *C. bicarinata*, *C. braunsiana*, *C. braunsiana alpha*, *C. braunsiana beta*, *C. braunsiana delta*, *C. braunsiana gamma* and *C. decipiens*; *C. nigriceps* = *C. holomelas*, *C. penicillifera*, *C. politula* and *C. penicillifera griseipennis; Ceratina nyassensis* = *C. rugosifrons* and *C. albinasis*; *C. minuta* = *C. alberti* and *C. microsoma*; *C. labrosa* = *C. emarginata*; *C. speculifrons* = *C. natalensis; C. durbanensis* = *C. opaca*; *C. daressalamica* = *C. furcilinea* and *C. pallidipes; C. nasalis* = *C. nasalis* var. *viriditincta*, *C. nasalis* var. *arida*, *C. nasalis viridior*, *C. acutipyga* and *C. pileifera*; and *C. inermis* = *C. turneri.* Biological observations include: nests of *Ceratina aloes* may have unique side entrances gnawed open by the ♀; nest of *Ceratina hexae* new species with 17 cells that are probably the work of two ♀♀; and nest of *Ceratina barbarae* new species with a unique distribution of sexes in pairs of cells.

K e y w o r d s : Botswana, Lesotho, Mozambique, Namibia, South Africa, Zimbabwe, pollen collector, food plants.

Zusammenfassung

In dieser Arbeit werden Bestimmungstabellen für die 29 im südlichen Afrika vorkommenden *Ceratina*-Arten vorgestellt, einschließlich Beschreibungen, taxonomische Gegebenheiten, die Auswertung von Sammlungsmaterial und biologische Angaben. Acht neue Arten (*C. ballotae*, *C. hexae*, *C. whiteheadi*, *C. barbarae*, *C. gnoma*, *C. stuckenbergi*, *C. braunsi* and *C. namibensis*) wurden beschrieben, folgende dreissig neue Synonyme herausgearbeitet (die älteren Synonyme zuerst genannt): *C. perpolita = C. perpolita rowlandi*; *C. citrinifrons = C. subulatella*; *C. liliputana = C. subulata; C. aliceae = C. pondoensis*; *C. subquadrata = C. bicarinata*, *C. braunsiana*, *C. braunsiana alpha*, *C. braunsiana beta*, *C. braunsiana delta*, *C. braunsiana gamma* und *C. decipiens*; *C. nigriceps = C. holomelas*, *C. penicillifera*, *C. politula* und *C. penicillifera griseipennis; Ceratina nyassensis = C. rugosifrons*, *C. albinasis* und *C. brevimaculata; C. minuta = C. alberti* und *C. microsoma*; *C. labrosa = C. emarginata*; *C. speculifrons = C. natalensis; C. durbanensis = C. opaca; C. daressalamica = C. furcilinea* und *C. pallidipes; C. nasalis = C. nasalis* var. *viriditincta*, *C. nasalis* var. *arida*, *C. nasalis viridior*, *C. acutipyga*, *C. pileifera*; und *C. inermis = C. turneri.* Die biologischen Beobachtungen behandeln die Arten *Ceratina aloes*, *Ceratina hexae* und *Ceratina barbarae*.

Introduction

Ceratina LATREILLE are small, pollen collecting bees. They bore their nests into dry, mostly pithy, plant stems, and therefore have earned the common name of small carpenter bees. They divide a single nest tunnel, along its length, into separate cells much like large carpenter bees of the genus *Xylocopa* LATREILLE (WATMOUGH 1974); unlike most other small carpenter bees (allodapine bees) that do not divide their nests into cells (MICHENER 1971). *Ceratina* contributes to pollination, as an essential ecosystem service, and the species are negatively affected by the removal of dead stems from the ecosystem; through fire and the collection of fire wood. More information is needed on the role of *Ceratina* in pollinating wild plants and agricultural crops. There are unlikely to be any species with unique food plant requirements (monolectic), but they apparently focus on certain plant groups (S. Gess, personal communications). This article is intended to stimulate further research on the biology, food plant preferences and conservation status of *Ceratina*, and help discover new species to inventory southern Africa's biodiversity.

In the Afrotropical Region the small carpenter bees comprise the tribes Ceratinini and Allodapini, and the large carpenter bees are Xylocopini; all within the family Apidae (MICHENER 2000). Ceratinini has two genera: *Ceratina* and *Megaceratina* HIRASHIMA ; Allodapini has seven African genera: *Allodape* LEPELETIER & SERVILLE, *Allodapula* COCKERELL, *Braunsapis* MICHENER, *Eucondylops* BRAUNS, *Compsomelissa* ALFKEN, *Macrogalea* COCKERELL and *Nasutapis* MICHENER; and Xylocopini has only *Xylocopa* (MICHENER 2000). *Ceratina* comprises five subgenera of which *Ctenoceratina* DALY & MOURE and *Simioceratina* DALY & MOURE were revised by DALY (1988), both as subgenera of the genus *Ctenoceratina* (*Ctenoceratina* and *Simioceratina* were given equivalent subgeneric status within *Ceratina* by MICHENER 2000). The southern African species of the remaining subgenera: *Ceratina* sensu stricto, *Pithitis* KLUG, *Protopithitis*

HIRASHIMA and *Ceratina* incertae sedis, which cannot be identified using the key to subgenera in MICHENER (2000), are the subject of this article. The proper placement of the latter group requires a world-wide revision of the subgenera.

Ceratina are fairly easy to identify. They are long-tongued bees with three submarginal cells, a curved basal vein in the forewing, but not as curved as in the Halictidae, and the scopa on the hind tibia. They are mostly black, often with yellow maculation on the face, pronotal lobe and legs (two species have a distinct red metasoma and four are metallic blue, green or gold).

The manuscript for this article was originally written by H.V. Daly (HVD), and finalized by C. Eardley (CE). Both authors studied all the type material. No infraspecific categories are considered to be definable taxa and if not previously synonymized that is done here. The biological notes are entirely the work of HVD.

TERZO & PAULY (in PAULY et al. 2001) and TERZO et al. (in press), as parts of more comprehensive studies, described two new subgenera of *Ceratina* to which they assigned a few southern African species. They had not studied all the southern African species and therefore did not place many of them into subgenera. We have retained MICHENER's (2000) subgeneric classification and not placed any of our species into the new subgenera because of the degree of uncertainty around the subgeneric placement of a few species. To try and apply part of their ongoing studies in our article would cause unnecessary confusion. The purpose of our article is to enable the identification of the southern Africa species of *Ceratina* and not to conduct a subgeneric review in parallel with Terzo and his collaborators.

Biological Studies

Female *Ceratina* excavate burrows in the pith of dead, dry stems of plants; sometimes dead stems on living plants. A single ♀ usually constructs the nest, but in certain species some nests may be constructed by two or rarely more ♀♀ (Fig. 7a; MICHENER 2000). Beginning at the end of the burrow furthest from the entrance, the ♀ provisions the first "cell" with a loaf of pollen mixed with honey. She lays an egg on the loaf with the anterior end of the egg oriented toward the exit of the burrow. She then seals the cell with a partition of firmly packed, pith particles, that is usually concave. The walls of the burrow and pith partitions are water repellent because of wax deposited from abdominal glands of the ♀. The pith partition becomes the base for the next cell or, in some nests, the next cell to be provisioned is separated from the former cell by an empty intercalary cell. The latter is created by a pith partition, often loosely packed, followed by an empty space, and then a second partition that often has the upper surface firmly packed and concave. When not collecting provisions outside the nest, the ♀ remains near the nest entrance, often within a slightly enlarged space called the sentry chamber. After the series of cells are provisioned and eggs are laid, she continues to defend the nest against intruders. The immatures develop without diapause in a sequence which can be described as: live egg on pollen loaf (dead eggs collapse into a film on the loaf); small white larva; small yellow larva (ingestion of pollen has begun); larva equal to length of pollen loaf; full grown larva (no food left); white eyed pupa (sex of pupae can be distinguished); brown eyed pupa; black eyed pupa; gray body pupa; black body pupa; milky winged

adult (just after final ecdysis); and adult ♂ or ♀ (wings sclerotized and clear). Development of the large *Ceratina aloes* takes about 2.5 months from egg to adult with milky wings. In temperate regions the young adults spend the winter in the brood nest and in the spring disperse, mate, and construct new nests. During inactive seasons in tropical regions a few adult bees of both sexes can be found in nests without brood cells.

♀ bees usually build nests in dead, dry stems that have been broken, cut, burned, or chewed by mammals thus exposing the pith core; males don't participate in nest building. However, some *C. aloes* ♀♀ are apparently able to gnaw into the flowering stalks of *Cotyledon paniculatum* and create a side entrance for their nest (Fig. 2d). *Ceratina* nests are usually not found in green stems, but BRAUNS (1926a) reports *Ceratina labrosa* nesting in green peduncles of *Aloe* in the manner of some wasps, such as *Thyreopus* (=*Dasyproctus*) sp. In the same article he describes *Xylocopa* spp. nesting in living aloe inflorescence, but this has not been seen since and is regarded with circumspection.

Biological studies were conducted by HVD in southern Africa during October to December, 1970. Tips of dead stems and flower stalks were examined for the characteristic clean round entrance holes in the central pith of stems. Stems with holes were cut about 300-600mm from the hole, which was closed with tape, and removed stems were placed in a plastic bag and kept cool until examined within a few hours. The stems were opened by longitudinal splitting with a sharp knife. Diameters were taken with a Helios dial caliper to the nearest 0.1 mm; depths were taken with a steel tape to the nearest 1.0 mm. Measurements are reported here as the mean ± standard error of the mean and the sample size. Each nest with bees or brood was assigned a unique number and the following was recorded: plant host; number of ♂ and ♀ adult bees; other arthropod occupants; outside diameter of the stem at the entrance; diameter of nest at the entrance, just below the entrance (sentry chamber), at the level of the first brood cell, and total length of nest burrow. If brood cells were present, the lowest cell (first to be constructed) was assigned the letter "a," the next "b," and so forth, so that cell "747c" is the third cell from the bottom of nest 747. Lengths of individual brood or intercalary cells of some nests were measured as well as the thickness of the pith partitions. Adult bees were preserved in Kahle's fluid and were later pinned. Immatures were either preserved in Kahle's fluid or kept alive in individual gelatin capsules until maturity. The nest number and cell designation was written in ink on the capsule. Capsules were arranged on double-stick tape in plastic petri dishes.

Taxonomic Methods

The length of the forewing, as a measure of body size, was taken to the nearest 0.1 mm from the wing tip to the base of the costal vein, just distad of the costal sclerite. Measurements of the head were previously illustrated (DALY 1983a). The numbers are millimetres × 100. As an aid for identification, the word "unique" is reserved for a morphological character that occurs in a single species treated in this study. The word "unusual" means the character occurs in only 2-3 species.

♀ bees have antennae 12 segmented, 6 exposed metasoma terga, apex of the metasoma pointed, and clypeus with or without a median ivory mark. ♂ bees have antennae 13 segmented, 7 exposed metasoma terga, end of the metasoma generally rounded, and the

clypeus is largely filled with a hat-shaped ivory mark (an exception is in *Ceratina hexae* new species in which the clypeal mark is small and oval).

Many species are difficult to separate. Therefore species-groups have been used to aid identification and to reduce confusion and repetition in the species comparisons. They comprise similar species, except in the first species-group *C. aloes* and *C. truncata* are distinctly bigger than the other species in the group. The species-groups have no phylogenetic significance. The diagnoses were designed to be brief aids for identifications, unique and unusual features are given first and then the features that are diagnostic in combination are recorded. Long diagnoses therefore indicate species that are difficult to identify. ♀♀ and ♂♂ are similar in size. Therefore size is not given for ♂♂ in the diagnoses. All species have mostly white vestiture. Only where vestiture is not white is its colour described. The vertical pronotal carina is on the dorsolateral region of the tergite, and its upper extreme coincides with the lateral edge of the pronotal collar. ♂ middle femora, if not modified, have the anterior and posterior edges converging towards the distal end of the femur, in ventral view; in the hind tibia the edges are parallel, otherwise it is described as swollen.

The co-ordinates for localities in the material examined were used to draw the distribution maps. Co-ordinates in square parentheses were not given on specimen labels. The abbreviations for collections are given in the acknowledgements. The illustrations of the ♂ sterna are ventral views, and the ♂ genitalia has the dorsal view on the left and the ventral view on the right.

Key to the southern African subgenera of Ceratinini

1 Tergum 2 without gradulus; either mostly black or metallic blue, green or gold (sometimes metallic integument largely confined to punctures); ♀ hind tibia without basitibial plate 2

- Tergum 2 with gradulus; mostly black and red, or weakly metallic greenish; ♀ mostly with a basitibial plate 3

2(1) Axilla spinose posteriorly; mandible curved inward ..... *Ceratina* (*Pithitis*)

- Axilla not modified; mandible straight ..... *Ceratina* (*Protopithitis*) *daressalamica* STRAND

3(1) Posterior margins of terga 2-5 and sterna 2-5 each with a row of coarse, posterior directed, setae, usually thickened, sometimes scale-like, sometimes interrupted medially; graduli on T2-T3 and S2-S3, not on T4 and S4 4

- Terga and sterna without bands of setae; graduli on T2-T4 and S2-S4 5

4(3) Scutellum strongly convex in profile, its posterior part nearly vertical; profile of metanotum and propodeum strongly declivous ..... *Ceratina* (*Simioceratina*)

- Scutellum gently convex in profile, its posterior part with metanotum and propodeum forming a gentle curve ..... *Ceratina* (*Ctenoceratina*)

5(3) Tergum 5 with gradulus ..... *Ceratina* (*Ceratina*)

- Tergum 5 without gradulus ..... *Ceratina* (incertae sedis)

Ceratina (*Simioceratina*) comprises three species all of whose distributions occurs partly in southern African. *Ceratina* (*Ctenoceratina*) has ten species; five occur in southern Africa. They can be identified using DALY (1988). In this article the species in *Ceratina* (*Ceratina*) and *Ceratina* (incertae sedis) are included in one key because the separating character, a gradulus in tergum 5, is often difficult to see. The subgenera *Pithitis* and *Protopithitis* are dealt with separately.

Key to the southern African species of
***Ceratina* (*Ceratina*) and *Ceratina* (incertae sedis)**

1 Mesosoma black, metasoma mostly reddish 2

- Mesosoma and metasoma black, blackish or weakly metallic green..... 3

2(1) ♀ with yellow facial maculation; ♂ unknown.....*Ceratina rhodura* COCKERELL

- ♀ clypeus black, ♂ with hat-shaped yellow maculation on clypeus ....*Ceratina whiteheadi*, **nov.sp.**

3(1) Mesosoma and metasoma black or blackish..... 4

- Mesosoma and metasoma weakly metallic green..... *Ceratina minuta* FRIESE

4(3) Axilla pointed posteriorly 5

- Axilla rounded posteriorly 7

5(4) Axilla sharply pointed; fore tibia partly yellow 6

- Axilla weakly pointed; fore tibia black ..... *Ceratina nativitatis* COCKERELL

6(5) Axilla, anterior to spine, convex mesally (both sexes)..... .....*Ceratina speculifrons* COCKERELL

- ♂ axilla concave mesally (♀ unknown).....*Ceratina durbanensis* COCKERELL

7(4) Alveolocellar area (between lateral ocellus and antennal socket) sparsely to densely punctured; alveolocellar groove absent or weakly developed..... 8

- Alveolocellar area virtually impunctate, usually polished; alveolocellar groove present and distinct..... 12

8(7) Pronotal lobe with integument dark, pubescence white; ♀ clypeus usually black, sometimes with a very small yellow median mark; small bees, wing length less than 4.0 mm; ♀ mandible with a dorsal, basal, angular protuberance; ♂ hind tibia with hair pencil on ventral surface; tergum 6 with pubescent, median keel; tergum 7 with shallowly emarginated, apex (Fig. 21d)..... 9

- Pronotal lobes yellow; ♀ clypeus with yellow maculation; size variable; ♀ mandible unmodified; ♂ hind femur with or without hair pencil; ♂ tergum 6 variable; apex of ♂ tergum 7 variable..... 10

9(8) ♀ unknown; ♂ clypeus black; fore and hind tibiae partly yellow .... *Ceratina pacis* COCKERELL

- ♀ as in couplet 8, ♂ clypeus partly yellow; fore and hind tibiae black ....*Ceratina nigriceps* FRIESE

10(8) ♀ with clypeus weakly pointed apicomedially; ♂ with hair pencil on ventral surface of hind femur; tergum 7 with small tubercle apicomedially .... *Ceratina namibensis*, **nov.sp.**

- ♀ with clypeus distinctly concave apicomedially; ♂ femur without hair pencil; tergum 7 apparently either tuberculate or carinate 11

11(10) Large bees, wing length 5 mm or more; ♀ with apex of clypeus broadly and evenly emarginate, strongly bilobed in larger specimens; ♂ tergum 6 with mediolongitudinal carina ..... *Ceratina labrosa* FRIESE

- Small bees, wing length 4.5 mm or less; ♀ with apex of clypeus shallowly emarginate medially; ♂ tergum 6 with rounded tubercle ..... *Ceratina nyassensis* STRAND

12(7) Pronotal lobes dark; large bees, ♀ wing length about 5.7-7.0 mm, ♂ wing length about 5.0-6.0 mm; ♀ clypeus without an ivory mark 13

- Pronotal lobes mostly ivory, body size and clypeal maculation variable; if lobes dark, then bees small, wing length about 4 mm 14

13(12) ♀ head polished, virtually impunctate, lower paraocular with only fine, widely separated punctures if any; half or more of hypoepimeral area impunctate; ♂ clypeal mark broad at apex, filling full width of clypeus; lower paraocular area with impunctate area near tentorial pits ..... *Ceratina aloes* COCKERELL

- ♀ head sparsely punctured, lower paraocular areas with distinct punctures, widely separated to as close as a puncture's width apart; less than half of hypoepimeral area impunctate; ♂ clypeal mark narrowed apically, apicolateral parts of clypeus dark, dull with fine punctures; lower paraocular area densely punctured throughout ..... *Ceratina truncata* FRIESE

14(12) Females, 12 antennal segments, 6 visible metasomal terga 15

- Males, 13 antennal segments, 7 visible metasomal terga 27

15(14) Clypeal maculation absent, if present, weakly developed, wing length about 2.4 mm and paraocular areas impunctate 16

- Clypeal maculation present, sharply defined; size variable 20

16(15) Basitibial spine within basal third of hind tibia or absent; with or without ivory marks on legs 17

- Distinct basitibial spine near middle of hind tibia; no ivory marks on legs ..... *Ceratina hexae*, **nov.sp.**

17(16) Mesopleuron just beneath hypoepimeral area rough, irregularly punctured, some pits confluent or cuticle surface at least minutely roughened 18

- Mesopleuron uniformly punctured, about a puncture width apart or more, cuticle surface between pits smooth 19

18(17) Small bee, wing length about 2.4 mm; dorsolateral angles of pronotum sharply defined, with visible ridge; scutum densely punctate anteriorly ..... *Ceratina subscintilla* COCKERELL

- Very small bees, wing length less than 2.0 mm; pronotum unmodified; scutum almost completely glabrous ..... *Ceratina electron* COCKERELL

19(17) Parapsidal lines short and shallow ..... *Ceratina perpolita* COCKERELL

- Parapsidal lines long (more than half as long as scutum) and distinct ..... *Ceratina ballotae*, **nov.sp.**

20(15) Mesopleuron densely punctured with coarse, deep, contiguous, subpolygonal punctures; hypoepimeral area mostly punctured; large bees, wing length 4 mm or greater (gena sometimes elongate, longer than eye width) 21

- Mesopleuron with medium to fine, shallow, round punctures of variable density; lower hypoepimeral area impunctate; smaller bees, wing length less than 4 mm 22

21(20) Pronotum width between dorsolateral angles normal, equal to about three-fourths width at pronotal lobes (Figs 16c-d); dorso-posterior edge of pronotum between angles straight; dorsolateral angles of pronotum and anterior edge of mesoscutum usually densely punctured, pubescent, dull; shape of head and procoxae normal, dimensions slightly altered in larger specimens ..... *Ceratina subquadrata* SMITH

- Pronotum width between dorsolateral angles unusually narrow, equal to about half width at pronotal lobes (Figs 16a-b); dorso-posterior edge of pronotum concave; dorsolateral angles of pronotum and anterior edge of mesoscutum sparsely punctured, shiny; dimensions of head and procoxae greatly altered in larger specimens: eyes strongly divergent below, mandibles long, labrum triangular, procoxae distorted, ventral edge carinate..... *Ceratina braunsi*, **nov.sp.**

22(20) Propodeum with sculpturing of dorsobasal and declivous posteromedian areas continuous, coriaceous throughout even though more coarsely so basally; central portion of tergum 1 coriaceous..... 25

- Sculpturing of dorsobasal area of propodeum coarsely coriaceous and distinctly different from shiny, declivous posteromedian area; central portion of tergum 1 largely shiny between punctures 23

23(22) Face almost devoid of punctures; lateral ocellus a little below head summit, separated from occiput by ocellus diameter; scutum almost entirely impunctate, glabrous; basitibial plate absent .....*Ceratina citrinifrons* COCKERELL

- Face sparsely punctured; lateral ocellus near head summit, separated from occiput by half ocellus diameter; impunctate area of scutal disk not interrupted medially, except by scattered punctures; basitibial plate present 24

24(23) Scutum densely punctate anteriorly and posteriorly, glabrous medially (across entire width of scutum); fore tibia yellow basodorsally ....*Ceratina barbarae*, **nov.sp.**

- Scutum sparsely punctate and glabrous medially; dorsal surface of fore tibia mostly yellow.....*Ceratina gnoma*, **nov.sp.**

25(22) Pterostigma large, about as long as first submarginal cell; ventro-distal surface of fore femur yellow..... *Ceratina stuckenbergi*, **nov.sp.**

- Pterostigma not enlarged; fore femur black 26

26(25) Scutum with anterior area sparsely punctate, glabrous; lateral ocellus a little below head summit, separated from occiput by an ocellus diameter .... *Ceratina liliputana* COCKERELL

- Scutum densely punctate anteriorly, and with mediolongitudinal band with fine, dense punctures; mediolateral region of scutum impunctate; lateral ocellus near head summit, separated from occiput by less than ocellus diameter .... *Ceratina aliceae* COCKERELL

27(14) Clypeus with oval, mediolongitudinal yellow area 28

- Entire clypeus yellow..... 30

28(27) Most of mediolongitudinal region of clypeus yellow; scutum mostly impunctate and glabrous .....*Ceratina citrinifrons* COCKERELL

- Yellow on medio-distal region of clypeus not quite reaching dorsal edge of clypeus; scutum mostly punctate..... 29

29(28) Face largely impunctate and glabrous; scutum partly shiny ..... *Ceratina hexae*, **nov.sp.**

- Face moderately punctate, shiny between punctures; scutum mat, with reticulate sculpture ..... *Ceratina aliceae* COCKERELL

30(27) Tergum 6 with medio-distal carina or spine 31

- Tergum 6 unmodified 32

31(30) Tergum 6 with medio-distal spine; pronotum width between dorsolateral angles unusually narrow, equal to about half width at pronotal lobes (Figs 16a-b) ..... *Ceratina braunsi*, **nov.sp.**

- Tergum 6 with medio-distal carina; pronotum width between dorsolateral angles normal, equal to about three-fourths width at pronotal lobes (Figs 16c-d) ..... *Ceratina subquadrata* SMITH

32(30) Hind tibia swollen, distal region much thicker than proximal region, much thicker than middle tibia 33

- Hind tibia with normal shape, distal region little thicker than proximal region, little thicker than middle tibia 35

33(32) Middle femur weakly expanded medially, posterior edge rounded; about 2.4 mm long 34

- Middle femur not expanded, about 1.7 mm long ..... *Ceratina electron* COCKERELL

34(33) Hind femur not thickened, hind tibia thicker than hind femur ..... *Ceratina subscintilla* COCKERELL

- Hind femur thickened, hind tibia about as thick as hind femur ..... *Ceratina gnoma*, **nov.sp.**

35(32) Pterostigma large, about as long as first submarginal cell; ventro-distal surface of fore femur yellow ..... *Ceratina stuckenbergi*, **nov.sp.**

- Pterostigma not enlarged; fore femur black 36

36(35) Tergum 7 with apex slightly emarginated or convex medially 37

- Tergum 7 with with posteromedian tubercle 38

37(36) Hind tibia a little expanded, weakly bowed medially; face densely punctate; propodeum mat, with reticulate sculpture ..... *Ceratina perpolita* COCKERELL

- Hind tibia not expanded, about parallel sided; face sparsely punctate and shiny; propodeum shiny ..... *Ceratina ballotae*, **nov.sp.**

38(36) Posteromedian process on tergum 7 very small; mediolongitudinal region of scutum punctate ..... *Ceratina barbarae*, **nov.sp.**

- Posteromedian process on tergum 7 distinct (Fig. 10d), scutum mostly glabrous ..... *Ceratina liliputana* COCKERELL

Ceratina (*Ceratina*)

Ceratina LATREILLE, 1802: 380. Type species: *Hylaeus albilabris* FABRICIUS, 1793 = *Apis cucurbitina* ROSSI, 1792; SPINOLA 1843: 141; KOHL 1894: 279; COCKERELL and PORTER 1899: 404-406; FRIESE 1903: 33; FRIESE 1905: 1-18; FRIESE 1909a: 85, 149, 190-191, 212, 260; FRIESE 1909b: 132-136; FRIESE 1911: 123; STRAND 1912b: 133-134; COCKERELL 1912: 30; BRAUNS 1913: 119; FRIESE 1915: 266; FRIESE 1916: 436, 439; STRAND 1921: 271; FRIESE 1921: 1096; FRIESE 1925: 530; BRAUNS 1926a: 194-198; 1926b: 418, 422, 425-426; HESSE 1934: 411, 424-425; COCKERELL 1937e: 1; SANDHOUSE 1943: 536; SKAIFE 1953: 4, 11, 353; BENOIST 1962: 108, 138; MICHENER 1969: 248; MICHENER 1970: 1-3, 11-12, 14, 16, 20; MICHENER 1971: 227-229, 284, 293-294; MICHENER 1973: 281-284; ROZEN & MCGINLEY 1974: 12; PRINS 1978: 856; GESS 1981: 32, 63, 64, 65, 66, 75, 76; DALY 1983a: 29-62; SAKAGAMI & MICHENER 1987: 439, 442-443; DALY 1988: 2, 6, 7; MASON 1989: 489; GESS & GESS 1990: 26, 28; 1991: 86; STRUCK 1994: 100-107; GESS 1996: 156, 173, 272-273, 275, 284, 286, 288, 291-294, 296, 299-302; MICHENER 1997: 14; PAULY 1998: 51; MICHENER 2000: 6, 22, 24, 72-73, 76, 84, 585-599, 600-602, 626; EARDLEY 2000: 370; TERZO & PAULY in PAULY et al. 2001: 287-303.

Ceratina (*Ceratina*) LATREILLE: MICHENER 2000: 594-597.

Ceratina sensu stricto does not have a conspicuous diagnostic feature; being recognized by a five segmented maxillary palpus, no combs of setae on the distal edges of the metasomal terga and sterna, an unmodified axilla and a gradulus on tergum 5, and the absence of metallic integument. They are mostly black (*C. whiteheadi* and *C. rhodura* have a red metasoma), with straight mandibles and graduli on terga and sterna 2-5. *Ceratina* sensu stricto comprises three species-groups and 17 species.

Ceratina (*Ceratina*) species-groups

The *C. aloes* species-group comprises a mixture of large and small species. The ♀ lower face is clearly convex, largely impunctate and glabrous, the clypeus reaches to below the eyes and is always completely black, the alveolocellar groove is distinct and straight, the upper paraocular area is gently convex, the mandible is without an inner subapical tooth, the pronotum is not narrow, as in *C. braunsi*, and tergum 6 is concave dorsally. The ♂ lower face is flat, the upper paraocular area is gently convex, the pronotum is not narrow, as in *C. braunsi*, the middle femur is without tufts of hair, in ventral view, the hind femur is without tubercle or facet and the medioposterior region of tergum 6 is not modified. The species-group comprises eight species; *C. aloes*, *C. truncata*, *C. perpolita*, *C. ballotae*, *C. subscintilla*, *C. hexae*, *C. electron* and *C. whiteheadi*. *Ceratina aloes* and *C. truncata* are most similar to one another in that they are substantially larger than all the other species in this species-group. *Ceratina perpolita*, *C. ballotae*, *C. subscintilla*, *C. hexae* and *C. electron* resemble one another closely and are difficult to separate. They can be identified by the combinations of characters given in the diagnoses under each species. *Ceratina whiteheadi* is unique within this group in that the metasoma is red, but it must not be confused with *C. rhodura*, in which the ♀ clypeus is partly yellow. The ♂ of *C. rhodura* is unknown.

The *Ceratina citrinifrons* species-group comprises those species in which the ♀ has the lower part of the face strongly convex, largely impunctate and glabrous, the clypeus reaches to below the eyes, the alveolocellar groove is indistinct, the clypeus is partly yellow, the mandible is without an inner subapical tooth, the pronotal lobe is not narrow

as in *C. braunsi*, and tergum 6 is concave dorsally. Males have the lower part of the face weakly convex, impunctate and glabrous, a distinct alveolocellar groove, the upper paraocular area convex, the pronotal lobe broad (not narrow as in *C. braunsi*), and no diagnostic tufts of hair or fascia on the legs. The included species are: *C. citrinifrons*, *C. liliputana*, *C. barbarae*, *C. gnoma*, *C stuckenbergi*, *C. aliceae* and *C. rhodura*. They are all small bees that resemble one another closely and are difficult to separate. They can be identified by the combinations of characters given in the diagnoses under each species. *Ceratina rhodura* is unique within the group in that the metasoma is red, but it must not be confused with *C. whiteheadi*.

The *C. subquadrata* species-group comprises two large species. Both sexes have the lower part of the face flat, the paraocular area densely punctate and a straight or weakly bowed alveolocellar groove, the mediolongitudinal region of the clypeus is yellow, the mandible is without an inner, subapical tooth and tergum 6 is concave dorsally. In males the upper paraocular area is weakly convex. This group comprises *C. subquadrata* and *C. braunsi*, which, in both sexes, are separated by the width of the pronotum in dorsal view (Fig. 16).

The *Ceratina aloes* species-group

Ceratina aloes COCKERELL (Figs 1a-I, 2a-d, 3)

Ceratina aloes COCKERELL 1932a: 272; COCKERELL 1937e: 4, 41; ANONYMOUS 1958: 30; DALY 1973: 384, 385; 1985: 342; DALY & ELSE 1988: 88; STRUCK 1992: 75, 77, 79, 82; STRUCK 1994: 12.

D i a g n o s i s : ♀ large (wing length 5.7-7.0 mm); head and scutum glabrous (nearly impunctate, very smooth, very shiny (Figs 1a-1c)); completely black (no pale yellow facial maculation, dark pronotal lobes); dark smoky wings. ♂ clypeus almost entirely pale yellow, extreme apicolateral areas with a little black (Fig. 1d); paraocular area moderately punctate (punctures about a puncture diameter apart); middle femur not modified.

D i s t r i b u t i o n (Fig. 3): South African, mostly western but also in southern and central regions of the Karoo, west of Willowmore.

D e s c r i p t i o n : Measurements: ♀ (lectotype): wing, 6.7 mm; hamuli, 6-7; eye, 190: 195: 200: 205; clypeus, 105 × 190: 50: 115; interocellar, 40: 62: 50: 75, D 22; frontal carina, 80; malar area, 0 × 80; interalveolar, 50: 50: 56: 70, D 20; antenna, 80: 20: 20: 12: 12: 15, D 15. (Nieuwoudtville): wing, 4.0 mm; hamuli, 5; eye, 107: 108: 102: 94; clypeus, 85 × 60: 26: 68; interocellar, 28: 33: 16: 12, D 22; frontal carina, 46; malar area, 0 × 51; interalveolar, 28: 26: 34: 39, D 11; antenna, 40: 11: 5: 6: 6: 6, D 16.

♂ (Willowmore): wing, 6.1 mm; hamuli, 6; eye, 174: 168: 145: 132; clypeus, 94 × 113: 139: 19: 81; interocellar, 29: 48: 32: 48: 23, D 19; frontal carina, 58; malar area, 0 × 42; interalveolar, 42: 32: 45: 48, D 13; antenna, 65: 16: 19: 10: 23: 16, D 16. (Nieuwoudtville): wing, 3.6 mm; hamuli, 5; eye, 101: 85: 70: 65; clypeus, 62 × 56: 20:

54; interocellar, 20: 22: 8: 20, D 19; frontal carina, 43; malar area, 0 × 23; interalveolar, 23: 14: 14: 34, D 9; antenna, 34: 11: 9: 5: 6: 8, D 11.

Colour and Structure: ♀. Integument black, sometimes small, obscure, pale yellow spot at base of tibiae; wings distinctly brown, weakly transparent. Vestiture orangish on ventral surfaces of tarsi and sternum 6. Head almost devoid of punctures, glabrous; alveolocellar groove sharp, distinct, straight; lateral ocellus well below head summit (Fig. 1a), 1.5× ocellus diameter from occiput; lower region of face convex, clypeus gently convex, length about 0.6× width; genal area distinctly wider than eye (Fig. 1b); mandible unmodified, length about 0.75× clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, without vertical carina; impunctate, glabrous area of scutum large, about half scutum length (Fig. 1c); parapsidal line not depressed, weakly visible; pterostigma length less than half marginal cell length (1:0.41); basitibial plate small, inconspicuous, near base of hind tibia (0.27 X tibia length from base); propodeum gently curved, finely and densely sculptured anteriorly, glabrous posteriorly; tergum 6 gently concave medially.

♂. Integument black with yellow maculation on entire clypeus, except extreme ventrolateral region (Fig. 1d), mediolongitudinal region of labrum, dorsal surface of fore femur, small, basal spot on middle tibia, dorsal surface of hind tibia; wings distinctly brown and weakly transparent. Vestiture on ventral surfaces of tarsi yellow or orange. Head mostly moderately punctate, upper face and clypeus sparsely punctate, glabrous, impunctate near tentorial pits; alveolocellar groove sharp, distinct, straight; paraocular area gently convex; lateral ocellus a little below head summit (Fig. 1d), an ocellus diameter from occiput; clypeus flat, length about 0.74× clypeus width (Fig. 1d), upper width distinctly greater than width of paraocular area at upper extreme of clypeus; gena narrower than eye (Fig. 1e); mandible length about half clypeus width; scutum centre almost impunctate, perimeter sparsely punctate (Fig. 1f); pterostigma length less than half marginal cell length (1:0.40); middle femur not expanded (cf. *C. truncata*), posterior edge straight; hind femur without basal facet; hind tibia swollen; without a basitibial plate; propodeum gently curved, finely and densely sculptured anteriorly, sparsely punctate posteriorly; posterior edge of tergum 7 broad, gently concave medially (Fig. 1g); sternum 6 and genital capsule as illustrated (Figs 1h-i).

R e m a r k s : See *C. truncata*.

B i o l o g y : *Ceratina aloes* was collected in nests at the following locations: Cape Province. Barrydale, 38.8 km W, 10-xi-1970, in *Cotyledon paniculatum* (24 nests, 8 with *Anthrax caffer* [Bombyliidae] larvae and 6 with *Gasteruption exsectum* [Gasteruptiidae] larvae); Ladismith, 10 km SE, Winkelpass Road, 27.x.1970, in *Cotyledon paniculatum* (1 nest); Worcester, Karoo Gardens, 14.x to 4.xi.1970, in *C. paniculatum* (18 nests, 2 with *G. exsectum* larvae) and *Cotyledon orbiculata* (3 nests); Lamberts Bay, 4.x.1974 and x.1974 (1 nest each), in *Aloe mitriformis*.

Nests of *Ceratina aloes* were found most frequently in dead, dry flower stalks of *Cotyledon paniculatum* and less frequently in stalks of *C. orbiculata*. At Karoo Gardens the stalks of *Cotyledon* occupied by *C. aloes* had mostly been broken near the top of the stalk, where the nest entrances were; a few had side entrances. Side entrances were common at Barrydale where unbroken stalks were occupied by *C. aloes* (Figs 2a, d). These nest entrances were round, about 3.6-4.7 mm in diameter just below the base of

the lower flower pedicel, and often concealed on the lower side of decumbent stalks. The wall of the stalk near the pedicel was thin; 0.5 mm thick, and some entrances had a gnawed area adjacent to the hole. Other stalks had a nest hole where a large pedicel had been torn away, but never where the base of the torn away pedicel was smaller than about 3.7 mm in diameter; apparently the surrounding integument was too tough to enlarge as a nest entrance. Some intact, unoccupied stalks had no hole, but had the same gnawed spot on the main stalk below a pedicel as if entry was unsuccessful. The holes through the sides of the stalks and the gnawed spots appear to be the work of *C. aloes* because there was no evidence of other equally large twig-nesting insects. Making nest entrances through unbroken stalks is unique to *Ceratina*, among small carpenter bees. Such behavior makes both broken and unbroken stalks available for nests. Side entrances are known elsewhere among twig-nesting bees in the related tribe Manueliini and are common in Xylocopini (DALY et al. 1987).

For 16 stalks with broken tips, the outside diameter was 5.9 ± 0.25 mm. The sentry chamber, if present, was just below the entrance and was 6-10 mm long with inside diameter about 5 mm. When disturbed, a ♀ bee in the sentry chamber makes a buzzing sound and emits a spicy odor. Below the sentry chamber the inside diameter of the 16 burrows was 4.4 ± 0.15 mm. At the bottom of the nest there is a pith plug that forms the base of the first cell.

A droplet of honey can often be seen in a new cell. After making the first honey droplet an initial loaf of pollen and honey that is moist, thin, flat, and almost the length of the cell is made. The complete loaf is quite moist and is shaped with a greatly enlarged anterior end (Figs 2b-c). The egg is about 5 mm long and usually placed at the posterior end of the loaf, but in one nest the first two cells had the eggs placed toward the middle of the loaves while all subsequent eggs were placed at the posterior end of the loaves. The cell is closed with a partition of packed pith that is concave on the upper side. The pith partitions and the walls of the burrow are water repellent. Ten cells in one nest measured 12.9 ± 0.16 mm in length, with pith partitions 2.1 ± 0.07 mm thick.

The number of cells in a nest is highly variable depending on the initial depth of the burrow, how long the provisioning has been in progress, and possibly how many ♀♀ participate. No intercalary cells were seen. Out of 46 nest burrows occupied by ♀ bees or brood, 41 (89 %) had 0-12 cells per nest and were 24-33 cm in length. A second group of 5 (11 %) nests had 16-19 cells per nest and were 29-38 cm in length. The majority of nests when collected were occupied by one ♀ bee, but in 5 (11 %) of the nests two adult ♀ bees were present. This is probably an underestimate of the number of nests with two ♀♀ because a second ♀ might be away from the nest at the time of collection. However, only one of the deeper nests had two ♀♀ so there is no clear association in these field collections that two resident bees were associated with deeper nest burrows and higher numbers of cells.

Judging by the discoloration and condition of the wall of the burrow, stalks are apparently reused from year to year as long as pith for the partitions can be scraped from the walls of the burrow. In 1970, nest provisioning and oviposition began in mid October and by late October nests had 8-12 cells. In early November nests had fully developed larvae. Brood collected in October and early November, and reared in gelatin capsules, became adults in early January. Several bees collected as eggs became adults with unsclerotized, milky wings 76 days later.

Mites, probably *Sennertia scutata* [Acari] (FAIN 1974), were frequently found on the first tergum of ♀ bees and on their brood, as well as on the walls of the nests. Large adult mites and eggs were present, in addition to immature instars. The mites may be beneficial associates by feeding on fungi. At Barrydale, from 1-6 bombyliid flies, *Anthrax caffer* HESSE, were reared or observed as larvae in each of 8 out of 24 nests. Fly larvae are ivory white in colour, without tubercles, and consume one bee larva. Adult flies apparently oviposit in the nest while the ♀ bee is away, and nests with two adult ♀ bees were also attacked. Fly larvae were found in the first cells as well as the last cells to be provisioned. Flies were not reared from other species of *Ceratina*. Also at Barrydale, from 1-3 gasteruptiid wasps, *G. exsectum* SCHLETT, were reared or observed in each of 6 nests. Wasp larvae are distinguished by dorsal and lateral tubercles on the first four metasomal segments. They consume more than one bee larva, destroying 3-4 cells, and also consume the pollen provisions. Prior to pupation the wasp larva secrets a membranous cocoon. In one nest, three adult bees of the brood were trapped below the membrane. This species of wasp was also reared from *Ceratina* (*Ctenoceratina*) *penicillata* (FRIESE) (DALY 1988) and *Ceratina subquadrata* (see below). Hollow stalks with the pith core excavated were also occupied by other insects: allodapine bees, ants (*Crematogaster tricolor* group [Formicidae]), and roaches (*Cyrtatria poduriformis* [Blattidae]).

The food plants are: *Anchusa capensis*, *Berkeya fruticosa*, *Berkheya* sp., *Galenia sarcophylla*, *Mesembryanthemum* sp., *Psilocaulon* sp., *Pteronia divaricata*, *Senecio cinerascens*, *Stachys aurea* and Lamiaceae.

Material examined: Type material. Lectotype, ♀: 'Type, BM TYPE HYM. 17a 2866, Blaukrans nr. Calvinia C.P. Nov. 17 L.O., *Ceratina aloes* BR. ♀, B.M. 1932-324, T.D.A. COCKERELL, *Ceratina aloes* COCKERELL Lectotype designated Daly and Else, 1987', (NHML).

Additional material: South Africa. Willowmore [33.17S 23.29E], 25.iii.1905 (7♀♀, 2♂♂), iii.1912 (7♀♀, 7♂♂), v.1904 (1♀), 5.vi.1918 (4♀♀, 1♂), viii.1912 (1♀, 13♂♂), 25.iii.1905 (1♂), ix.1912 (8♀♀, 2♂♂), 15.xii.1901 (1♀) (TMSA), iii.1912 (1♀, 2♂♂, SAMC), iii.1912 (1♂, DMSA), 25.iii.1905 (1♀), 5.iv.1905 (1♂) (MHUB), H. Brauns. Remhoogte, 30.24S 25.09E, C. Meyer (1♀ SANC). Klaarstroom [33.20S 22.32E], Prince Albert District, x.1952 (1♀, SAMC). Matjiesfontein [33.13S 20.35E], 6-30.x.1928 (4♀♀), 1-6.xi.1928 (9♀♀), 1-18.xii.1928 (1♀), R.E. Turner (NHML). Augustfontein [31.39S 19.21E], near Calvinia, ix.1947 (12♀♀, SAMC). Blaukrans [31.28S 19.47E], near Calvinia, 17.xi.1931, W.P. Cockerell (1♀, NHML). Ceres [33.22S 19.19E], 460 m, xii.1920, R.E. Turner (3♀♀, NHML). Biedouw Valley, 32.08S 19.14E, Clanwilliam district, 5-7.ix.1987, C.D. Eardley (2♀♀, 1♂, SANC). Clanwilliam, 18 km E on Die Bos road [32.09S 19.02E], 19.ix.1966, C.D. Michener (1♀, UK). Warmwaterberg, 30 km NE Barrydale, 33.46S 20.53E, C.D. Eardley, R.G. Oberprieler (2♀♀, SANC). Swaarmoedplaas, 33.21S 19.28E, E Ceres, C.D. Eardley (1♀, SANC). DeWet [33.36S 19.30E], 1-10.x.1940, G. van Son (6♀♀, TMSA). Garies [30.21S 17.53E], 25 km N, 21.x.1968, J.G. Rozen, E. Martinez (1♀, AMNH). Hagedisberg Pass, 34.24S 19.33E, 15 km NE Stanford, 14.xi.1982, C.D. Eardley, R.G. Oberprieler (2♀♀, SANC). Brandkop, 31.13S 19.12E, 9.ix.1987, C.D. Eardley (1♀, SANC). Lambert's Bay [32.6S 18.18E], 4.x.1974, R.H. Watmough (4♀♀, 2♂♂, SANC). Lambert's Bay, 40 km S [32.26S 18.22E], 30.x.1999, M. Hafada (1♀, OLML & SC). Leipoldtville [32.13S 18.29E], xi.1956 (4♀♀, SAMC). Eland's Bay [32.18S 18.21E], xi.1948 (1♀, SAMC). Worcester [33.39S

19.26E], 300 m, 8.x.1966, C.D. Michener (1♀, 2♂♂, UK). Montagu, 16 km E [33.44S 20.15E], 12.xi.1966, C.D. Michener (1♀, UK). Ouberg Pass, 24 km NE Montagu, 33.48S 20.12E, 17.xi.1982, C.D. Eardley, R.G. Oberprieler (6♀♀, 23♂♂, SANC). Outiep [30.36S 17.51E], Garies, ix.1953, J. du Toit (2♀♀, SAMC). Robertson [33.48S 19.53E], 280m, 9.x.1966, M. & C.D. Michener (5♀♀, 3♂♂, UK). Springbok [29.40S 17.53E], 28.x.1974, R.H. Watmough (1♀, SANC). Van Rhynsdorp [31.37S 18.44E], 110m, viii.1927, H. Brauns (1♀, TMSA). Piekenierskloofpas, 33.37S 18.57E, 4.x.1990, C.D. Eardley (9♀♀, SANC). Hopefield, 9 km N [32.59S 18.20E], 15.x.1972, J.G. Rozen, R. McGinley, C. Thompson (1♀, AMNH). Nieuwoudtville [31.23S 19.06E], 18.x.1972, J.G. Rozen, R. McGinley, C. Thompson (1♀, AMNH). Nieuwoudtville Flower Reserve, 31.22S 19.08E, 730m, 7.x.2006, 16.ix.2002, M. Kuhlmann (3♀♀ 2♂♂, KC). Nuwerus, 31.08S 18.22E, F.W. & S.K. Gess, on *Berkheya* sp. & *S. cinerascens* (6♀♀, AMGC). Sors Sors/Taaiboskraal, 30.08S 18.01E, 3.x.1995, F.W. & S.K. Gess, on pink *Mesembryanthemum* sp. (1♀, AMGC). Sors Sors [30.09S 18.01E], 9 km NE Kamieskroon, 17.ix.1992, F.W. & S.K. Gess, on *A. capensis* (4♀♀, 1♂, AMGC). Goegap Nature Reserve, Kraaiwater, 29.38S 18.00E, 30.ix.1997, F.W. & S.K. Gess, on *G. sarcophylla* (1♂, AMGC). Goegap windmill, 29.37S 17.59E, 4-8.x.1994, F.W. & S.K. Gess, on *S. aurea* (1♀, AMGC). Bakleikraal, near Kamieskroon, 30.13S 18.03E, 9-11.x.1994, F.W. & S.K. Gess, on *A. capensis* (1♀, AMGC). Between Kleinalexanderhoek & Het Kruis, 32.20S 18.46E, 26.ix.1985, F.W. & S.K. Gess (2♀♀, AMGC). Graafwater, 32.09S 18.33E, 14.x.1994, F.W. & S.K. Gess, on *Psilocaulon* sp. (1♀, AMGC). Nieuwoudtville Waterfall, 31.19S 19.07E, 23.30.ix.1994, F.W. & S.K. Gess, on *P. divaricata* (5♀♀, AMGC). Skuinshoogte Pass, 31.16S 19.08E, 23-30.ix.1994, F.W. & S.K. Gess, on *B. fruticosa* (4♀♀), on *Mesembryanthemum* sp. (2♀♀), on Lamiaceae (12♀♀) (AMGC).

Ceratina truncata FRIESE (Figs 3-4)

Ceratina truncata FRIESE 1905: 3-5, 11-12; FRIESE 1909a: 191, 192, 193, 197, 198; FRIESE 1909b: 135-136; COCKERELL 1932b: 276; COCKERELL 1937c: 548; COCKERELL 1937e: 4, 23, 28, 41; ANONYMOUS 1958: 33; DALY 1973: 387.

D i a g n o s i s : ♀ large (wing length 5.5-6.5 mm); head sparsely punctate (Figs 4a-b); scutum moderately punctate; shiny between punctures (Fig. 4c), completely black; dark, smoky wings. ♂ clypeus mostly pale yellow, lateral areas about half black (Fig. 4d); paraocular area densely punctate (punctures less than a puncture diameter apart); middle femur distinctly expanded, anterior and posterior edges parallel (Fig. 4f).

D i s t r i b u t i o n (Fig. 3): Southern region of South Africa, more common in the south-east, with one outstanding record near Barberton in the north-east.

D e s c r i p t i o n : Measurements: ♀ (Willowmore syntype): wing, 6.2 mm; hamuli, 7; eye, 171: 177: 187: 187; clypeus, 90 × 168: 39: 100; interocellar, 36: 65: 48: 65, D 19; frontal carina, 84; malar area, 0 × 65; interalveolar, 42: 52: 52: 65, D 19; antenna, 76: 16: 16: 9: 11: 14, D 16.

♂ (lectotype): wing, 5.9 mm; hamuli, 6-7; eye, 165: 145: 135: 130; clypeus, 95 × 125: 35: 90; interocellar, 30: 42: 25: 30, D 22; frontal carina, 60; malar area, 0 × 50; interalveolar, 35: 30: 40: 45, D 20; antenna, 70: 15: 15: 8: 10: 15, D 20.

Colour and Structure: ♀. Integument of head, mesosoma and metasoma black, no yellow maculation, except yellow spot near base of all tibiae. Vestiture orange under tarsi,

mostly white on sternum 6. Head sparsely punctate, glabrous (a little more punctate than *C. aloes*) (Fig. 4a); alveolocellar groove sharp, distinct, straight; lateral ocellus well below head summit, three times ocellus diameter from occiput; clypeus flattish, length 0.57× width; gena slightly wider than eye (Fig. 4b); mandible unmodified, length 0.79× clypeus width; pronotum near dorsolateral angles rounded, finely punctured, sparsely pubescent, without vertical carina; mesoscutal disk densely punctured anteriorly, mostly impunctate and glabrous in centre, posterior margin densely punctate (impunctate area about two-fifths scutum length, Fig. 4c, smaller than in *C. aloes*); parapsidal line not depressed, weakly visible; pterostigma small, 0.40× as long as marginal cell; basitibial plate about one forth from base of hind tibia (0.25 tibia length from base); propodeum gently curved, densely sculptured anteriorly, sparsely punctate to glabrous behind; tergum 6 weakly concave medially.

♂. Integument of head, mesosoma and metasoma black, with yellow maculation on clypeus (except apicolateral region, less yellow than in *C. aloes*) (Fig. 4d), mediolongitudinal region of labrum, most of dorsal surfaces of fore tibia and basitarsus, and hind tibia and basitarsus, basal area of middle tibia. Head punctation ranges from sparse (below lateral ocelli and upper region of clypeus) to dense (lower paraocular area); mostly shiny between punctures; alveolocellar groove sharp, distinct, straight; paraocular area gently convex; lateral ocellus on head summit (Fig. 4d), about ocellus diameter from occiput; clypeus flat, length 0.74× width, upper width distinctly greater than width of paraocular area at upper extreme of clypeus; mandible length 0.61× clypeus width; pronotum near dorsolateral angles rounded, finely punctured, sparsely pubescent, without vertical carina; scutal disk mostly densely punctured, sparsely punctured medially (cf. Fig. 4e); pterostigma more than half as long as marginal cell (1:0.64); middle femur greatly expanded below (compared with *C. aloes*) with posterior and anterior edges parallel (Fig. 4f); hind femur without basal facet; hind tibia not expanded; propodeum gently curved, strongly sculptured anteriorly, sparsely punctate to glabrous posteriorly; tergum 7, sternum 6 and genital capsule as in *C. aloes* (cf. Figs 1g-i).

R e m a r k s : It was apparently known that two similar, large, black *Ceratina* existed at Willowmore about 100 years ago, but the association of the sexes was confused from the outset. FRIESE (1905) described *C. truncata* from specimens sent to him by Dr. Brauns. This material had a manuscript name *Ceratina aloes*. Friese's description of the ♀ indicates that he had before him "*Ceratina aloes*"; but the ♂ was evidently *C. truncata*. COCKERELL (1932b) published the Brauns name, aware that *C. truncata* was similar. Cockerell's description of both sexes is that of "*Ceratina aloes*." The only specimens that can be definitely recognized as examined by Cockerell are ♀♀ from Calvinia. DALY (1973) designated one of these as the lectotype of *C. aloes* and chose a ♂ of the other species (*C. truncata*) from material examined by Friese as the lectotype for *C. truncata*, thus associating an existing name with each biological species.

B i o l o g y : *Ceratina truncata* was collected in nests at the following location: Cape Province. Hilton Farm, 20 km NW Grahamstown, 16.xi.1970, in *Kniphofia* sp. (3 nests); Willowmore, i.1979, in *Aloe* sp. peduncle (1 nest). The 3 stems had outside diameters, 9-11 mm; burrow depths, 13.5-24.2 cm; inside diameters at entrance, 4.2-4.3 mm; and inside diameter at cells, 5.0-5.4 mm. One nest had no cells prepared, while two nests had

4-9 cells with provisions and eggs. Some cells had a droplet of honey and in others the pollen loaves were semi-liquid.

The only known food plant is *Lasiospermum bipinnatum.*

M a t e r i a l e x a m i n e d : Type material. Lectotype, ♂: 'Capland Willowmore 9.6.1904 Dr. Brauns, Type, *Ceratina truncata* FR. ♂ 1904 Friese det., *Ceratina truncata* FRIESE ♂ Lectotype Howell V. Daly 1973', (MHUB).

A d d i t i o n a l m a t e r i a l : South Africa. Barberton [25.47S 31.03E], iii.1979, C.D. Eardley, in *Jacaranda* sp. branch (1♀, SANC). Algoa Bay [33.50S 25.50E], 25.xii.1896, H. Brauns (1♀, TMSA). Umdala [32.47S 26.38E], near Fort Beaufort, iii.1954 (4♀♀, SAMC). Alicedale [31.28S 25.51E], 22.xi.1970, J.G.H. Londt (1♂ AMGC). Near Fort Brown [33.08S 26.37E], 30.ix.1959, C. Jacot-Guillarmod (1♀ AMGC). Hilton Farm [33.12S 26.21E], 16.xi.1970, H.V. Daly (3♀♀, CAS). Idem, 21.v.1978 (11♀♀, 18♂♂), 27.vii.1978 (7♀♀, 12♂♂), boring into *Aloe* sp. peduncle, F.W. Gess (AMGC). Idem, 4.x.1977 (1♂), 3.xi.1977 (1♀) on *L. bipinnatum*, F.W. Gess (AMGC). Grahamstown, 3 km SE [33.19S 26.32S], 26.xi.1970, H.V. Daly (1♀, CAS). Grahamstown, Resolution [33.10S 26.37E], 15.xi.1928, A. Walton (1♀, TMSA). Ouplaas, 20 km SW Malgas, 34.21S 20.23E, 15.xi.1982, C.D. Eardley (1♀, 2♂♂, SANC). Willowmore, 38.vii.1920, R.E. Turner (1♀, 1♂, NHML); 10.ii.1904 (1♂), 2.iv.1905 (1♀), H. Brauns (SAMC), i.1979, C.D. Eardley (1♀, 1♂, SANC). Raubenheimer Dam, near Oudtshoorn [33.36S 22.17E], 10.x.1972, C. Jacot-Guillarmod (4♀♀, AMGC). Rooiheuwel, 5 km E Oudtshoorn, 33.36S 22.17E, xi.1982, R.H. Watmough (1♀, 1♂, SANC).

Ceratina perpolita COCKERELL (Fig. 5)

Ceratina perpolita COCKERELL 1937a: 28; DALY & ELSE 1988: 87.
Ceratina perpolita rowlandi COCKERELL 1937a: 28; DALY & ELSE 1988: 87. **nov.syn.**

D i a g n o s i s : ♀ small (wing length 2.4-4.0 mm); distance between lateral ocellus and occiput twice ocellus diameter; no clear vertical ridges on pronotum; parapsidal lines not depressed; basitibial plate one third from base of hind tibia. ♂ paraocular areas sparsely punctate; middle femur expanded, rounded posteriorly; hind tibia weakly swollen; posterior edge of tergum 7 entire (cf. Fig. 1g); sternum 6 and genital capsule as *C. aloes* (cf. Figs 1h-i).

D i s t r i b u t i o n (Fig. 5): Most in south-western Namibia, and the western and southern regions of South Africa. Two outstanding records occur in the middle of South Africa.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, 3.8 mm; hamuli, 6; eye, 105: 120: 113: 115; clypeus, 60 × 105: 20: 70; interocellar, 22: 40: 20: 40, D 15; frontal carina, 50; malar area, 0 × 50; interalveolar, 27: 30: 40: 45, D 15; antenna, 50: 13: 10: 5: 5: 7, D 10.

♂ (Aguhlas): wing, 3.7 mm; hamuli, 5; eye, 219; 203: 190: 161; clypeus, 129 × 16: 42: 129; interocellar, 64: 67: 26: 61, D 29; frontal carina, 97; malar area, 0 × 55; interalveolar, 58: 42: 71: 87, D 23; antenna, 107: 42: 19: 16: 16, D 19.

Colour and Structure: ♀. Integument black to brownish (legs more brownish), except yellow maculation on pronotal lobe, basal spot on dorsal surfaces of all tibiae, sometimes dorsal surface of fore tibia mostly yellow (clypeus always black). Vestiture orange on

ventral surfaces of tarsi. Head almost devoid of punctures, glabrous; alveolocellar groove sharp, distinct, straight; lateral ocellus well below head summit, separated from occiput by twice ocellus diameter; lower region of face convex; clypeus gently convex (cf. Fig. 1b), length 0.68 × width; gena slightly wider than eye; mandible unmodified, length 0.77 × clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, without vertical carina; mesoscutal disk almost entirely impunctate, glabrous, sparsely punctate anteriorly, moderately punctate posteriorly; parapsidal line not depressed, weakly visible; pterostigma half as long as marginal cell; basitibial plate small, inconspicuous, about one third from base of hind tibia (0.40 tibia length from base); propodeum gently curved, densely and finely sculpture anteriorly, glabrous posteriorly; tergum 6 distinctly concave medially.

♂. Integument black to brownish (legs and metasoma more brownish), except yellow maculation on entire clypeus (cf. Fig. 1d), mediolongitudinal region of labrum (conical shape), pronotal lobe, dorsal surface of fore tibia, basal spot on middle tibia, basal half of dorsal surface of hind tibia, entire dorsal surface of hind basitarsus. Head mostly moderately punctate, upper region of face impunctate, glabrous; alveolocellar groove sharp, distinct, straight; paraocular area moderately convex; lateral ocellus on head summit, less than ocellus diameter from occiput; clypeus flat, length 0.80× width, upper width distinctly greater than width of paraocular area at upper extreme of clypeus; mandible length 0.74× clypeus width; scutum mostly impunctate; pterostigma 0.56× as long as marginal cell; ventral surface of middle femur expanded, rounded posteriorly; hind femur without basal facet; hind tibia weakly swollen; without basitibial plate; propodeum gently curved, mostly with dense, finely sculpture or finely punctate; tergum 7 posterior margin broad, truncate (cf. Fig. 1g); sternum 6 and genital capsule as in *C. aloes* (cf. Figs 1h-i).

B i o l o g y : *Ceratina perpolita* was collected in nests at the following locations: Calitzdorp, 5 km W, 27.x.1970, in *Cotyledon paniculatum* (2 nests). Ladismith, 10 km SE, 27.x.1970, in *Cotyledon paniculatum* (3 nests). Stems for the 5 nests had outside diameters of 3.5-4.2 mm; depth of burrow, 10.5-27 cm; entrance inside diameter, 1.9-2.4 mm; and up to 8 cells in one nest with eggs or young larvae. Each nest had only one ♀ and no intercalary spaces.

The food plants are: *Herrea* sp., *Lasiospermum bipinnata*, *Psilocaulon* sp., *Wahlenbergia* cf. *constricta*, *Wahlenbergia* sp. and Mesembryanthemaceae.

M a t e r i a l e x a m i n e d : Type material. Holotype *C. perpolita*, ♀: 'Cape Province Little Karoo 38m E of Ceres 17-25.xi.1925, Holotype, B.M. Type Hym. 17B 304, S. Africa R.E. Turner Brit. Mus. 1924-518, *Ceratina perpolita* CKLL. Type', (NHML). Holotype *C. perpolita rowlandi*, ♀: 'Cape Town Milnerton 14-28.xii.1925, type, B.M. Type Hym. 17B 305, S. Africa R.E. Turner Brit. Mus. 1926-28, *Ceratina perpolita rowlandi* CKLL. Type', (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. 80 km N Bloemfontein [28.29S 26.37E], 26.xi.2002, M. Halada (1♀, 4♂♂, OLML & SC). 20 km W Bothaville [27.24S 26.23E], 27.xi.2002, M. Halada (1♂, OLML & SC). Grahamstown, 20 km NW [33.12S 26.20E], 29.xi.1970, H.V. Daly (1♀, UCB). Hilton Farm, 1-26.ii.1971 (1♀) 27.vii.1978 (1♀, 2♂♂), 4.x.1977 on *L. bipinnatum* (1♂), F.W. Gess (AMGC). Calitzdorp, 5 km W [33.30S 21.39E], 27.x.1970, H.V. Daly (8♀♀, 3♂♂, UCB). Agulhas [34.49S 20.01E], 18.i.1971, M.W. Strydom (4♀♀, 5♂♂, SANC). Kommetjie [34.08S 18.19E], 6.xi.1968, J.G. Rozen,

E. Martinez (5♀♀, AMNH), 15-29.x.1966, C.D. & B.J. Michener (7♀♀, UK). Ladismith, 10 km SE [33.32S 21.21E], 27.x.1970, H.V. Daly (2♂♂, UCB). Pearly Beach [34.39S 19.29E], Bredasdorp, xii.1958 (9♀♀, SAMC). Cape Town, 50 km N [33.31S 18.38E], 21.xi.2002, M. Halada (1♀, OLML & SC). Eland's Bay, x.1947 (1♀, SAMC). Citrusdal [32.36S 19.01E], 8.ix.1966, C.D. Michener (4♀♀, UK). Lambert's Bay coast [32.05S 18.18E], 29.x.1999, M. Halada (16♀♀, 2♂♂, OLML & SC). Lambert's Bay, 5 km S [32.08S 18.18E], 26.xi.2002, M. Halada (4♀♀, OLML & SC). Pakhuis Pass, W side [32.08S 18.58E], 770 m, 3.ix.1966, C.D. Michener (2♀♀, UK). Papendorp [31.42S 18.13E], Olifants River, x.1950 (1♀, SAMC). Willowmore, iii.1912, H. Brauns (1♀, TMSA). Kleinalexanderhoek, 32.20S 18.46E, 1-2.x.1990, F.W. & S.K. Gess, on *W.* cf. *constricta* (AMGC). Clanwilliam Dam, 32.11S 18.53E, 3-7.x.1988, D.W. Gess, on *Wahlenbergia* sp. (2♀♀ AMGC). Clanwilliam [32.11S 18.54E], 8.ix.1966 (1♀), 4.xi.1966 (2♀♀, 2♂♂), C.D. Michener (UK). Heerenlogement, Graafwater district, 31.58S 18.33E, 8.x.1995, F.W. & S.K. Gess, on *Psilocaulon* sp. (1♀, AMGC). Calvinia, 31.27S 19.45E, 1050 m, 7.xii.1996, J. Carpenter, A. Davidson (2♀♀, AMNH). Vanrhynsdorp, 6.xii.1996, J. Carpenter, A. Davidson (3♀♀, AMNH). Idem, vii-viii.1927, G. van Son (1♀, TMSA). Near Wagendrift, 32.12S 18.21E, 14.xi.1984, C.D. Eardley (1♀ AMGC). Hondeklip Bay, 30.19S 17.17E, 12.x.1994, F.W. & S.K. Gess, on *Herrea* sp. (14♀♀, AMGC). Wallekraal, 7 km WNW [30.19S 17.27E], 14-16.ix.1992, F.W. & S.K. Gess (3♀♀, AMGC). Papkuilsfontein Farm, Matjes site, 31.30S 19.10E, 12-19.x.2000, S. van Noort, H.G. Robertson (1♀, SANC). Between Nieuwoudtville and top Vanrhyn's Pass [31.22S 19.04E], 29-30.ix.1990, F.W. & S.K. Gess, on *Wahlenbergia* sp. (1♀, AMGC). Between Annis and Dabie, 28.20S 16.55E, 20.ix.1997, F.W. & S.K. Gess, on pink Aizoaceae (1♀, AMGC). Farm Engelsepunt, Nieuwoudtville, 31.14S 19.09E, 30.viii.2003, K. Timmermann (1♀, KC). Glen Lyon Farm, Nieuwoudtville, 31.23S 19.09E, 14-20.x.2000, S. van Noort, H.G. Robertson (1♀, SANC). Farm Kaap se Drif, Knersvlakte, 31.26S 18.47E, 14.ix.1999, M. Kuhlmann (1♀, KC). Velddrif [32.47S 18.10E], 15.x.1972, J.G. Rozen, R. McGinley, C. Thompson (1♀, AMNH). Farm Arkoep, 6 km N Kamieskroon, 30.19S 17.56E, 1-2.x.1990, C.D. Eardley (2♀♀, SANC). Hester Malan Nature Reserve [29.41S 17.54E], near Springbok, 10-11.x.1969, D.W. Gess (2♀♀, AMGC). Port Nolloth, 40 km N, 28.54S 18.44E, 11.ix.2001, C.D. Eardley (1♀, SANC). Paradise Kloof, Richterveld National Park, 28.19S 17.01E, 22.ix.1995, F.W. & S.K. Gess (1♀, AMGC). Namibia. Rosh Pinah, 16 km S, 28.04S 16.51E, 14.x.2000, F.W. & S.K. Gess, on Mesembryanthemaceae (3♀♀, AMGC). Uguchab River, near Aurusberg, 27.32S 16.11E, 22.iv.1988, C.D. Eardley (1♂, SANC).

Ceratina ballotae EARDLEY & DALY, nov.sp., (Fig. 5)

E t y m o l o g y : Named after the plant host, *Ballota africana*, in which the nest was made by the bee at the type locality.

D i a g n o s i s : ♀ small (wing length 2.4-4.0 mm); distance between lateral ocellus and occiput an ocellus diameter; no clear vertical carina on pronotum; parapsidal lines clearly depressed; no basitibial plate. ♂ paraocular area moderately punctate, middle femur little expanded, anterior and posterior edges parallel; hind tibia not swollen; tergum 7 posterior edge entire; sternum 6 and genital capsule as in *C. aloes* (cf. Figs 1h-i).

D i s t r i b u t i o n (Fig. 5): Known from the Eastern and Western Cape provinces of South Africa.

D e s c r i p t i o n : Measurements: ♀ (allotype): wing, 29 mm; hamuli, 4; eye, 84: 93: 87: 84; clypeus, 43 × 74: 23: 59; interocellar, 14: 28: 20: 33, D 11; frontal carina, 28; malar area, 0 × 40; interalveolar, 25: 23: 33: 37, D 8; antenna, 134: 40: 40: 32: 32: 32, D 34.

♂ (holotype): wing, 2.6 mm; hamuli, 5; eye, 59: 77: 65: 59; clypeus, 42 × 59: 16: 46; interocellar, 20: 22: 8: 22, D 9; frontal carina, 39; malar area, 0 × 23; interalveolar, 19: 14: 28: 31, D 9; antenna, 98: 32: 40: 18: 18: 18, D 34.

Colour and Structure: ♀. Integument black to brownish, except pronotal lobe yellow. Head sparsely punctate on lower face and vertex, upper face impunctate, glabrous (cf. *C. truncata*, Fig. 4a); alveolocellar groove sharp, distinct, straight; lateral ocellus a little below head summit, an ocellus diameter from occiput (cf. Fig. 1a); lower region of face convex, clypeus length 0.76× width; gena a little narrower than eye; mandible unmodified, length 0.83× clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, without vertical carina; mesoscutal disk almost entirely impunctate, glabrous, sparsely punctate posteriorly; parapsidal line clearly depressed; pterostigma half as long as marginal cell; basitibial plate absent; propodeum gently curved, densely and finely sculptured, shiny; tergum 6 distinctly concave medially.

♂. Integument black or brownish, yellow maculation on entire clypeus, labrum, pronotal lobe, most of dorsal surface of fore tibia, basal spots on middle and hind tibiae. Head mostly sparsely punctate, glabrous; alveolocellar groove sharp, distinct, straight; paraocular area moderately convex; lateral ocellus on head summit, an ocellus diameter from occiput; clypeus flat, length 0.78× width (cf. Fig. 1d), upper width distinctly greater than width of paraocular area at upper extreme of clypeus; mandible length 0.63× clypeus width; mesoscutum mostly impunctate; pterostigma half as long as marginal cell; middle femur a little expanded, fore and posterior edges about parallel (cf. Fig. 4f); hind femur without basal facet; hind tibia not swollen medially; without a basitibial plate; propodeum gently curved, densely and finely sculptured; tergum 7 broad, truncate posteriorly (cf. Fig. 1g); sterna 6 and genital capsule similar to *C. aloes* (Figs 1h-i).

B i o l o g y : *Ceratina ballotae* was collected in nests at the following locations: Hilton Farm, 16.xi.1970, in *B. africana* BENTH. (1 nest, No. 182). Worcester, 5 km E, Orange Grove Farm (Heatlie Farm) along Hex River, 20.x.1970, in *Salvia africana* (1 nest). The stem of *B. africana* had one ♀ bee and was 3.4 mm in outside diameter; burrow 15.5 cm deep; 2.3 mm in internal diameter; with 9 cells measuring 8.01 ± 0.29 mm in length and partitions 1.96 ± 0.30 mm thick; and with one intercalary space between the cells 6-7, measuring 5.6 mm long and with a partition 3.2 mm thick. When collected on 16.xi.1970, the lower 6 cells had young larvae and the upper 3 cells had eggs on moist pollen loaves. By 31.xii. 1970, two of the larvae had reached adulthood. The nest in *S. africana* had one ♀ bee and was in a stem 3.8 mm in outside diameter, burrow depth 13.8 cm, inside diameter 2.1 mm, and with two cells both with eggs.

M a t e r i a l e x a m i n e d : Type material. Holotype, ♂: 'S. Africa Cape 12 mi NW Grahamstown 16.xi.70 H.V. Daly nest No. 182' [33.12S 26.20E], (NHML). Allotype ♀, 1♀, 2♂♂ paratypes: Idem, except no nest number, (NHML).

A d d i t i o n a l m a t e r i a l : Worcester [32.07S 19.07E], 5 km E Orange Grove Farm (Heatlie Farm) along Hex River, 3219 AA, 20.x.1970, M.E. & B.J. Irwin, nest in *S. africana* (1♀, CAS). Pakhuis Farm, 3 km NNE, 600 m., Pakhuis Mountains [32.08S 19.03E], 14.ix.1972, M.E. & B.J. Irwin, (1♂, CAS). Farm Kalkgat, 40 km NE Vanrhynsdorp, 31.07S 18.55E, 14.ix.2003, M. Kuhlmann (1♂, KC).

Ceratina subscintilla COCKERELL (Figs 6a-c, 8)

Ceratina subscintilla COCKERELL 1937e: 34-35; DALY & ELSE 1988: 91.

D i a g n o s i s : ♀ small (wing length about 2.4 mm); distance between lateral ocellus and occiput an ocellus diameter; weak vertical carina laterally on pronotum; parapsidal lines shallowly yet clearly depressed; without basitibial plate, or with tiny, inconspicuous plate. ♂ terminalia unique (Figs 6b-c); paraocular areas moderately punctate, finely sculptured between punctures; middle femur not expanded; hind tibia strongly swollen; posterior edge of tergum 7 acutely pointed (Fig. 6a).

D i s t r i b u t i o n (Fig. 8): Known from the southern and western regions of South Africa.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, 2.4 mm; hamuli, 5; eye, 75: 75: 75: 85; clypeus, 30 × 72: 20: 62; interocellar, 15: 25: 12: 30, D 10; frontal carina, 47; malar area, 0 × 30; interalveolar, 17: 15: 35: 40, D 19; antenna, 35: 10: 6: 5: 5: 6, D 10.

♂ (Agulhas): wing, 3.5 mm; hamuli, 5; eye, 101: 99: 90: 73; clypeus, 59 × 74: 20: 57; interocellar, 26: 28: 9: 28, D 12; frontal carina, 38; malar area, 0 × 31; interalveolar, 26: 19: 34: 39, D 12; antenna, 45: 12: 11: 12: 8: 8, D 11.

Colour and Structure: ♀. Integument black to brownish (legs and metasoma brownish), yellow maculation on pronotal lobe (clypeus with small yellow spot in one specimen). Head almost devoid of punctures, glabrous (cf. Fig. 1a); alveolocellar groove sharp, distinct, straight; lateral ocellus well below head summit, separated from occiput by ocellus diameter (cf. Fig. 1a); lower region of face convex, length 0.69× width; gena a little narrower than eye; mandible unmodified, length 0.77× clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, weak vertical ridge; scutal disk almost entirely impunctate, glabrous, sparsely punctate posteriorly; parapsidal line shallowly depressed; pterostigma small, 0.41× as long as submarginal cell; basitibial plate absent to very small, inconspicuous, about one fifth from base of hind tibia (0.45 tibia length from base); propodeum weakly divided, posterior surface concave, entire propodeum with fine, reticulate sculpture; tergum 6 distinctly concave medially.

♂. Integument black to brownish (legs mostly brownish), except yellow maculation on entire clypeus (cf. Fig. 1d), entire labrum, dorsal surface of fore tibia, basal spot on middle tibia, basal half of dorsal surface of hind tibia. Head moderately punctate, finely sculptured; paraocular area convex; alveolocellar groove distinct, bowed gently outwards; lateral ocellus on head summit, less than ocellus diameter from occiput;

clypeus gently convex, length 0.79× width, upper width subequal to width of paraocular area at upper extreme of clypeus; mandible length 0.78× clypeus width; scutum moderately to densely punctate; ventral surface of middle femur not expanded; hind femur without basal facet; hind tibia swollen; without basitibial plate; propodeum distinctly divided, posterior surface concave, entire propodeum with fine, reticulate sculpture; tergum 7 pointed mediolongitudinally (Fig. 6a); sterna 6 and genital capsule as illustrated (Figs 6b-c), gonostylus bi-lobed (dorsal and ventral lobe) in posterior view.

Material examined: Type material. Holotype, ♀: 'Cape Province Ceres xii.1924, Type, B.M. Type Hym. 17B 312, S. Africa R.E. Turner Brit. Mus. 1925-44, *Ceratina subscintilla* CKLL. Type, *Ceratina subscintilla* COCKERELL Lectotype designated DALY & ELSE, 1987', (NHML).

Additional material: South Africa. Greyton, Riviersonderend [34.03S 19.37E], 7.xi.1999, M. Halada (1♀, OLML & SC). Algoa Bay, 16.ii.1896 (1♀), 10.vii.1896 (1♀), H. Brauns (TMSA). Ceres, xii.1924 (2♀♀), xii.1920 (1♀), i.1921 (1♀) R.E. Turner (NHML). Uitenhage [33.50S 25.50E], x.1931, L. Ogilvie (1♂, NHML). Willowmore, x.1910, H. Brauns (2♂♂, TMSA, NHML), 15-25.v.1908 (4♀♀, 4♂♂), 9.vii.1905 (1♂), H. Brauns (TMSA). Warmwatersberg, 10 km NW, 33.42S 20.50E, 17.xii.1988, C.D. Eardley (1♀, SANC). Ladismith, 33.30S 21.17E, 14.xii.1996, J. Carpenter, A. Davidson (1♀, AMNH). Witwater, 30.23S 18.34E, 22.ix.2003, C. Meyer (1♀, SANC). Algeria, 10 km W, 32.21S 19.03E, 4.ix.1987, C.D. Eardley (1♀, SANC). Februarie Farm, 40 km W Kirkwood, 33.33S 25.03E, S. van Noort, H.G. Robertson (2♂♂, SANC). Papkuilsfontein farm, Matjes site, 11-19.x.2000, S. van Noort, H.G. Robertson (1♀, SANC). Glen Lyon Farm, 11-18.x.2000, S. van Noort, H.G. Robertson (1♀, SANC).

Ceratina gnoma EARDLEY & DALY, nov.sp. (Figs 6d-e, 8)

Etymology: This species is named for the little ivory mark on the ♀ clypeus.

Diagnosis: ♀ very small (wing length about 2.4 mm); distance between lateral ocellus and occiput an ocellus diameter; weak vertical carina laterally on pronotum; scutum sparsely punctate and shiny; parapsidal lines scarcely visible; mesopleuron finely punctured, lower hypoepimeral area impunctate; without basitibial plate; small basal area of tergum 2 coriaceous. ♂ genitalia as in Fig. 6e; paraocular areas sparsely punctate, glabrous between punctures; with unusual hind femur and hind tibia swollen, hind tibia less in width than length of hind basitarsus; apex of tergum 7 rounded (Fig. 6d).

Distribution (Fig. 8): Known only from the type locality at Okahandja, Namibia.

Measurements: ♀ (Allotype): wing, 2.4 mm; hamuli, 5; eye, 77: 79 :70 : 64; clypeus, 38 × 62: 18: 52; interocellar, 18: 26: 8: 23, D 10; frontal carina, 41; malar area, 0 × 23; interalveolar, 22: 15: 31: 36, D 8; antenna, 26: 10: 5: 4: 4: 4, D 7.

♂ (Holotype): wing, 2.3 mm; hamuli, 5; eye, 74: 72: 62: 54; clypeus, 38 × 49: 13: 46; interocellar, 18: 23: 8: 18, D 10; frontal carina, 38; malar area, 0 × 21; interalveolar, 18: 13: 28: 36, D 9; antenna, 26: 10: 8: 3: 4: 5, D 8.

Colour and structure: ♀ body and legs dark reddish-brown, tarsi slightly lighter but not testaceous; ivory marks on clypeus, pronotal lobes, stripe on fore tibia, basal spot on mid tibia, larger basal spot on hind tibia, spot on tegula, and spot on basal plate at costal vein.

Wings hyaline; alveolocellar groove, distinct, curved outwards; lateral ocellus a little below head summit, separated from occiput by ocellus diameter (cf. Fig. 1a); lower region of face convex, length 0.64× width; gena a little narrower than eye; mandible unmodified, length 0.60× clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, weak vertical ridge; scutal disk mostly impunctate, glabrous, sparsely punctate anteriorly, sparsely to densely punctate posteriorly; parapsidal line shallowly depressed; pterostigma small, 0.41× as long as submarginal cell; basitibial plate absent; propodeum distinctly divided, anterior surface with fine, reticulate sculpture, posterior surface shiny; tergum 6 distinctly concave medially.

♂. Integument black to brownish (legs and metasoma mostly brownish), except yellow maculation on entire clypeus (cf. Fig. 1d), entire labrum, pronotal lobe, spot on tegula, dorsal surface of fore tibia, basal spot on middle tibia, bigger basal spot on dorsal surface of hind tibia. Head sparsely punctate, shiny between punctures; paraocular area convex; alveolocellar groove distinct, bowed gently outwards; lateral ocellus on head summit, less than ocellus diameter from occiput; clypeus gently convex, length 0.79× width, upper width 1.5× as wide as paraocular area at upper extreme of clypeus; mandible length 0.82× clypeus width; scutum moderately to densely punctate; ventral surface of middle femur not expanded; hind femur, weakly expanded, without basal facet; hind tibia distinctly swollen, but subequal in width to hind tibia because femur is also swollen; without basitibial plate; propodeum distinctly divided, anterior surface with fine, reticulate sculpture, posterior surface flat, shiny; tergum 7 emarginate posteromedially (Fig. 6d); sterna 6 as in Fig. 6b; genital capsule as illustrated (Fig. 6e), apex of gonostylus simple.

M a t e r i a l e x a m i n e d : Type material. Holotype, ♀: 'Holotype, ♂, 'Okahandja 19-29.xii.1927, S.W.Africa R.E. Turner Brit. Mus 1928-53, Holotype *Ceratina gnoma* Howell V. Daly', (NHML). Allotype, ♀, 5♀♀ paratypes: Idem, (NHML).

Ceratina hexae EARDLEY & DALY, nov.sp. (Figs 6f-j, 7, 8)

E t y m o l o g y : Named for the Hex River along which the nests were found.

D i a g n o s i s : ♀ small (wing length about 2.7 mm); distance between lateral ocellus and occiput an ocellus diameter; no vertical carina on pronotum; parapsidal lines weakly depressed; basitibial plate in middle of hind tibia. ♂ clypeus with a pale yellow, oval mark (Fig. 6f), which is unique within this species-group; terminalia unique (Figs 6h-j); labrum dark; paraocular area sparsely punctate; middle femur a little expanded, angulate posteriorly (Fig. 6g); hind femur with unique basal, pubescent facet anteroventrally; hind tibia swollen; tergum 7 posterior edge simple, rounded (Fig. 6h).

D i s t r i b u t i o n (Fig. 8): Known only from the type locality near Worcester, South Africa.

D e s c r i p t i o n : Measurements: ♀ (allotype): wing, 2.7 mm; hamuli, 5; eye, 73: 78: 74: 70; clypeus, 40 × 64: 19: 54; interocellar, 20: 28: 8: 23, D 8; frontal carina, 39; malar area, 0 × 26; interalveolar, 23: 17: 29: 36, D 9; antenna, 25: 12: 7: 4: 5: 4, D 8.

♂ (holotype): wing, 2.5 mm; hamuli, 5; eye, 65: 65: 59: 54; clypeus, 33 × 46: 14: 43; interocellar, 17: 17: 9: 20, D 9; frontal carina, 31; malar area, 0 × 22; interalveolar, 19: 11: 23: 31, D 9; antenna, 19: 9: 7: 4: 5: 4, D 8.

Colour and Structure: ♀. Integument black to brownish (legs mostly paler), except yellow maculation on pronotal lobe. Head sparsely punctures, glabrous; alveolocellar groove sharp, distinct, bowed outward; lateral ocellus well below head summit, separated from occiput by ocellus diameter (cf. Fig. 1a); lower region of face convex, clypeus length 0.63× width; gena distinctly narrower than eye; mandible unmodified, 0.74× as long as clypeus width; pronotum near dorsolateral angles sparsely punctured, glabrous between scattered pits, without vertical ridge; scutal disk densely punctate anteriorly, mediolongitudinally, laterally and posteriorly, impunctate and glabrous mesolaterally; parapsidal line weakly depressed; pterostigma 0.69× as long as marginal cell; basitibial plate conspicuous, in middle of hind tibia; propodeum gently curved, entire propodeum with reticulate sculpture; tergum 6 gently convex medially.

♂. Integument black to brownish (legs mostly paler), except oval yellow area on clypeus (Fig. 6f); labrum and legs without yellow maculation. Head sparsely punctate, glabrous; alveolocellar groove sharp, distinct, bowed outwards; paraocular areas gently convex; lateral ocellus on head summit, less than ocellus diameter from occiput; clypeus gently convex, length 0.71× width, upper width subequal to width of paraocular area at upper extreme of clypeus; mandible length 0.70× clypeus width; scutal disk densely punctate anteriorly, mediolongitudinally, laterally and posteriorly, impunctate, glabrous mesolaterally; pterostigma 0.70× as long as marginal cell; ventral surface of middle femur, weakly and angulately expanded (Fig. 6g); hind femur with a unique basal, pubescent anteroventral facet; hind tibia weakly swollen; propodeum not distinctly divided, entire propodeum with reticulate sculpture; tergum 7 with apex simple and rounded (Fig. 6h); sternum 6 and genital capsule as illustrated (Figs 6i-j).

Biology: *Ceratina hexae* was collected in nests at Cape Province, 5 km E Worcester, on Orange Grove Farm (Heatlie Farm) along the Hex River, 18, 20.x.1970, nesting in *S. africana* (8 nests). Seven stems with nests of 1♀ each and 1-4 cells, measured 4.3 ± 0.32 mm in outside diameter, 7.2 ± 1.21 cm in burrow depth, and 2.0 ± 0.07 mm in inside diameter. One extraordinary nest (Figs 7a-c) with 2♀♀ and 17 cells measured 4 mm in outside diameter, 31 cm in depth, 2.4 mm in inside diameter, and with cells 4.2 ± 0.11 mm in length and partitions 1.0 ± 0.08 mm thick. No intercalary spaces were observed in any of the nests. At the time of collection, the nests contained eggs to large larvae; survivors of the latter reached adulthood by 31.xii.1970. One nest had a larva of *Eurytoma* sp. [Eurytomidae] attached to a large bee larva.

Type material examined: Holotype, ♂: 'South Africa: Cape Prov. Worcester 3 mi E, Orange Grove Farm (Heatlie Farm) along Hex River, 18/20.x.1970 H.V. Daly Note No. 32b', (CAS). Idem, except different note numbers, allotype, ♀, 10♀♀, 5♂♂ paratypes. 7♀♀ paratypes: 'Worcester, 3 mi E, Orange Grove Farm 20.Oct. 1970 H.V. Daly', nest numbers 20, 21, 29, 33, 34, (CAS).

Ceratina electron **COCKERELL (Fig. 9)**

Ceratina electron COCKERELL 1937e: 11, 35; DALY & ELSE 1988: 87.

D i a g n o s i s : ♀ very small (wing length about 1.7 mm); distance between lateral ocellus and occiput twice ocellus diameter; no distinct dorsolateral ridges on pronotum; parapsidal lines not depressed; without basitibial plate. ♂ genital capsule as in *C. subscintilla* (cf. Fig. 6c); entire face sparsely punctate, glabrous; middle femur weakly expanded medially, posterior edge rounded; hind tibia strongly swollen; tergum 7 pointed posteromedially (cf. Fig. 6a).

D i s t r i b u t i o n (Fig. 9): Widespread in Namibia and the southern region of South Africa.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, 1.7 mm; hamuli, 5; eye, 45: 57: 50: 45; clypeus, 22 × 40: 10: 37; interocellar, 12: 20: 7: 15, D 7; frontal carina, 27; malar area, 0 × 15; interalveolar, 12: 10: 22: 27, D 7; antenna, 22: 7: 4: 2: 2: 2, D 5.

♂ (Gibeon): wing, 1.9 mm; hamuli, 5; eye, 54: 58: 51: 43; clypeus, 29 × 42: 9: 37; interocellar, 16: 20: 8: 22, D 8; frontal carina, 28; malar area, 0 × 16; interalveolar, 12: 11: 22: 28, D 8; antenna, 17: 8: 3: 2: 3: 5, D 8.

Colour and Structure: ♀. Integument black, pronotal lobe yellow, basal spot on all tibiae yellow. Head almost devoid of punctures, glabrous (cf. Fig. 1a); alveolocellar groove sharp, distinct, bowed outwards; lateral ocellus a little below head summit, separated from occiput by twice ocellus diameter; lower region of face convex; clypeus length 0.61× width; gena about half as wide as eye; mandible unmodified, length 0.74× clypeus width; pronotum near dorsolateral angles sparsely punctured, shiny between scattered pits, with vertical carina; scutum almost entirely impunctate, glabrous; parapsidal lines not depressed; pterostigma half as long as marginal cell; without discernable basitibial plate; propodeum distinctly, yet gently curved, finely and densely reticulate, shiny; tergum 6 gently convex.

♂. Integument black with extensive yellow maculation covering entire clypeus, pronotal lobe, basal yellow spots on all tibiae. Head almost devoid of punctures, glabrous; alveolocellar groove distinct, gently concave, bowed gently outwards; upper paraocular area gently convex; lateral ocellus a little below head summit, separated from occiput by less than ocellus diameter; clypeus gently convex, length 0.77× width; mandible length 0.76× clypeus width; scutum mostly impunctate; parapsidal lines not depressed; pterostigma small, 0.35× as long as marginal cell; propodeum gently curved, finely sculptured; middle femur weakly expanded medially, posterior edge rounded; hind femur without basal facet; hind tibia strongly swollen; without basitibial plate; tergum 7 pointed posteromedially (cf. Fig. 6a) and sternum 6 as in *C. aloes* (Fig. 1h); genital capsule as in *C. subscintilla* (cf. Fig. 6c), including bilobed gonostylus.

The known food plants are *Psilocaulon salicornioides* and *Zygophyllum simplex*.

M a t e r i a l e x a m i n e d : Type material. Holotype, ♀: 'Holotype, BM TYPE HYM. 17a 251, Okahandja 19-29.xii.1927, S.W. Africa, R.E. Turner Brit. Mus. 1928-93, *Ceratina electron* CKLL. TYPE' [21.40S 17.20E] (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. Uitenhage, x.1931, L. Ogilvie (1♂, NHML). Willowmore, H. Brauns (2♂♂, AMGC, NHML, cotype *C. paradoxa*). Ladismith, 10.xii.1996, J. Carpenter, A Davidson (1♂, AMNH). Ceres, i.1921, xii.1924, R.E. Turner

(1♀, 1♂, NHML). Minverwagspoort, 31.52S 22.07E, 16.ii.1991, C.D. Eardley (1♀, SANC). Mannetjie farm, 31 km from Kirkwood, 33.32S 25.08E, 10-17.ii.2001, S. van Noort (1♂, SANC). 30 km N Vanrhynsdorp, Knersvlakte, 31.22S 18.42E, 5-6.ix.2003, K. Timmermann (1♀, KC). Remhoogte, 30.39S 18.27E, 15.ix.2003, C. Meyer (1♀, KC). Namibia. Gobabeb, Namib Desert Research Station, 23.34S 15.03E, 26.iii.1979, R. Wharton, on *Z. simplex* (1♀, SANC). Usakos, 11 km W [21.59S 15.28E], 6.iii.1977, J.G. Rozen (1♀, 1♂, AMNH). Gibeon, 41 km on 1089, 25.20S 17.29E, 10.iii.979, F.W. & S.K. Gess (1♀, 1♂, AMGC). Windhoek, 3 km S [22.35S 17.05E], 11.iii.1976, J.G. & B.L. Rozen (1♂, AMNH). Windhoek, 25 km S [22.45S 17.08E], 5.ii.1990, W.J. Pulawski (3♂♂, CAS). Swakop river bed on road to Goanikontes, 22.41S 14.35E, 11.iv.1998, F.W. & S.K. Gess, on *P. salicornioides* (1♂, AMGC).

Ceratina whiteheadi EARDLEY & DALY, nov.sp. (Figs 6k-m, 9)

E t y m o l o g y : This species is named for the late Dr Vincent Whitehead who contributed much to bee systematics in South Africa.

D i a g n o s i s : Metasoma red, both sexes, only shared by *C. rhodura*. ♀ small (wing length about 3.4 mm); face completely black; pronotal lobe yellow; face largely impunctate, glabrous. ♂ terminalia unique (Figs 6k-m); entire clypeus and labrum pale yellow (cf. Fig. 1d); paraocular area densely punctate; middle femur expanded medially, posterior edge angulate; hind tibia swollen distally; large basitibial plate near distal end of hind tibia (0.66 of tibia length from its base); tergum 7 convex posteromedially (Fig. 6k).

D i s t r i b u t i o n (Fig. 9): Apparently wide spread in Namibia, extending into the north-western part of South Africa, close to the Namibia border.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, 3.6 mm; hamuli, 5; eye, 104: 110: 107: 107; clypeus, 57 × 99: 22: 65; interocellar, 22: 34: 19: 36, D 12; frontal carina, 50; malar area, 0 × 42; interalveolar, 28: 26: 40: 50, D 11; antenna, 37: 16: 8: 5: 5: 8, D 9.

♂ (Ameib): wing, 2.7 mm; hamuli, 5; eye, 94: 84: 84: 81; clypeus, 34 × 73: 19: 54; interocellar, 19: 20: 16: 23, D 12; frontal carina, 39; malar area, 0 × 39; interalveolar, 28: 17: 31: 37, D 11; antenna, 23: 12: 8: 4: 5: 8, D 12.

Colour and Structure: ♀. Integument of head and mesosoma black, except pronotal lobe yellow; fore tibia and all tarsi orangish, base of dorsal surfaces of all tibiae yellow; metasoma with tergum 1 and anterior region of tergum 2 blackish, remainder of metasoma reddish-orange. Vestiture under tarsi orange. Head glabrous, virtually impunctate (cf. Fig. 1a); alveolocellar groove present, distinct, straight; lateral ocellus below head summit, twice ocellus diameter from occiput; lower region of face convex; clypeus gently convex, length 0.62× width; mandible unmodified, length 0.75× clypeus width; pronotum near dorsolateral angles punctured, impubescent, shiny, with vertical ridges; scutal disk almost entirely impunctate, glabrous, few punctures posteriorly; parapsidal line not depressed; pterostigma less than half as long as marginal cell (1: 0.45); basitibial plate about one third from base of hind tibia (0.32 tibia length from base); propodeum gently curved, finely sculptures anteriorly, glabrous posteriorly; tergum 6 concave medially.

♂. Integument of head and mesosoma black, all legs orangish, entire clypeus, labrum and pronotal lobe yellow; metasoma reddish-orange. Vestiture under tarsi orange. Head densely punctured, shiny between punctures; alveolocellar groove absent; upper paraocular area flat; lateral ocellus near head summit, an ocellus diameter from occiput; clypeus flattish, half as long as wide; upper clypeus width subequal to paraocular area width at upper extreme of clypeus; mandible 0.68× as long as clypeus width; scutal disk densely punctured, shiny between punctures; parapsidal line not depressed, almost obliterated by punctures; pterostigma distinctly shorter than marginal cell (1:0.40); middle femur expanded, obtuse angle behind; hind femur, without basal facet; hind tibia swollen distally; basitibial plate about two thirds from base of hind tibia (0.66 tibia length from base); propodeum distinctly divided, strongly sculptured anteriorly, finely sculptured posteriorly; tergum 7 gently convex (Fig. 6k); sternum 6 and genital capsule as illustrated (Figs 6l-m).

The food plants are: *Cephalophyllum* sp., *Drosanthemum* sp., *Psilocaulon* sp., Aizoaceae and Mesembryanthemaceae.

Type material examined: Holotype, ♀: 'South Africa, Khubus-Ochta [28.12S 16.55], near Vyfsusters mountains, 2816BB, 7.x.1987, M. Struck', (SANC). Allotype, ♂, 20♀♀ paratypes: South Africa: Paradise Kloof, 22.ix.1995, F.W. & S.K. Gess, on *Drosanthemum* sp. (3♀♀, AMGC). Between Annis and Dabie, 20.ix.1997, F.W. & S.K. Gess, on Aizoaceae (1♀, AMGC). Pootjiespram, 28.05S 16.57E, 7.ix.1996, F.W. & S.K. Gess, on Mesembryanthemaceae (1♀, AMGC). Sendlingsdrif, 37km from checkpoint, 28.23S 16.44E, 24.ix.1997, F.W. & S.K. Gess, on *Psilocaulon* sp. (1♀, AMGC). Namibia. Obib camp, 28.00S 16.38E, 14.ix.2003, F.W. & S.K. Gess, On *Cephalophyllum* sp. (4♀♀, AMGC). Ameib, near Karibib, 21.49S 15.40E, R.H. Watmough (allotype, SANC). Rosh Pinah, 16 km south, 28.04S 16.51E, 14.x.2000, F.W. & S.K. Gess, On Mesembryanthemaceae (8♀♀, AMGC). Rosh Pinah, 10 km south, 28.02S 16.50E, 15.x.2000, F.W. & S.K. Gess On Mesembryanthemaceae (2♀♀, AMGC).

Ceratina citrinifrons species-group

Ceratina citrinifrons COCKERELL (Figs 10a-b, 12)

Ceratina citrinifrons COCKERELL 1937e: 8-9; DALY & ELSE 1988: 87.
Ceratina subulatella COCKERELL l937a: 10, 35; COCKERELL 1937c: 548; DALY & ELSE 1988: 88, **nov.syn.**

Diagnosis: ♀ small (wing length 2.7-3.3 mm); face almost devoid of punctures (Fig. 10a); lateral ocellus a little below head summit, separated from occiput by ocellus diameter; pterostigma not modified; scutum almost entirely impunctate, glabrous; basitibial plate absent; entire propodeum finely reticulate anteriorly, glabrous posteriorly. ♂ clypeus pale yellow mediolongitudinally; face largely impunctate, glabrous; lateral ocellus just below head summit, about half ocellus diameter from occiput; scutum mostly impunctate; propodeum gently curved, finely reticulate dorsally, glabrous posteriorly; middle femur and hind tibia not expanded; tergum 6 with very small posteromedian

protuberance; tergum 7 with a very small mediolongitudinal protuberance; sternum 6 and genital capsule as in *C. aloes* (Figs 1h-i).

D i s t r i b u t i o n (Fig. 12): Widespread through Namibia and the arid and semi-arid areas of South Africa.

D e s c r i p t i o n : Measurements: ♀ (Fullerton): wing, 2.7 mm; hamuli, 5; eye, 85: 85: 81: 76; clypeus, 53 × 71: 16: 53; interocellar, 20: 23: 9: 31, D 9; frontal carina, 39; malar area, 0 × 28; interalveolar, 22: 17: 34: 39, D 8; antenna, 33: 11: 6: 3: 5: 5, 10, D 9.

♂ (holotype): wing, 2.4 mm; hamuli, 5; eye, 90: 75: 65: 62; clypeus, 45 × 55: 22: 57; interocellar, 15: 20: 10: 25, D 12; frontal carina, 47; malar area, 0 × 25; interalveolar, 17: 12: 30: 37, D 12; antenna, 32: 12: 10: 7: 7: 8, D 10.

Colour and Structure: ♀. Integument black, except mediolongitudinal region of face (Fig. 10a), pronotal lobe yellow, mostly with basal yellow spot on all tibiae (dorsal surface of fore tibia sometimes mostly yellow). Head almost devoid of punctures, glabrous; alveolocellar groove indistinct, bowed outward; lateral ocellus a little below head summit, an ocellus diameter from occiput; lower region of face convex, clypeus length 0.68× width; gena distinctly narrower than eye; mandible unmodified, length 0.80× clypeus width; pronotum near dorsolateral area rounded, sparsely punctured, shiny between scattered pits, with vertical carina; scutum almost entirely impunctate, glabrous (Fig. 10b); parapsidal lines not impressed; pterostigma small, 0.30× as long as marginal cell, very narrow; basitibial plate absent; propodeum gently curved, finely sculptured anteriorly and glabrous posteriorly; tergum 6 distinctly concave medially.

♂. Integument black with yellow maculation on mediolongitudinal region of clypeus, pronotal lobe, most of dorsal surface of fore tibia, basal spot on middle and hind tibiae; antenna and fore tibia sometimes orange. Head almost devoid of punctures, glabrous; alveolocellar groove sharp, distinct, bowed outward; lateral ocellus just below head summit, half ocellus diameter from occiput; clypeus convex, as in ♀, length 0.81× width; upper clypeus width subequal to paraocular area at top of clypeus; mandible length 0.76× clypeus width; scutum mostly impunctate; parapsidal lines not impressed; pterostigma small, 0.29× as long as marginal cell; middle and hind femora, and hind tibia not modified; propodeum gently curved, finely reticulate anteriorly, glabrous posteriorly; tergum 6 without posteromedian protuberance; tergum 7 with very small mediolongitudinal protuberance; sternum 6 and genital capsule as in *C. aloes* (Figs 1h-i).

B i o l o g y : *Ceratina citrinifrons* was collected in nests at the following location: Cape Province. Strowan Farm, 5 km W Grahamstown [33.18S 26.28E], 29.xi.1970, *Berkeya heterophylla* (3 nests), and a red stem shrub (1 nest). The 3 stems of *Berkeya* had outside diameter, 3.8-4.4 mm; burrow depth, 3.9-10.7 cm; entrance inside diameter, 1.9-2.1 mm; inside diameter at cells, 2.5-2.7 mm; with 4-11 cells in each nest which contained brood ranging from eggs to white pupae; the total of 21 cells measured 5.3 ± 0.19 mm long with partitions 1.1 ± 0.13 mm thick. Larvae that had finished feeding and white pupae reached adulthood by 24.xii.1970.

The food plants are: *Aptosimum* sp., *Hermannia* sp., *Monechma* sp., *Psilocaulon salicornioides*, *Sisyndite spartea*, *Wahlenbergia* sp. and Aizoaceae.

M a t e r i a l e x a m i n e d : Type material. Holotype *C. citrifrons*, ♂: 'Holotype, B.M. TYPE HYM. 17B-272, Mossel Bay [34.11S 22.08E], Cape Province, Aug. 1921, S. Africa R.E. Turner Brit. Mus. 1921-353, *Ceratina citrifrons* CKLL. TYPE', (NHML). Holotype *C.*

subulatella, ♀: 'Holotype, B.M. TYPE HYM. 17B-315, Lion's Head [33.56S 18.23E] Cape Town Aug. 1920, S. Africa R.E. Turner Brit. Mus. 1920-342, *Ceratina subulatella* CKLL. TYPE', (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. Grootfontein, near Middleburg, 31.28S 25.01E, 1-14.ii.1992, M. DeJager (1♀, SANC). Hogsback Mountain, 32.35S 27.05E, 5.xii.1983, G.L. Prinsloo, N.C. Grobbelaar (1♀, SANC). Cradock [32.11S 25.37E], 24.ix.1952, C. Jacot-Guillarmod (1♀, AMGC). Algoa Bay, 20.iii.1910 (1♀, TMSA), 6, 16.vii.1896 (13♀♀, TMSA, MHUB), 12 & 28.viii.1896 (7♀♀ TMSA, MHUB), 13 & 27.ix.1896 (2♀♀, TMSA), H. Brauns. Bot River [34.14S 19.12E], 11.xi.1933, J. Ogilvie (1♀, NHML). Mossel Bay, 25.xi.1938, R.E. Turner (1♂, NHML). Ysterfontein [33.20S 18.10E], ix.1960 (4♀♀, SAMC). Gibeon, 10.iii.979, F.W. & S.K. Gess (1♂, AMGC). Idem on *Hermannia* sp. (1♀, 1♂, AMGC). Prince Albert Road, 32.59S 21.41E, 9.xii.1996, J. Carpenter, A Davidson (1♀, AMNH). Port Nolloth 70 km E [29.15S 17.31E], 26.xi.1974, J.G. & B.L. Rozen (2♂♂, AMNH). Vioolsdrif [28.46S 17.39E], 29.xi.1974, J.G. & B.L. Rozen (3♂♂, AMNH). Wallekraal, 14-16.ix.1992, F.W. & S.K. Gess, on *Wahlenbergia* sp. (1♀, AMGC). Sors Sors, 17.ix.1992, F.W. & S.K. Gess, on *Wahlenbergia* sp. (1♀, AMGC). Olifantshoek, 27.57S 22.48E, 20.ii.1991, C.D. Eardley (1♀, SANC). Minverwagspoort, 16.ii.1991, C.D. Eardley (1♀, SANC). Putsonderwater, 5 km S, 29.17S 21.54E, 19.ii.1991, C.D. Eardley (1♀, SANC). Perdefontein, 31.45S 20.44E, 11.xii.1988, C.D. Eardley (1♀, SANC). Pootjiespram, 28.05S 16.57E, 7.ix.1996, F.W. & S.K. Gess, on *S. spartea* (3♀♀, 3♂♂, AMGC). Namibia. Khorixas, 156 km between Uis & Henkies Bay, 21.24S 14.46E, 9.iv.1998, F.W. & S.K. Gess (1♂, AMGC). Karibib, 15 km W, 21.56S 15.42E, 5.iv.1998, F.W. & S.K. Gess, on Aizoaceae (2♂♂, AMGC). Kuiseb River, near Gobabeb, 18.ii-20.iii.1983 (10♀♀ SANC). Aus [26.40S 16.16E], 8.xii.1994, M. Kuhlmann (1♀, Kuhlmann). Swakop river bed on road to Goanikontes, 11.iv.1998, F.W. & S.K. Gess, on *P. salicornioides* (8♀♀, 3♂♂, AMGC). Swakopmund, E [22.41S 14.32E], 4.ii.1993, M. Schwarz (2♀♀, 3♂♂, OLML & SC). Swakopmund [22.41S 14.32E], 12.ii.1993, M. Schwarz (1♀, 3♂♂). Swakopmund, 63 km NE, 22.24S 15.02E, 5 & 9.xii.1996, W. Pulawski (2♀♀, 2♂♂, CAS). Windhoek, 5.ii.1990, W. Pulawski (1♀, CAS). Keetmanshoop, 140 km N, 25.23S 17.54E, 17.iv.1998, F.W. & S.K. Gess, on *Aptosimum* sp. (1♀, AMGC). Kreuzung road [27.01S 17.51E], Keetmanshoop, 70 km SSW, 10.xii.1994, M. Kuhlmann (1♀ 2♂♂, Kuhlmann). Maltahohe, S. 25.18S 17.01E, 23.iii.1999, F.W. & S.K. Gess, on *Monechma* sp. (1♀, 1♂, AMGC). Between Karasberg and Ariamsvlei, 28.05S 19.25E, 18.iv.1998, F.W. & S.K. Gess, on *Hermannia* sp. (2♂♂, AMGC). Usakos, 11 km W, 6.iii.1977, J.G. Rozen (2♂♂, AMNH). Kalkrand 10 km N [24.00S 17.32E], 9.ii.1990, W. Pulawski (1♂, CAS). Karibib [21.56S 15.50E], 7.ii.1993, M. Schwarz (1♂, OLML & SC). Karibib, 15 km E [21.57S 16.00E], 13.i.1993, M. Schwarz (3♂♂, OLML & SC).

Ceratina liliputana COCKERELL (Figs 10c, 12)

Ceratina liliputana COCKERELL, 1932a: 278; COCKERELL 1937d: 10; 1937e: 9, 15-16, 26, 29, 30, 41; ANONYMOUS 1958: 32; Daly 1973: 383, DALY & ELSE 1988: 88.

Ceratina subulata COCKERELL 1932a: 277; COCKERELL 1937e: 4, 10, 26-27, 28, 30, 33, 35, 41; COCKERELL 1937c: 548; COCKERELL 1939: 42; ANONYMOUS 1958: 33; DALY 1973: 384; DALY & ELSE 1988: 88, **nov.syn.**

D i a g n o s i s : ♀ small (wing length about 2.0 mm); face sparsely punctate; lateral ocellus a little below head summit, separated from occiput by an ocellus diameter;

pterostigma not modified; scutum with mediolateral area sparsely punctate, glabrous, adjacent to densely punctate medioscutal area; basitibial plate one-forth from base of tibia; entire propodeum finely reticulate. ♂ clypeus entirely pale yellow (cf. Fig. 1d); entire face largely impunctate, glabrous (less shiny that *C. citrinifrons*); lateral ocellus on head summit, about half ocellus diameter from occiput; scutum sparsely punctured medially; middle and hind legs not modified; tergum 7 with large posteromedian protuberance (Fig. 10c); sternum 6 and genital capsule as in *C. aloes* (Figs 1h-i).

D i s t r i b u t i o n (Fig. 12): Known from the arid and semi-arid areas of Namibia and South Africa, except for one record from Pretoria.

D e s c r i p t i o n : Measurements: ♀ (Willowmore): wing, 2.0 mm; hamuli, 5; eye, 64: 67: 60: 59; clypeus, 33 × 53: 17: 45; interocellar, 16: 22: 9: 22, D 8; frontal carina, 31; malar area, 0 × 19; interalveolar, 17: 12: 25: 31, D 8; antenna, 23: 17: 26: 8: 6: 8, D 16.

♂ (holotype): wing, 2.4 mm; hamuli, 5; eye, 80: 70: 57: 55; clypeus, 45 × 47: 7: 42; interocellar, 15: 17: 11: 20, D 11; frontal carina, 40; malar area, 0 × 25; interalveolar, 17: 10: 27: 32, D 11; antenna, 30: 8: 8: 4: 5: 5, D 10; subpleural signum 4 × 10.

Colour and Structure: ♀. Integument black, yellow on mediolongitudinal region of face and pronotal lobe, part of dorsal surface of fore tibia, basal spots on middle and hind tibiae. Head sparsely punctate, glabrous; alveolocellar groove rounded, distinct, bowed outwards; lateral ocellus a little below head summit, separated from occiput by an ocellus diameter; lower region of face flattish, clypeus flat, length 0.61× width; gena and eye subequal in width; mandible unmodified, length 0.83× clypeus length; pronotum near dorsolateral area rounded, densely pubescent, not glabrous, with weak vertical carina; scutum with mediolateral area sparsely punctate, glabrous, medioscutal area moderately punctate; parapsidal lines shallowly impressed; pterostigma small, 0.36× as long as marginal cell; basitibial plate one forth from base of tibia; propodeum gently curved, finely reticulate; tergum 6 distinctly concave medially.

♂. Integument black (antenna, legs and metasoma sometimes brownish), yellow maculation on entire clypeus (cf. Fig. 1d), labrum, pronotal lobe, dorsal surface of fore tibia, basal spot on middle and hind tibiae, sometimes on hind basitarsus. Head sparely punctures, glabrous; alveolocellar groove sharp, distinct, bowed outwards; lateral ocellus on head summit, about half an ocellus diameter from occiput; clypeus flattish; length 0.92× width; mandible length 0.48× clypeus width; upper end of clypeus distinctly wider than paraocular area adjacent to upper clypeus edge; scutum moderately punctured anteriorly and medially, sparsely punctate mediolaterally; parapsidal line shallowly impressed; pterostigma 0.31× as long as marginal cell, very narrow; middle and hind femora, and hind tibia not expanded; propodeum gently curved, finely reticulate anteriorly, glabrous posterior; tergum 6 strongly convex posteromedially; tergum 7 with small, acute, mediolongitudinal protuberance (Fig. 10d); sternum 6 and genital capsule as in *C. aloes* (Figs 1h-i).

The food plants are *Galenia papulose* and *Wahlenbergia* sp.

M a t e r i a l e x a m i n e d : Type material. Holotype *C. liliputana*, ♂, allotype: 'Type, B.M TYPE HYM. 17B 255, Willowmore Capland Dr Brauns 20.i.02, B.M. 1932-324 T.D.A. COCKERELL, *Ceratina liliputana* BR. TYPE ♂, *Ceratina liliputana* ♂♀ m.i.l,' (NHML, holotype and allotype mounted together). Holotype *C. subulata*, ♂: 'Holotype, B.M. TYPE

HYM. 17B-314, Lion's Head Cape Town Aug 1920, S. Africa R.E. Turner 1920-342, *Ceratina subulata* CKLL. TYPE', (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. Faerie Glen Koppies, Pretoria, 25.45S 28.12E, 18.iii.1998, R.P. Urban (1♀, SANC). Cradock, 17 km N, 24.ix.1952, C. Jacot-Guillarmod (1♀, AMGC). Algoa Bay, 20.iii.1910, H. Brauns (1♀, TMSA). Ceres, i.1921, R.E. Turner (6♀♀, 1♂, NHML). Colesburg, 30 km N [30.36S 25.21E], 25.xi.2002, M. Halada (1♂, OLML & SC). Prince Albert Road, 26.xi-4.xii.1931, R.E. Turner (1♀, NHML). Willowmore, 20.i.1903 (1♀, 1♂, TMSA), 1.ii.1903 (1♀, SAMC), 5.ii.1905 (3♀♀, 6♂♂, TMSA, NHML), 25.iii.1905 (1♀, 1♂, MHUB), 15.iv.1903 (1♀, 3♂♂, TMSA, NHML), H. Brauns. Mannetjie Farm, 10-17.ii.2001, S. van Noort (1♀, SANC). Between Nieuwoudtville and top Vanrhyn's Pass, 29-30.ix.1990, F.W. & S.K. Gess, on *Wahlenbergia* sp. (2♀♀, AMGC). Grahamstown [33.18S 26.32E], 12.ii.1967, D.J. Brothers (1♀, AMNH). Tussen-die-Riviere Nature Reserve, near Bethulie, 30.30S 26.12E, 20-26.i.1994, C.D. Eardley (1♀, SANC). Velddrif, 15.x.1972, J.G. Rozen, R. McGinley, C. Thompson (3♀♀, AMNH). Farm Liberty, 50 km N Ceres, 32.54S 19.27E, 27.ix.1990, C.D. Eardley (♀, SANC). Gydo Pass [33.12S 19.19E], 17 km N Ceres, 30.xi.1989, F.W. & S.K.Gess (1♀, AMGC). Ysterfontein, ix.1960, (4♂♂, SAMC). Mossel Bay, 25.xi.1938, R.E. Turner, (1♂, NHML). Prince Albert Road, 26.xi-4.xii.1931, R.E. Turner, (1♂, NHML). Bot River, 11.xi.1933, J. Ogilvie (1♂, NHML). Namibia. Swakop river bed on road to Goanikontes, 11.iv.1998, F.W. & S.K. Gess, on *G. papulose* (1♀, AMGC). Seeis [22.28S 17.40E], 9 km ESE, 16.ii.1977, J.G. & B.L. Rozen (1♀, AMNH).

Ceratina barbarae EARDLEY & DALY, nov.sp. (Figs 10d-e, 11, 12)

E t y m o l o g y : Named for the collector and loyal companion of HVD, Barbara Boole Daly.

D i a g n o s i s : ♀ small (wing length about 2.6 mm); mediolongitudinal region of clypeus yellow; face sparsely punctured; lateral ocellus near head summit, separated from occiput by half ocellus diameter; impunctate area of scutal disk not interrupted medially, except by scattered punctures; basitibial plate near middle of tibia (0.42 from base); pterostigma not modified; propodeum abruptly curved, finely reticulate anteriorly, shiny. ♂ clypeus entirely pale yellow (cf. Fig. 1d), entire face sparsely punctate, shiny; lateral ocellus on head summit, about half ocellus diameter from occiput; scutum densely punctured anteriorly and medially, mediolateral area impunctate, glabrous; propodeum abruptly curved, finely reticulate; middle femur weakly expanded, weakly pointed posteriorly; tergum 7 with apicomedian point (Fig. 10d); sternum 6 as illustrated (Fig. 10e); genital capsule similar to Fig. 1i.

D i s t r i b u t i o n (Fig. 12): Known only from the type locality near Pietermaritzburg, South Africa.

D e s c r i p t i o n : Measurements: ♀ (paratype): wing, 2.6 mm; hamuli, 5; eye, 77: 77: 73: 65; clypeus, 40 × 57: 17: 53; interocellar, 16: 25: 8: 23, D 9; frontal carina, 46; malar area, 0 × 16; interalveolar, 23: 17: 28: 31, D 8; antenna, 26: 11: 4: 4: 5: 6, D 9.

♂ (paratype): wing, 2.5 mm; hamuli, 5; eye, 77: 70: 63: 53; clypeus, 43 × 51: 20: 54; interocellar, 16: 23: 6: 23, D 11; frontal carina, 43; malar area, 0 × 23; interalveolar, 20: 11: 23: 26, D 11; antenna, 19: 9: 4: 4: 4: 7, D 10.

Colour and Structure: ♀. Integument black, with mediolongitudinal region of clypeus (cf. Fig. 10a) and pronotal lobe yellow. Head sparsely punctured, glabrous; alveolocellar groove indistinct, rounded; lateral ocellus near head summit, separated from occiput by half ocellus diameter; lower region of face convex, clypeus flattish, maximum length 0.77× width; gena distinctly narrower than eye; mandible unmodified, length 0.82× clypeus width; pronotum near dorsolateral area rounded, densely pubescent, not glabrous, without vertical carina; scutum medially impunctate, glabrous, anteriorly and posteriorly sparsely punctate; pterostigma 0.59× as long as marginal cell; basitibial plate near middle of tibia (0.42 from base); propodeum abruptly curved, finely reticulate anteriorly, glabrous posteriorly; tergum 6 gently convex medially.

♂. Integument black to brownish, with yellow maculation on entire clypeus, labrum and pronotal lobe. Head sparely punctate, glabrous; alveolocellar groove indistinct; lateral ocellus on head summit, about half ocellus diameter from occiput; clypeus flattish, maximum length 0.87× width; mandible length 0.67× clypeus width; upper clypeus width subequal to median paraocular area width; scutum densely punctured anteriorly and medially, mediolateral area impunctate, glabrous; pterostigma length 0.56× as long as marginal cell; ventral surface of middle femur a little expanded medially, weakly angled posteriorly; hind tibia not modified; propodeum abruptly curved, finely reticulate, posterior surface very finely reticulate; middle femur weakly expanded, weakly pointed posteriorly; hind femur unmodified; hind tibia not swollen; tergum 6 not modified; tergum 7 with small, acute, mediolongitudinally protuberant (Fig. 10d); sternum 6 without small mediolateral tubercles (Fig. 10e); genital capsule similar to *C. aloes* (cf. Fig. 1i).

B i o l o g y : *Ceratina barbarae* was collected in one nest at Pietermaritzberg, 3 km NW, Town Bush, 920 m elevation, 6.xii.1970. The nest was in the slender, dead stem of a weedy Asteraceae (Fig. 11a-c). Barbara Daly slipped on a steep, wet slope and arrested her fall by grabbing a handful of weeds. She noticed that one of the broken stems had a minute nest entrance of 2 mm in diameter. No other nests of this kind were found. The stem was 5 mm in outside diameter, the burrow about 20 cm in depth, and inside diameter of the lower burrow, 2.4 mm. A single cell was at the bottom of the nest, but the other 10 cells were arranged in 5 pairs. The 11 cells averaged 5.0 ± 0.21 mm in length. The cells of each pair were separated from each other by a short, firmly packed, pith partition and separated from the next pair by a long, loosely packed, pith partition. Five short partitions between adjacent cells averaged 1.26 ± 0.06 mm in thickness; five long partitions between pairs of cells averaged 10.5 ± 0.55 mm in length. Judging by the residue of a dead egg, the egg is placed at the rear of the pollen loaf. The loaf is simple in shape, measuring 3 mm in length and 1.4 mm in width and height. Five ♀♀ and two ♂♂ bees were reared from the brood.

The series of cells arranged in pairs is apparently unique among species of *Ceratina*. Furthermore, the brood in two pairs of cells each had a ♂ and a ♀ bee, suggesting that the parent ♀ exercises her control of the sex of her offspring in each pair of cells. Control of the sex of offspring is well known among bees (MICHENER 2000), but the sequence of the sexes in nests made by *Ceratina* usually do not follow an obvious pattern.

M a t e r i a l e x a m i n e d : Type material: Holotype ♂: 'South Africa Natal Prov. Pietermaritzburg, 2 mi. NW, Townbush ca 2 mi NW Pietermaritzburg, 3000 ft. elev, 6 Dec

70 Barbara B. Daly reared from nest 248, *Ceratina barbarae* Eardley & Daly HOLOTYPE ♂', (CAS). Allotype, 4♀♀, 1♂ paratypes: Idem, except [29.24S 30.20E], allotype and paratype labels, (CAS).

Ceratina stuckenbergi EARDLEY & DALY, nov.sp. (Fig. 13)

E t y m o l o g y : Named for B.R. Stuckenberg in recognition of his contributions to systematic entomology in southern Africa.

D i a g n o s i s : Both sexes with unique large pterostigma; unique ivory marks on fore femur. ♀ small (wing length about 3.8 mm); mediolongitudinal region of clypeus yellow; face moderately punctured; lateral ocellus on head summit, separated from occiput by half ocellus diameter; impunctate area of scutal disk not interrupted medially, and mostly on posterior half of scutum; basitibial plate on proximal half of tibia (0.38 from base); propodeum gently curved, entire surface with fine, reticulate sculpture. ♂ tergum 6 emarginate (cf. Fig. 1g) or bidentate; clypeus entirely pale yellow (cf. Fig. 1d); entire face sparsely punctate, shiny; lateral ocellus on head summit, about half ocellus diameter from occiput; scutum densely punctured anteriorly and medially, mediolateral area impunctate, glabrous; propodeum distinctly curved, finely reticulate; middle femur weakly expanded, weakly angled posteriorly; hind femur unmodified; hind tibia not modified; sternum 7 and genital capsule resemble *C. aloes* but could not be compared carefully or illustrated because the material is poorly preserved.

D i s t r i b u t i o n (Fig. 13): Known only from the Natal coast of South Africa, near Durban.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, 2.9 mm; hamuli, 6; eye, 79: 79: 74: 62; clypeus, 39 × 54: 19: 54; interocellar, 12: 25: 8: 25, D 11; frontal carina, 26; malar area, 0 × 23; interalveolar, 19: 14: 17: 31, D 9; antenna, 16: 5: 36: 4: 3: 3, D 5.

♂ (allotype): wing, 2.9 mm; hamuli, 6; eye, 84: 71: 65: 56; clypeus, 28 × 48: 19: 50; interocellar, 16: 23: 8: 28, D 11; frontal carina, 26; malar area, 0 × 23; interalveolar, 19: 14: 17: 31, D 9; antenna, 22: 9: 12: 4: 8: 9, D 12.

Colour and Structure: ♀. Integument black, with mediolongitudinal region of clypeus (cf. Fig. 10a), pronotal lobe, distal region of fore femur and basal region of fore tibia yellow. Head moderately punctured, shiny between punctures; alveolocellar groove indistinct, rounded; lateral ocellus near head summit, separated from occiput by ocellus diameter; lower region of face convex, clypeus flattish, maximum length 0.72× width; gena distinctly narrower than eye; mandible unmodified, length 0.79× clypeus width; pronotum near dorsolateral area rounded, densely pubescent, not glabrous, without vertical carina; scutum densely punctate anteriorly, impunctate and glabrous posteriorly; pterostigma 0.70× as long as marginal cell; basitibial plate on proximal half of tibia (0.38 from base); propodeum gently curved, entirely finely reticulate; tergum 6 gently convex medially.

♂. Integument black with yellow maculation on entire clypeus, labrum, pronotal lobe, distal end of fore femur, dorsal surface of fore tibia, basal spots on middle and hind tibiae. Head sparely punctate, shiny; alveolocellar groove absent; lateral ocellus on head summit, about half ocellus diameter from occiput; clypeus flattish, length 0.90× width; mandible length 0.80× clypeus width; upper clypeus width subequal to middle

paraocular area; scutum densely punctured anteriorly and medially, mediolateral area impunctate, glabrous; pterostigma large, length 0.67× marginal cell length, wide; ventral surface of middle femur a little expanded medially, posterior edge angulate; hind tibia not modified; propodeum gently curved, finely reticulate; tergum 6 unmodified; tergum 7, sternum 6 and genital capsule poorly preserved and could not be properly studied.

Material examined: Type material. Holotype, ♀: 'Verulam [29.39S 31.03E] Natal, 25 Nov. 1954 Bevis & Davidson, *Ceratina stuckenbergi* EARDLEY and DALY HOLOTYPE ♂', (DMSA). Paratype, 1♂: 'Congella [29.52S 31.00E], Durban, 20.ii.1927, L. Bevis' (DMSA).

Ceratina aliceae COCKERELL (Figs 10f-g, 13)

Ceratina aliceae COCKERELL 1937a: 4, 35; DALY & ELSE 1988: 89.
Ceratina pondoensis COCKERELL 1937a: 15-16, 29, 30; DALY & ELSE 1988: 88, **nov.syn.**

Diagnosis: Both sexes, mediolongitudinal region of clypeus yellow (cf. Fig. 10a); moderately punctate; lateral ocellus near head summit, separated from occiput by less than ocellus diameter; pterostigma not modified; scutum densely punctate anteriorly, interrupted medially by longitudinal band with fine, dense punctures; mediolateral region of scutum impunctate, shiny; entire propodeum finely reticulate. ♀ small (wing length about 3.3 mm); basitibial plate tiny, slightly basal to middle of hind tibia (0.44 tibia length from base). ♂ terminalia unique (Figs 10f-g); middle femur expanded, angulate posterior margin, without tuft of hair near apex of expanded area; hind femur unmodified; hind tibia weakly swollen; tergum 6 with very small, posteromedian tubercle; tergum 7 with apex rounded.

Distribution (Fig. 12): This species is widespread in the southern half of South Africa.

Description: Measurements: ♀ (lectotype): wing, 3.3 mm; hamuli, 6; eye, 95: 95: 90: 75; clypeus, 45 × 65: 30: 65; interocellar, 17: 30: 7: 25, D 12; frontal carina, 45; malar area, 0 × 35; interalveolar, 22: 20: 30: 35, D 12; antenna, 35: 12: 7: 5: 5: 6, D 12.

♂ (holotype of *C. pondoensis*): wing, 2.7 mm; hamuli, 6; eye, 80: 80: 65: 55; clypeus, 35 × 47: 22: 55; interocellar, 15: 22: 5: 20, D 12; frontal carina, 45; malar area, 0 × 25; interalveolar, 20: 15: 27: 30, D 12; antenna, 25: 10: 7: 3: 3: 4, D 11.

Colour and Structure: ♀. Integument black, with yellow maculation on mediolongitudinal region of clypeus (cf. Fig. 10a), pronotal lobe, most of dorsal surface of fore tibia, basal spot on middle tibia and basal area of hind tibia. Head moderately punctate, shiny; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by less than ocellus diameter; clypeus flattish, length 0.71× width; gena distinctly narrower than eye; mandible unmodified, length 0.71× clypeus width; pronotum near dorsolateral angle finely punctate, densely pubescent, without vertical carina; scutum densely punctate anteriorly, interrupted medially by longitudinal band with fine, dense punctures; mediolateral region of scutum impunctate, shiny; pterostigma 0.66× as long as marginal cell; basitibial plate slightly basal to middle of hind tibia (0.44 tibia length from base); propodeum distinctly divided, finely reticulate; tergum 6 flattish.

♂. Integument black with yellow triangle on clypeus (cf. Fig. 10a), median region of labrum, entire pronotal lobe, almost entire dorsal surface of fore tibia, basal spots on

middle tibia and hind tibiae. Head moderately punctate, shiny; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by less than ocellus diameter; clypeus flattish, length 0.73× width; mandible length 0.77× clypeus width; upper clypeus width subequal to middle paraocular area; pronotum near dorsolateral angle finely punctate, densely pubescent, without vertical carina; scutum densely punctate anteriorly and mediolongitudinally, mediolateral area impunctate, shiny, reticulate sculpture; pterostigma 0,62× as long as marginal cell; middle femur expanded, angulate posterior margin; hind femora not modified; propodeum distinctly divided, finely reticulate; tergum 6 and tergum 7 gently rounded posteromedially; sternum 6 and genital capsule as illustrated (Figs 10f-g).

Material examined: Type material. Lectotype *C. aliceae*, ♀: 'Lectotype, B.M. TYPE HYM. 17B307, South Africa Durban The Bluff, x.1931 Miss A. Mackie, T.D.A. Cockerell Exp. To Africa 1031. Pres by Imp. Inst. Ent. B.M. 1932-291. *Ceratina aliceae* CKLL. TYPE', (NHML). Holotype *C. pondoensis*, ♂: 'Syntype, B.M. TYPE HYM. 17B 307, Port St. John Pondoland April 1-5 1923, S. Africa R.E. Turner Brit. Mus. 1923-241, *Ceratina pondoensis* TYPE', (NHML).

Additional material: South Africa. Port St. Johns, 25-31.iii.1923, R.E. Turner (1♀, NHML). Hellahella, 20 km SW Richmond on Unkomaas River [29.54S 30.05E], 740 m, 13.i.1967, C.D. Michener, D.J. Brothers (8♀♀, 2♂♂, UK). Pietermaritzburg [29.37S 30.23E], 1.ii.1967, C.D. Michener (1♂, UK). Town Bush, 5 km NW, [29.38S 30.23E], 920 m, 6.xii.1970, H.V. Daly (5♀♀, 1♂, UCB). 18 km S, 20.xii.1966, C.D. Michener (2♀♀, UK). Salt Rock [29.30S 31.15E], 6.i.1967, C.D. Michener, D.J. Brothers (2♀♀, UK). Scottburgh [30.17S 30.45E], 11.i.1967, C.D. Michener, B. Stuckenberg, D.J. Brothers (2♀♀, UK). Cape Point Nature Reserve [29.54S 30.05E], 1.x.1966, C.D. Michener (5♀♀, UK). Hout Bay, 19.x.1966, C.D. Michener (1♀, UK). Tradouw Pass, 33.57S 20.42E, near Barrydale, 17.xi.1982, C. Eardley (2♀♀, 2♂♂, SANC). Farm Engelsepunt, Nieuwoudtville, 31.14S 19.09E, 30.viii.2003, K. Timmermann (1♀, KC).

Ceratina rhodura COCKERELL (Fig. 13)

Ceratina rhodura COCKERELL 1937c: 544-545; DALY 1985: 343; DALY & ELSE 1988: 91; STRUCK 1994: 12.

Diagnosis: ♀ red metasoma shared only with *C. whiteheadi*; medium size (wing length about 3.4 mm); clypeus with yellow spot dorsally; face sparsely punctate, glabrous; lateral ocellus below head summit, separated from occiput by almost twice ocellus diameter; pterostigma not modified; scutal disk almost entirely impunctate, glabrous, anterior, posterior regions sparsely punctate; basitibial plate about one third from base of hind tibia (0.32 tibia length from base); propodeum abruptly divided, finely reticulate. ♂ Unknown.

Distribution (Fig. 13): This species is wide spread in southern Africa, being more commonly collected in the dry areas.

Description: Measurements: ♀ (holotype): wing, 3.4 mm; hamuli, 5; eye, 110: 100: 100: 105; clypeus, 50 × 90: 20: 70; interocellar, 25: 25: 20: 25, D 11; frontal carina, 55; malar area, 0 × 30; interalveolar, 25: 20: 40: 45, D 15; antenna, 45: 13: 7: 5: 6: 8, D 12.

Colour and Structure: Integument of head and mesosoma black, metasoma reddish-orange; fore tibia and tarsus orangish, middle and hind legs blackish-orange; yellow maculation on dorsal part of clypeus, pronotal lobe, dorsal surface of fore tibia, base of dorsal surfaces of middle and hind tibiae. Head sparsely punctate, glabrous (cf. Fig. 1a); alveolocellar groove rounded, bowed outwards; lateral ocellus below head summit, separated from occiput by almost twice ocellus diameter; clypeus flattish, length 0.54× width; gena much narrower than eye; mandible unmodified, length 0.74× clypeus width; pronotum near dorsolateral angles punctured, pubescent, without vertical ridge; scutal disk almost entirely impunctate, glabrous, anterior and posterior regions sparsely punctate; pterostigma very small, 0.23× as long as marginal cell, narrow; basitibial plate about one third from base of hind tibia (0.32 tibia length from base); propodeum abruptly divided, finely reticulate; tergum 6 flattish medially.

R e m a r k s : *Ceratina rhodura* is one of two medium size species of Ceratinini in Southern Africa with a reddish metasoma. The other is *Ceratina whiteheadi*. In West Africa, *Megaceratina sculpturata* and *Ceratina allodapoides*, both larger in size, may have a red or reddish metasoma.

B i o l o g y : They visit flowers of: *Aptosimum* sp, *Blepharis* sp., *Geigeria* sp., *Peliostomum leucorrhizum*, *Prenia pallens* and *Rhigozum trichototum*.

M a t e r i a l e x a m i n e d : Type material. Lectotype ♀: 'Type, S. Africa, 48.90, B.M. TYPE HYM. 17B 268, *Ceratina rhodura* CKLL. TYPE, S.W. Africa Cape Town Beaufort West 30.vi.1034, J. Ogilvie, Brit. Mus. 1934-78, *Ceratina rhodura* Lectotype designated Daly and Else, 1987', (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. Laingsburg District, ix.1937 (1♀, SAMC). Sutherland, 90 km N [31.42S 20.52E], 11.xii.1971, E. Holm (1♀ SANC). Gouph, Lainsburg district, ix.1937 (1♀, SAMC). Namibia. Aus, 8-30.xi.1929, R.E. Turner (2♀♀, NHML). Belmont [27.29S 28.43], 24.ii.1934, J. Ogilvie (1♀, NHML). Gouph (Koup) [33.07S 21.16E], Twee Rivieren, Kalahari Gemsbok National Park, 26.25S 20.37E, 18-29.x.1989, M.W. Mansell (3♀♀, SANC). Twee Rivieren, 38 km S, 26.45S 20.36E, 23.iii.1983, R.G. Oberprieler (1♀, SANC). Vyf koppies, Kenhardt, 29.20S 21.09E, 3.iii.1995, on *R. trichototum* (10♀♀ SANC). Namibia. Keetmanshoop, 50 km SE [26.48S 18.32E], 23.x.1968, J.G. Rozen, E. Martinez (1♀, NHML). Mata Mata, 1 km W, Welverdiend Farm No. 328, 25.47S 19.59E, 19.x.1972, C.L. Hogue (1♀, LACM). 6 km S on 201 from 26, 27.0S 19.01E, 7.iii.1999, F.W. & S.K. Gess on *Blepharis* sp. (6♀♀, AMGC). Idem, except on *P. leucorrhizum* (1♀, AMGC). Karasberg, 30 km E on road to Ariamsvlei, 28.00S 19.03E, 12.iii.1997, F.W. & S.K. Gess on *Geigeria* sp. (5♀♀, AMGC). Koes, 29 km NE, 25.45S 19.15E, F.W. & S.K. Gess on *Aptosimum* sp. (2♀♀, AMGC). Usakos, 6.iii.1977, J.G. Rozen (1♀, AMNH). 25 km N Karibib [21.44S 28.12E], 6.ii.1993, M. Schwarz (1♀, OLML & SC).

Ceratina subquadrata SMITH (Figs 14a-f, 15a-c, 16c-d, 17, 20)

Ceratina subquadrata SMITH 1854: 224; FRIESE 1901: 263; FRIESE 1905: 3, 16-17; CAMERON 1905: 199; FRIESE 1909a: 191, 201, 202; MEADE-WALDO 1913: 496; COCKERELL 1922: 268; 1937e: 6, 40.

Ceratina bicarinata CAMERON, 1905: 198-199; FRIESE 1909a: 191, 203-204; COCKERELL 1937e: 5, 40 (synonym of *C. braunsiana*).; DALY 1973: 387. **nov. syn.**

Ceratina braunsiana FRIESE, 1905: 3-4, 12-13 [part]; FRIESE 1909a: 191, 192, 198, 199; FRIESE 1909b: 135; COCKERELL 1920: 247; BRAUNS 1926a: 196-198, 230-231; COCKERELL 1932a: 272; COCKERELL 1937c: 547; 1937e: 5, 6, 31, 40, 41; FRIESE 1941: 100; ANONYMOUS 1958: 31; DALY 1973: 385; DALY & ELSE 1988: 88, **nov.syn.**

Ceratina braunsiana alpha COCKERELL, 1937e: 6; DALY & ELSE 1988: 89, **nov.syn.**

Ceratina braunsiana beta COCKERELL, 1937e: 6; DALY & ELSE 1988: 89, **nov.syn.**

Ceratina braunsiana gamma COCKERELL, 1937e: 6. DALY & ELSE 1988: 88, **nov.syn.**

Ceratina braunsiana delta COCKERELL, 1937e: 7; DALY & ELSE 1988: 87, **nov.syn.**

Ceratina decipiens COCKERELL 1937e: 10; DALY & ELSE 1988: 87, **nov.syn.**

D i a g n o s i s : Both sexes with pronotum, dorsal view, with less than pronotal lobe width between collar and base of lobe (Fig. 16c-d). ♀ large (wing length about 5.2 mm), black, pale yellow on clypeus and pronotal lobe; face sparsely punctate, except ventral region of paraocular area densely punctured; clypeus half as long as wide, not modified. ♂ clypeus entirely pale yellow (cf. Fig. 1d), lower paraocular area, supraclypeal area and vertex densely punctate, clypeus and upper paraocular area sparsely punctate; middle and hind legs not modified, tergum 6 with posterior mediolongitudinal carina; tergum 7 truncate posteromedially (Fig. 15a).

D i s t r i b u t i o n (Fig. 20): Widespread in South Africa and also occurring on the eastern side of Zimbabwe.

D e s c r i p t i o n : Measurements: ♀ (holotype): wing, ca. 5.2 mm; hamuli, 7; eye, 145: 130: 135: 155; clypeus, 70 × 145: 35: 95; interocellar, 25: 40: 50: 70, D 17; frontal carina, 65; malar area, 0 × 55; interalveolar, 35: 35: 45: 55, D 19; antenna, 60: 17: 17:-:-:-, D.

♀ (Tradouw Pass - minimum head modification): eye, 138: 123: 126: 132; clypeus, 126 × 63: 33: 84; interocellar, 26: 33: 42: 55; frontal carina, 58; malar area, 0 × 55; interalveolar, 23: 32: 42: 48.

♀ (Resolution - maximum head modification): eye, 148: 148: 165: 194; clypeus, 200 × 55: 55: 90; interocellar, 29: 48: 77: 87; frontal carina, 68; malar area, 0 × 71; interalveolar, 42: 45: 48: 58.

♂ (holotype, *C. braunsiana alpha*): wing, 5.2 mm; hamuli, 8; eye, 145: 135: 120: 140; clypeus, 75 × 12: 30: 80; interocellar, 30: 35: 40: 50, D 18; frontal carina, 65; malar area, 0 × 50; interalveolar, 35: 30: 45: 55, D 18; antenna, 45: 15: 18: 10: 10: 17, D 15.

Colour and Structure: ♀. Integument black, with yellow on mediolongitudinal region of clypeus and pronotal lobe; most of dorsal surface of fore tibia, basal spot on middle and hind tibiae. Vestiture yellow to orange under tarsi. Facial punctation ranges from

impunctate, below lateral ocelli and clypeus, through sparse, on vertex, to dense on lower paraocular area and supraclypeus; alveolocellar groove distinct, gently concave (Fig. 14a); lateral ocellus well below head summit, separated from occiput by four to five times ocellus diameter; clypeus flat, length less than half width (1: 0.44); eye distinctly wider than gena (Fig. 14b); mandible unmodified, shorter than clypeus width; pronotum near dorsolateral angles sparsely punctured, glabrous between scattered pits, with prominent vertical ridge; pronotum, dorsal view, with less than pronotal lobe width between collar and base of lobe (Fig. 14c); scutal disk sparsely punctured anteriorly, impunctate and glabrous medially, densely punctured posteriorly (Fig. 14c); pterostigma less than half as long as marginal cell (1: 0.39); basitibial plate about one third from base of hind tibia (0.35 tibia length from base); propodeum gently curved, finely reticulate; tergum 6 flat medially.

♂. Integument black with yellow maculation on entire clypeus, labrum, pronotal lobe, dorsal surface of fore tibia, basodorsally on middle tibia, dorsally on hind tibia between proximal end and basitibial plate. Vestiture yellow to orange under tarsi. Face shiny; punctation ranges from impunctate, below lateral ocelli, to densely punctate on lower paraocular area (Fig. 14d); alveolocellar groove distinct, gently concave; upper paraocular area gently convex; lateral ocellus well below head summit, separated from occiput by two and a half times ocellus diameter; clypeus flat, length 0.58× maximum width (Fig. 14e); upper clypeus width subequal to median width of paraocular area; mandible length 0.76× clypeus maximum width; gena as in Fig. 14d; pronotum near dorsolateral angles sparsely punctured, glabrous between scattered pits, with prominent vertical ridge; pronotum, dorsal view, with less than pronotal lobe width between collar and base of lobe (cf. Figs 16c-d); scutal disk mostly moderately punctate (Fig. 14f); pterostigma small, 0.33× as long as marginal cell; middle and hind legs not modified, and without hair tufts and fascia; basitibial plate about one third from base of hind tibia (0.36 tibia length from base); propodeum gently curved, finely reticulate; tergum 6 with medioposterior tubercle; tergum 7 truncate (Fig. 15a) to weakly emarginate; Sternum 6 and genital capsule as illustrated (Figs 15b-c).

R e m a r k s : See discussion under *C. braunsi* new species.

B i o l o g y : *Ceratina subquadrata* was collected in nests at the following locations: Cape Province. Barrydale, 25 km W, 10.xi.1970, *Rubus* sp. (5 nests). Cape Town, Kirstenbosch Gardens, 7.xi.1970, *Watsonia* sp. (1 nest with *Gasteruption pedicillatum* larva). Hilton Farm, 13.xi.1970, vine (1 nest); 16.xi.1970, *Artemisia afra* (1 nest); 21.xi.1970, Asteraceae (6 nests, 1 with *G. exsectum* larva), *Rubus* sp. (1 nest). Fairewood, 3 km SE Grahamstown, 26.xi.1970, *Rubus* sp. (5 nests, 1 with *Eurytoma* sp. larva); 29.xi.1970, *Melia azedarach* (2 nests). Strowan Farm, 29.xi.1970, *Berkheya heterophylla* (12 nests, 1 nest with *Gasteruption* sp. larva, 1 nest with *G. fulvivagina* larva, and 1 nest with both *G. fulvivagina* and *G. pedicillatum* larvae). Grahamstown, 8 km S, 3.xii.1970, *Foeniculum vulgare* (4 nests). Pietermaritzburg, Town Bush 3 km NW, 6.xii.1970, Asteraceae (1 nest); 27.xii.1970, *Rubus* sp. (1 nest). Stellenbosch, Jonkershoek, 25.x.1970, shrub (1 nest), Apiaceae (1 nest), *Rubus* sp. (4 nests, 2 with *G. exsectum* larvae). Swellendam, 21.x.1970, *Rubus* sp. (1 nest). Swellendam, Farm Montana, 26.x.1970, *Rubus* sp. (25 nests, 1 with *Gasteruption* sp. larva). Swellendam, Farm Ou Meul Bessies, 26.x.1970, *Rubus* sp. (14 nests, 5 with *G. exsectum* larvae). Natal Province. Empangeni, 8 km NE, 20.xii.1970, Asteraceae (1 nest).

Ceratina subquadrata nests in the dead stems of a variety of alien and native plants (see above). The most nests were found in the pruned, dead canes of *Rubus* sp. at commercial berry farms (Fig. 17). At Farm Montana 24 nests were in canes an average outside diameter of 5.7 ± 0.19 mm; burrow depth of 15.5 ± 1.3 cm; and internal diameter of 3.36 ± 0.097 mm. In one nest with 9 cells, the cells measured 10.4 ± 0.34 mm in length, partitions 4.5 ± 0.29 mm thick, and 3 intercalary spaces were 8.1 - 11 mm in length and partitions 3.6-3.8 mm thick. The 60 nests with at least 2 cells had intercalary spaces as follows: 25 % had no intercalary spaces, 60 % had at least 1 intercalary space, and 15 % had an equal number of intercalary spaces and cells. Out of the 87 nests taken for this species only 3 nests had 2 adult ♀♀ in each nest and their nests, with only 5-8 cells, were not extraordinary.

The food plants are: *Berkheya heterophylla*, *Chrysocoma tenuifolia*, *Gazania uniflora*, *Lasiospermum bipinnatum* and *Senecio* sp.

M a t e r i a l e x a m i n e d : Type material. Holotype *C. subquadrata*, ♀: 'Type, S. Africa, 48.49, B.M. TYPE HYM. 17B 316, *Ceratina subquadrata* Type SMITH, *subquadrata* Type SM., *Ceratina*', (NHML). Holotype *C. bicarinata*, ♀: 'ALBANY MUSEUM GRHAMSTOWN, 112, *Ceratina bicarinata* Cam. type, *Ceratina bicarinata* Cam. ♀ type Howell V. Daly 1973', (AMGC). Lectotype *C. braunsiana*, ♀: 'Algoa Bay Capland Dr. H. Brauns 24.vii.96, *Ceratina braunsiana* FR. ♀ 1904 Friese det., Type, *Ceratina braunsiana* Friese Lectotype ♀ Howell V. Daly 1973', (MHUB). Lectotype *C. braunsiana alpha*, ♂: 'Type, B.M. TYPE HYM. 17B 246, *Ceratina braunsiana* v. *alpha* CKLL. TYPE, S. Africa Yokeskei R. Johannesbrg 31.iii.1932 J. Ogilvie, T.D.A. Cockerell Exp. To Africa 1931. Pres by Imp. Inst. Ent. B.M. 1932-291, *Ceratina braunsiana alpha* COCKERELL Lectotype designation Daly and Else, 1987.', (NHML). Lectotype *C. braunsiana beta*, ♂: 'Type, B.M. TYPE HYM. 17B 247, *Ceratina braunsiana* v. *beta* CKLL. TYPE, T.D.A. Cockerell Exp. To Africa 1931. Pres by Imp. Inst. Ent. B.M. 1932-291, Natal National Park 3-15.iii.1932 J. Ogilvie, *Ceratina braunsiana beta* COCKERELL Lectotype designation Daly and Else, 1987.', (NHML). Holotype *C. braunsiana gamma*, ♂: 'Type, B.M. TYPE HYM. 17B 249, *Ceratina braunsiana* v. *gamma* CKLL. TYPE, T.D.A. Cockerell Exp. To Africa 1931. Pres by Imp. Inst. Ent. B.M. 1932-291, S, Rhodesia Vumba 23-26.v.1932 J. Ogilvie', (NHML). Holotype *C. braunsiana delta*, ♂: 'Type, B.M. TYPE HYM. 17B 248, *Ceratina braunsiana delta* CKLL. TYPE, T.D.A. Cockerell Exp. To Africa 1931. Pres by Imp. Inst. Ent. B.M. 1932-291, S, Rhodesia Xmas Pass, Umtali, 20-21.v.1932 J. Ogilvie', (NHML). Holotype *C. decipiens* ♀: 'Type, S. Africa Cape Town Lion's Head 6.i.1932 A. Mackie, *Ceratina decipiens* CKLL. TYPE, B.M. TYPE HYM. 17B 276, T.D.A. Cockerell Exp. To Africa 1931. Pres by Imp. Inst. Ent. B.M. 1932-291', (NHML).

A d d i t i o n a l m a t e r i a l : Lesotho. Khabo's Leribe, i.1932, C. Jacot-Guillardmod (1♀, AMGC). Mahlatsa's [29.13S 28.00E], 1.i.1953, L. Bevis (2♀♀, DMSA). Mamathes [29.08S 27.51E], i.1955 (1♀), L. Bevis, 20.ix.1952 (1♂), O.W. Richards (DMSA), various dates, i-ii, iv, ix-xii.1932-1952 (17♀♀) various dates, iv, ix-xi.1945-1951 (7♂♂), C. Jacot-Guillarmod (AMGC). Teyateyaneng [29.09S 27.44E], 25.xi.1945, C. Jacot-Guillarmod (1♀, 1♂, AMGC). South Africa. Entabeni Forest Reserve, Soutpansberg, 23.00S 30.16E, 3-7.xi.1980, M.W. Mansell (1♂, SANC). Happy Rest, 22.59S 29.46E, 10.iii.1990, C.D. Eardley (4♀♀, 2♂♂, SANC). Louis Trichardt [23.03S 29.54E], 4-10.iv.1932, A. Mackie (1♀, 1♂, NHML). Albassini Graves, 23.07S 30.08E, 12.i.1987, C.D. Eardley (2♀♀, 1♂, SANC). Kaapschehoop [25.35S 30.46E], 13.ii.1968, D.J. Brothers (1♀, AMGC). Barberton, xii.1978, G.L. Prinsloo (2♀♀, SANC). Discovery [26.10S 27.53E], 9.ix.1961, H.N. Empey (5♂♂, SANC). Welgevonden, 24.52S 30.34E, 11-20.xi.1990, V.M. Uys (1♀,

1♂, SANC). Duiwelskloof, 23.42S 30.06E, 12-14.i.1987, C.D. Eardley (1♀, SANC). Burkes Luck, 24.40S 30.48E, 28.ii.1986, C.D. Eardley (1♀, 2♂♂, SANC). Retief's Kloof [25.49S 27.16E], 17.ix.1961, H.N. Empey (5♀♀, SANC). Rustenberg Nature Reserve, 25.40S 27.12E, 23-26.ii.1981, C.D. Eardley (1♂, SANC). Hennops River, 20 km W Pretoria, 25.47S 27.55E, 5.iii.1980, C.D. Eardley (1♂, SANC). Pretoria [25.45S 28.10E], 2.x.1933, G. van Son (1♀, 1♂, TMSA). Johannesburg [26.12S 28.05E], H. Brauns (1♂, NHML), vii. 1906, G. Kobrow) (1♀, 1♂, CAS), vi.1906, G. Kobrow (6♀♀, 5♂♂, TMSA, SAMC), 4.xii.1977-2.i.1978, H.R. Hepburn (4♀♀, 4♂♂, CAS). Yokeskei River [26.07S 28.08E], 31.iii.1932, J. Ogilvie (2♀♀, 1♂, NHML). Amanzimtoti [30.03S 30.53E], 10.iv.1952, C. Jacot-Guillarmod (2♀♀, 1♂, AMGC). Durban [29.51S 31.01E], x.1916, C.N. Barker (1♂, DMSA); Umbilo [29.54S 30.59E], iv.1926, A.L. Bevis (2♂♂, DMSA). Bluff [29.51S 31.01E], ii.ix.1920, C.N. Barker (1♂, DMSA), 8.iii.1925 (1♀, TMSA). Isipingo N, 25.ii.1940, L. Bevis (1♀, DMSA). Illovo Beach [30.37S 30.51E], 35 km S Durban, 11.i.1967, C.D. Michener, B. Stuckenberg, D.J. Brothers (1♀, 1♂, UK). Greytown [29.04S 30.35E], 20.x.1931, T. Ogilvie (1♀, NHML). Ingogo [27.34S 29.54E], iii.1932, J. Ogilvie (1♀, NHML). Mfongosi [27.18S 32.10E], D. & D. Jones (1♀, SAMC), ii.1914, W.E. Jones (4♂♂, SAMC, MHUB), iii.1914, W.E. Jones (1♀, MHUB), xii.l914, W.E. Jones (1♂, SAMC). Royal Natal National Park [28.44S 28.55E], 3-15.iii.1932, A. Mackie (2♀♀, NHML). Pietermaritzburg, 13.xii.1966 (1♀), 21.i.1967 (1♀, 1♂). Nagle Dam [29.37S 30.08E], 18 km S, 20.xii.1966 (1♀), Idem, 28 km E, 5.i.1967, C.D. Michener, D.J. Brothers (3♀♀, UK). Richmond [29.45S 30.56E], 860 m, 26.xii.1966 (4♀♀, 1♂); 13 km SE, 23.i.1967 (4♀♀). Hellahella, 22 km SW [29.54S 30.05E], 340 m, 13.i.1967 (4♀♀); Idem, on Umkomaas River, 740 m, 13.i.1967, C.D. Michener, D.J. Brothers (1♀, UK). Salt Rock [29.30S 31.15E], 48 km N Durban, 29.xii.1966 (8♀♀), 6.i.1967 (1♀), 25.ii.1967 (2♀♀, 1♂) C.D. Michener (UK). Rosetta, 29.18S 29.58E, 15.xi.1981, I.M. Millar (1♀, SANC). Scottburgh [30.17S 30.45E], 11.i.1967, C.D. Michener, B. Stuckenberg, D.J. Brothers (4♀♀, 2♂♂, UK). Tongaat Beach [29.34S 31.11E], 5.i.1972, F.L. Farquharson (1♂, DMSA). Weenen [28.51S 30.04E], x-xi.1926, H.P. Thomasset (1♀, NHML). Widenham [30.13S 30.48E], x.1938, A.L. Bevis (1♀, DMSA). Winklespruit [30.06S 30.51E], 31.xii.1918, C.N. Barker (1♂, DMSA). Winterton, 47 km S, Cathedral Peak Hotel [29.22S 29.11E], 1450 m, 16.ii.1967, C.D. Michener (1♀, UK). Ladysmith [28.33S 29.47], 20.i.2003, M. Snizek (1♀, 1♂, OLML & SC). Newcastle, 20 km S [27.53S 29.58E], 28.xi.2002, M. Halada (2♀♀, OLML & SC). Newcastle, N [27.44S 29.55E], 28.xi.2002, M. Halada (3♀♀, OLML & SC). Port St. Johns [31.37S 29.32E], ii.1917 (1♂), viii.1916 (3♀♀, 1♂), ix.1916 (1♀, 2♂♂), x.1916 (1♀) H.H. Swinny (TMSA), i.1924 (1♀), 6-25.ii.1924 (1♂), xii.1923 (3♀♀), R.E. Turner (NHML). Bloemfontein, 80 km N [28.29S 26.37E], 26.xi.2002, M. Halada (4♀♀, 1♂, OLML & SC). Bethlehem [28.13S28.18E], 7.ii.2001, M. Halada (1♀, OLML & SC). Ficksburg, N [28.51S 27.54E], 17.i.2003, M. Snizek (1♀, OLML & SC). Bothaville, 29 km W [27.24S 26.23E], 27.xi.2002, M. Halada (2♀♀, OLML & SC). Umtata [31.35S 28.47E], 17.x.1937, L. Bevis (1♀, DMSA). Paterson [33.27S 25.58E], 300m, 19.iii.1972, M.E. and B.J. Irwin (1♀, CAS). Kei Mouth, NE East London [32.41S 28.21E], 11.xii.2002, M. Halada (1♀, OLML & SC). Port Elizabeth [33.58S 25.35E], 22.xii.1985, J.G.H. Londt, (1♀ AMGC). Albany [28.27S 21.43E], v.1956, Cooke (1♀, AMGC). Alice [32.47S 26.50E], 1944, N.C. Mokhehle (1♂, AMGC). Algoa Bay, during vii, ix, xii.1895-1896 (10♀♀), 25.xii.1895 (3♂♂), (TMSA), 16.vii.1896, (2♀♀, CAS), 6.ii.1896 (1♀), 25.xii.1895 (1♀), (NHML), 12.i.1896 (2♀♀, 1♂), 25.xii.1896 (1♂), (NM), 21.i.1896 (1♀), (SM), H. Brauns. Aliwal North [30.42S 26.42E], 15-27.xi.1922 (1♂), xii.1922 (3♀♀, 3♂♂), 1-13.i.1923 (8♀♀, 1♂), R.E. Turner (NHML), i.1979, C.D. Eardley (1♀, 1♂, SANC). Harrismith, Drakensberg Botanical

Gardens, 28.17S 29.09E, 5.xii.1985, C.D. Eardley (1♀, SANC). Donkerspoort [25.47S 28.30E], 18.iv.1934, J. Ogilvie (1♀, NHML). Tussen-die-Rievere Nature Reserve, 20-26.i.1994, C.D. Eardley (6♀♀, 4♂♂, SANC). Ficksburg [28.53S 27.53E], 26.ii-1.iii.1932, J. Ogilvie (4♀♀, NHML). Goedemoed [28.07S 22.26E], near Orange River, x.1939 (7♂♂), xi.1939 (1♂) (SAMC). Gum Tree [27.27S 27.52E], 29.ii.1932, L. Ogilvie (1♀, NHML). Kroonstad [27.39S 27.14E], v.1946, S. Brothers (1♀, AMGC). North Bank Halt, Norvals Pont [30.38S 25.27E]. 14, 16.iv.1934 (2♀♀), 12.iv.1934 (4♂♂) J. Ogilvie (NHML). Cookhouse [32.45S 25.49E], iii.1954 (1♂, SAMC). DeWet, 1-10.x.1940, G. van Son (1♀, TMSA). East London [32.59S 27.54E], vii.1914, Lightfoot (1♂, SAMC). Goedehoop [26.32S 29.12E], Heidelburg District, x.1951 (1♀, SAMC). Graaff-Reinet [32.15S 24.33E], 26.x., T.D.A. Cockerell (1♀, NHML). Boknes, 33.43S 26.35E, 14.ii.1984, F.W. Gess, on *G. uniflora* (3♀♀, AMGC). Grahamstown, 12.ii.1967 (2♀♀), 29.x.1967 (1♀) D.J. Brothers (AMNH). Idem, 11.xi.1958 (1♀), 4.xii.1969 (1♀) C. Jacot-Guillarmod) (AMGC). Idem, 12.vii.1911, F. Graham (1♀, AMGC); 7.xii.1966, C.D. Michener (5♀♀, 2♂♂, UK). Idem, i.1979, C.D. Eardley, G.L. Prinsloo (1♀, SANC). Idem, 17 km N, 20.xi.1966 (1♀, 5♂♂). Idem, 20 km W, 19.xi.1966 (3♂♂), C.D. Michener (UK). Belmont Valley, 5 km SE [33.18S 27.23E], 6.xii.1966, C. Jacot-Guillarmod (1♀), 18-21.x.1971 (3♀♀), 22-24.xi.1971 (1♀), F.W. Gess (AMGC). Boesmans River [33.15S 25.59E], iii.1954 (1♀, SAMC). Hilton Farm, 1-15.ii.1971 (3♂♂), 1-17.iii.1971 (1♀, 2♂♂), 21-31.x.1970 (2♀♀, 1♂), 1-11.xi.1970 (1♂), F.W. Gess (AMGC). Idem, during 4-25.x.1977, F.W. Gess, on *L. bipinnatum* (4♀♀, AMGC). Idem, 17.ii.1990, S.K. Gess, on *C. tenuifolia* (1♀, AMGC). Cathcart, Goshen [32.16S 27.03E], iii.1954 (2♀♀, SAMC). Howison's Poort [33.20S 26.30E], 3-6.i.1972 (6♀♀, 1♂), 12-26.xi.1971 (5♀♀), 20-23.xii.1971 (1♀), F.W. Gess (AMGC). Strowan [33.18S 26.28E], various dates between 12-15.x.1972, F.W. Gess, on *B. heterophylla* (7♀♀, AMGC). Strowan, 5 km W [33.18S 26.28E], 14.ix.1969 (1♀), 27.xi.1966 (1♀), 16.xii.1967 (1♀) C. Jacot-Guillarmod (AMGC), various dates, ii, iii, ix, x, xii.1969 (8♀♀), ii, x.1969 (3♂♂), F.W. Gess (AMGC). Table Farm, 28.xii.1986, D.W. Gess, on *Senecio* sp. (1♀, 1♂, AMGC). Table Farm [33.15S 26.25E], 13-26.ii.1971 (7♀♀, 4♂♂), 10-31.iii.1971 (3♂♂) F.W. Gess (AMGC). Resolution, 1930, Walton (1♂, SAMC). Umdala, iii.1954 (1♂, SAMC). Fort Brown [33.08S 26.37E], 30-ix.1959, C. Jacot-Guillarmod (1♂, AMGC). George [33.58S 22.27E], ii.1909, H. Brauns (1♀, TMSA). Katberg, 1200 m, 1-15.i.1933 (1♀), 11-18.ii.1933 (1♂), xii.1932 (4♀♀) R.E. Turner (NHML). Queenstown [31.54S 26.53E], 1100 m, 16.i-10.ii.1923, R.E. Turner (1♀, NHML). Sunday River [33.43S 25.51E], near Port Elizabeth, 22.xii.1892, H. Brauns (1♂, TMSA). Assegaibos, La Motte [33.44S 21.34E], x.1940, G. van Son (1♀, TMSA). Barrydale [33.54S 20.44E], 16.xii.2002, M. Snizek (7♀♀, OLML & SC). Barrydale, Tradow Pass, 33.57S 20.42E, 17.xi.1982, C.D. Eardley (3♀♀, 1♂, SANC). Bot River, 7.xi.1933, J. Ogilvie (2♀♀, NHML). Caledon, Veld near the Baths [34.13S 19.25E], 9.ii.1914, G.B. Longstaff (1♀, UM). Springfontein [30.16S 25.42E], x.1931, Bell-Morley (1♀, TMSA). Vanwyksfontein farm, near Colesburg & Norvalspont, 30.43S 25.27E, F.W. & S.K. Gess, on *Senecio* sp. (1♀, AMGC). Willowmore, 5.viii.1912, H. Brauns (1♀, TMSA), 15.xi.1905, H. Brauns (2♀♀, AMGC). Montagu Pass [33.52S 22.27E], M.L. Penther (1♀, NM). Oudtshoorn [33.35S 22.12E], 31.x, J. Ogilvie (1♀, NHML). Knysna [34.02S 23.02E], 1.i.1910, H. Brauns (1♀, TMSA). Pearston [32.35S 25.08E], 15.iii.1969, M.S. Strydom (1♀, SANC). Robertson, 9.x.1966, C.D. Michener (1♂, UK). Rust en Vrede [33.34S 24.05E], Oudtshoorn District, x.1951 (4♀♀, SAMC). Sandflats [30.23S 29.13E], 280 m, 18.iv.1958, E.S. Ross, R.E. Leech (1♀, 2♂♂, CAS). Seven Weeks Poort [33.24S 21.24E], Ladismith District, 10.ix.1948, C. Jacot-Guillarmod (3♀♀, AMGC). Cango River [33.34S 22.25E], Oudtshoorn District, x.1937,

(2♀♀, SAMC). Fort Beaufort District, 12.x.1969, C. Jacot-Guillarmod (2♀♀, AMGC). Cape Town [33.55S 18.25E], x.1963 (1♀), i.1915 (2♂♂), Lightfoot, vii.1912 (1♀) Phillips (SAMC). Betty's Bay, 34.20S 18.55E, 20.xi.1982, C.D. Eardley (1♂, SANC). Hout Bay, 15.ix-19.x.1966, 8.ii.1967, C.D. Michener (39♀♀, 7♂♂, UK). Cape Town, E [33.57S 18.33E], 8.xi.1999, M. Halada (1♀, OLML & SC). Table Mountain [33.58S 18.25E], 920 m, 1.xii.1966, C.D. Michener (1♀, UK). Kirstenbosch Botanical Garden [33.58S 18.25E], 29.xi.1966 (3♀♀), 7.ii.1967 (1♀, 2♂♂) C.D. Michener (UK). Cape Point Nature Reserve, 1.x.1966 (7♀♀), 15.x.1966 (2♂♂), 5.ii.1967 (1♀) C.D. Michener (UK). Langberg [33.57S 20.42E], Kein Karoo, 15.ii.2002, M. Halada (3♀♀, 2♂♂, OLML & SC). Ceres, during xi & xii.1920 to i-iii.1921 (26♀♀, 9♂♂), 1-12.xi.1924 (1♀) R.E. Turner (NHML); 12-18.ii.1932 (3♀♀) A. Mackie (NHML). Farm Engelsepunt, Nieuwoudtville, 31.14S 19.09E, 14.x.2006, K. Timmermann (2♀♀, KC). Leliefontein, 30.22S 18.14E, 23.ix.2003, C. Meyer (1♀, KC). Clanwilliam, 50 km E on Die Bos Road, [32.09S 19.13E], 19.ix.1966 (3♀♀). Idem, 20 km N, 4.xi.1966, C.D. Michener (1♀, UK). Cold Bokkeveld [33.22S 19.19E], Ceres District, 15-30.x.1924, M. Versfeld (1♀, SAMC). DuToits Kloof [33.44S 19.11E], 700 m, 8.x.1966, C.D. & M.H. Michener (8♀♀, UK). Franschoek Pass, 33.56S 19.09E, 21.xi.1982, C.D. Eardley (1♀, SANC). Huguenot [34.02S 18.21E], 5-10.ii.1932, A. Mackie (1♀, NHML). Kleinmond [34.20S 19.01E], 34.20S 19.01E, 20.xi.1982, C.D. Eardley (1♀, SANC). Kroomie [32.46S 26.26E], Matroosberg [33.23S 19.40E], 1100 m, ix.1939 (1♀), i.1917 (1♂) Lightfoot (SAMC). Paarl [33.44S 18.58E], 29.ix.1959 (4♀♀, SAMC), 9.ii.1932 (1♀, NHML), J. Ogilvie. Somerset East [32.43S 25.35E], 1-26.i.1931 (2♀♀), x.1930 (1♂), ix.1930 (1♀), 1-9.xii.1930 (1♀), 23-31.xii.1930 (1♀) R.E. Turner (NHML). Stellenbosch [33.56S 18.51E], 1.ix.1923, H. Brauns (1♀, TMSA). Strandfontein [30.58S 17.40E], 11.x.1965 (1♀, SAMC). Swellendam [33.57S 20.05E], 32 km W, 150 m, 14.i.1967, E.S. Ross, K. Lorenzen (1♀, CAS). Wit River Valley [33.35S 19.08E], Bainskloof, xii.1949 (2♀♀, SAMC). Worcester, xii.1933, R.E. Turner (1♂, NHML). Pearly Beach, xii.1958 (1♀ SAMC). Kommetjie, 12.x.1972, J.G. Rozen, R. McGinley, C. Thompson (1♀, AMNH). Kimberley [28.44S 24.46E], 9.i.1965, H.N. Empey (1♀, SANC). Zimbabwe. Inyanga [18.13S 32.45E], 7.ii.1940 (1♀, SAMC). Vumbu Mountains [19.53S 31.22E], 6-17.iv.1923 (1♀, SAMC).

Ceratina braunsi EARDLEY & DALY, nov.sp. (Figs 15d-e, 16a-b, 18, 19, 20)

Ceratina braunsiana, BRAUNS 1926a: 196-198 [part]; COCKERELL 1937b: 547.

E t y m o l o g y : Named for the first student of the biology of *Ceratina* in Africa, Dr. med. H. Brauns of Willowmore.

D i a g n o s i s : Both sexes similar to *C. subquadrata*, except pronotal collar narrow, separated from pronotal lobe by more than basal width of pronotal lobe (Figs 16a-b). The ♀ of this species varies considerably, in the one extreme the head capsule has more or less normal proportions and in the other the gena and vertex are very long, the clypeus short and the mandibles are greatly enlarged.

D i s t r i b u t i o n (Fig. 20): This species is only known from the southern region of South Africa.

D e s c r i p t i o n : Measurements: ♀ (allotype): wing, 5.1 mm; hamuli, 6; eye, 145: 139: 155: 171; clypeus, 52 × 181: 32: 155; interocellar, 29: 46: 57: 70, D 12; frontal carina, 54; malar area, 0 × 54; interalveolar, 34: 42: 42: 48, D 17; antenna, 62: 20: 14: 8: 14: 9, D 14.

♂ (holotype): wing, 4.4 mm; hamuli, 6; eye, 132: 110: 105: 110; clypeus, 63 × 99: 31: 77; interocellar, 31: 33: 31: 46, D 11; frontal carina, 54; malar area, 0 × 34; interalveolar, 31: 23: 39: 46, D 14; antenna, 46: 14: 7: 9: 11: 14, D 14.

Colour and Structure: Both sexes as in *C. subquadrata* except as described below. ♀. Facial punctation moderate, impunctate between antennal sockets and ocelli, densely punctate below antennal sockets (Fig. 15d); alveolocellar groove distinct, gently concave, bowed weakly outwards; lateral ocellus well below head summit, separated from occiput by two to five times ocellus diameter (short clypeus form with longer vertex); clypeus normal to very reduced in length (width twice length to around four times length); eye subequal in width to gena to substantially narrower than gena; mandible unmodified, shorter than clypeus width to longer than clypeus width (latter in specimens with short clypeus); pronotum near dorsolateral angles sparsely punctured, glabrous between scattered pits, with prominent vertical ridge (Fig. 15e); pronotum, in dorsal view, reduced transversely, with sharp dorsolateral angles separated from pronotal lobes by more than basal width of pronotal lobes (Figs 16a-b).

♂ vestiture pale yellow on ventral surfaces of tarsi. Clypeus length 0.64× width, upper width distinctly greater than median paraocular width; dorsal view, pronotal collar reduced transversely, sharp dorsolateral angles separated from pronotal lobes by more than basal width of pronotal lobes (cf. Figs 16a-b); pterostigma 0.41× as long as marginal cell; middle femur expanded, rounded posteriorly, without tuft of hair in ventral view; hind femur without tubercle or facet; hind tibia swollen, without tuft of hair; propodeum gently curved, finely reticulate to glabrous.

R e m a r k s : *Ceratina subquadrata* and *C. braunsi* are treated here as two bisexual, sympatric species in which the larger ♀♀ of *C. braunsi* (wing lengths about 4.8-5.2mm) exhibit conspicuous macrocephaly. BRAUNS (1926a) and COCKERELL (1937b) considered the macrocephalic ♀♀ to be local variants of a single, widespread species. BRAUNS (1926a) made a careful study of the morphology of heads of ♀♀, but did not mention the abnormal pronotum that distinguishes both sexes of *C. braunsi* (Figs 16a-b). It became evident that we were dealing with two species rather than polymorphism in a single species when we found normal bees referable to *C. subquadrata* and other bees with an abnormal pronotum in both large and small ♀♀ as well as in males. By rearing the broods of nests of both species, we found progeny, including a variety of body sizes and both sexes, had the same kind of pronotum as the parental ♀♀.

Based on our limited collections, some evidence exists of ecological separation between the species: *C. braunsi* nests commonly in *Cotyledon paniculatum* and infrequently at the same locations as *C. subquadrata*. The latter species nests in a variety of alien and native plants, but we did not find it in *Cotyledon* sp. We suggest that the macrocephaly of *C. braunsi* is an example of morphological character displacement (BROWN & WILSON 1956) between sympatric, sister species. For example, the macrocephaly of *C. braunsi* may be an advantage in excavating the burrow or in defense of the nest against natural enemies and competitors. A large ♀ in her burrow was observed to spread her enlarged mandibles across the full width of the entrance in a position to prevent entry of intruders.

Ceratina subquadrata is widespread and morphologically variable in Southern Africa, ranging from the Cape subtropical region to Zimbabwe. *Ceratina braunsi* is sympatric, but limited to the Cape subtropical region and southern Great Karoo. The two species are

remarkably similar in a wide range in body sizes, punctation, and ivory maculations. The heads of large *C. subquadrata* (wing lengths about 4.9-5.6 mm) are allometrically larger, the eyes diverge below, and the mandibles are larger. Otherwise, the fore coxae are normal in shape and the pronotum is normal with the dorsolateral angles rounded and separated from the pronotal lobes by about the basal width of the pronotal lobes (Figs 16a-b). In contrast, the allometric features of *C. braunsi* are especially developed in large ♀♀ (wing lengths about 4.8-5.2mm): strongly divergent eyes, triangular labrum, long mandibles, and the fore coxae of some bees with the anterior surface concave and the ventral edge sharp. Both sexes of *C. braunsi* have an abnormal pronotum: the dorsum of the pronotum is reduced transversely in width and with sharp dorsolateral angles that are separated from the pronotal lobes by a distance greater than the basal width of the pronotal lobes. Furthermore, males of *C. subquadrata* have a median apical keel on tergum 6 that is rounded in lateral view, while *C. braunsi* has a small apical spine or no process. The apex of tergum 7 is broadly rounded or truncate in *C. subquadrata* compared to the narrowly rounded apex of *C. braunsi*.

B i o l o g y : *Ceratina braunsi* was collected in nests at the following locations (* = *C. subquadrata* collected at same place): Cape Province. *Barrydale, 25 km W, 10.xi.1970, *Rubus* sp. (1 nest *with Gasteruption fulvivagina* [Gasteruptiidae] larva). Calitzdorp, 5 km W, 27.x.1970, *Cotyledon paniculatum* (4 nests). *Hilton Farm, 16.xi.1970, *Ballota africana* (1 nest); 21.xi.1970, Asteraceae (1 nest). Ladismith, 10 km SE, Winkelpass Road, 27.x.1970, *Cotyledon paniculatum* (2 nests). Worcester, 3 mi E, Orange Grove Farm (Heatlie Farm), 18.x.1970, *Salvia africana* (2 nests); 20.x.1970, *Cotyledon paniculatum* (2 nests), *Ricinus communis* (2 nests).

Based on the above collections, *C. braunsi* nests frequently in *C. paniculatum* (8 nests out of a total of 15), in stalks an average of 4.4 ± 0.14 mm in outside diameter, burrows 15.7± 2.32 cm in depth, inside diameter 3.3 ± 0.12 mm, and for 3 cells, 18.6 ± 1.45 mm long with partitions 3.3 ± 0.3 mm thick, and 1 intercalary space 10 mm long (Fig. 17). Perhaps because the plants are more resistant to burrow excavation, two nests in thick stems of *R. communis* had shorter burrows and cells (compare Figs 18-19): average stem outside diameter was 13.4 mm, burrow depth 7.1 cm, inside diameter 3.4 mm, and for 8 cells 7.7 ± 0.23 mm in length. Pollen loaves in *Cotyledon* were 7 mm long, but were 6.3 mm and misshapened inside the shorter cells of *Ricinus*, demonstrating a flexible behavior by ♀♀ in provisioning cells of different sizes.

T y p e m a t e r i a l e x a m i n e d : South Africa. ♂ holotype: 'Worcester 3 mi E, 18-20.x.1970 H.V. Daly, *Ceratina braunsi* EARDLEY & DALY ♂ HOLOTYPE', (CAS). Allotype, ♀, 64♀♀, 18♂♂ paratypes: Idem, (7♂♂, CAS). Worcester, 300 m, 8.x.1966, C.D. Michener (4♀♀, UK). Algoa Bay, 16.ii.1896, H. Brauns (1♀, TMSA). Umdala, iii.1954 (9♀♀, 1♂, SAMC). Fort Brown, 1.iii.1928, Walton (1♂, AMGC). Burnt Kraal [33.15S 26.30E], near Grahamstown, 4.xii.1967, F.W. Gess (1♀, AMGC). Hilton Farm, 1-11.xi.1970, F.W. Gess (1♀, AMGC). Resolution [33.48S 19.53E], Albany District, 15.i.1929 (1♀), 26.vii.1927 (1♀), 23.xi.1928 (1♀), A. Walton (TMSA). Idem, i-iv.1928, A. Walton (1♀, SAMC). Idem, i-iv.1928, Miss Walton (1♀ paratype, SAMC). Idem, 17 km N, 20.xi.1966, C.D. Michener (1♀, UK). Idem, 20 km W, 19.xi.1966, C.D. Michener (6♀♀, 1♂, UK). Kliplaat [33.05S 27.04E], 19.i.1911, H. Brauns (2♀♀, TMSA). Nelspoort [32.07S 23.00E], 2.xii.1933, J. Ogilvie (1♀, NHML). Ouplaas, 15.xi.1982, C.D. Eardley (1♀, SANC). Willowmore, 15-18.v.1908 (3♀♀, 4♂♂, TMSA), 1-5.v.1918 (10♀♀), 3-5.viii.1912 (11♀♀, 3♂♂, TMSA, MHUB), ix.1919 (1♀), ix.1916 (1♂, TMSA),

10.xi.1906 (1♀, NHML), 1.xii.1920 (1♀), H. Brauns (TMSA). Ladismith, 24.ix.1948, C. Jacot-Guillarmod (1♀, AMGC). Pearly Beach, xii.1958 (1♀, SAMC). Robertson, 9.x.1966, M.H. & C.D. Michener (4♀♀, UK).

Ceratina (incertae sedis)

Ceratina (incertae sedis) comprises two species-groups: the *C. nigriceps* species-group with four species and the *C. speculifrons* species-group with three species, and an additional two, ungrouped, species, *C. minuta* and *C. labrosa*. *Ceratina* (incertae sedis) resembles *Ceratina* (sensu stricto) except that it does not have a gradulus on tergum 5, one species, *C. minuta*, is weakly metallic pale green, and three species (the *C. speculifrons* species-group) have spinose axillae – alternatively they may be *Ceratina* (*Simioceratina*) without scale-like setae on the metasoma.

The *C. nigriceps* species-group comprises four medium sized species: *C. nigriceps*, *C. nyassensis*, *C. namibensis* and *C. pacis*. In both sexes there is no alveolocellar groove.The ♀♀ have the lower part of the face strongly convex and densely punctate, the ventral edge of the clypeus is distinctly concave, except in *C. namibensis* in which it is slightly pointed, and the pronotum is not narrow, as in *C. braunsi*. In the ♂♂ the lower part of the face is flat, the lower paraocular area is densely punctate, and the upper paraocular area is convex. The shape of the clypeus separates the ♀♀ in this group. The ♂♂ are separated by shape of tergum 6. *Ceratina pacis*, which is only known from one ♂ specimen, appears to be a melanized variety of *C. nyassensis.*

Ceratina minuta is unique in that the both sexes are weakly metallic green. The axilla is gently rounded posteriorly and they have a distinct gradulus on tergum 2, which separates it from *Pithitis*. The ♂ also has a unique tubercle on the hind femur.

Ceratina labrosa is unique. It is large, the ♀ clypeus is strongly concave ventrally and it does not have an alveolocellar groove. The ♂ has the lower part of face flat and the lower paraocular area densely punctate, and there is an alveolocellar groove and the upper paraocular area is convex. The ♀ resembles *C. nigriceps* and *C. nyassensis* in that they are devoid of a subantennal grooves and each has a modified clypeus, but *C. labrosa* is much larger. The ♂♂ resemble *C. nyassensis* that has a weakly tubercular tergum 6.

Ceratina speculifrons species-group comprises *C. speculifrons*, *C. nativitatus* and *C. durbanensis*. Both sexes have the axilla pointed behind (where both sexes are known), resembling the *Ceratina* subgenus *Pithitis*, but they are black like *Ceratina* sensu stricto. They also have similar propodeums. We have provisionally placed these species in the *C. speculifrons* specis-group in *Ceratina* (incertae sedis) even though the ♀♀ do not have rows of thickened, posterior directed setae on the posterior margins of T2-T5, and they do have a gradulus on T4. The clypeus is protuberant, with a glabrous, ventro-horizontal area between the labrum and ventral clypeal margin, in frontal view, which resembles the subgenus *Simioceratina*. In *C. nativitatis* the ♂ has a few scale-like setae on the posterior margins of T2-T5, but it also does not have a gradulus on T4. *Ceratina ruwenzoricus* COCKERELL, which does not occur in southern Africa, belongs to this group.

Ceratina nigriceps FRIESE (Figs 21, 22)

Ceratina nigriceps FRIESE 1905: 3-4, 11; FRIESE 1909a: 191, 192, 197; FRIESE 1909b: 133, 135; COCKERELL 1920: 248; 1937e: 34, 40; DALY 1973: 386; PAULY 2001: 125-131.

Ctenoceratina nigriceps (FRIESE):TERZO & PAULY. [In] PAULY et al. 2001: 298.

Ceratina penicillifera COCKERELL 1932a: 274; COCKERELL 1937c: 548; 1937e: 27, 40; DALY & ELSE 1988: 88, **nov.syn.**

Ceratina politula COCKERELL, 1934: 1; COCKERELL 1937e: 29-30, 40; DALY & ELSE 1988: 88, **nov.syn.**

Ceratina politula griseipennis COCKERELL, 1934: 1; COCKERELL 1937e: 17, 30, DALY & ELSE 1988: 88, **nov.syn.**

Ceratina holomelas COCKERELL, 1937c: 548; DALY & ELSE 1988: 88, **nov.syn.**

D i a g n o s i s : ♀ clypeus protuberant ventrally, and broadly concave, mandible with dorsal, angular protuberance. ♂ hair pencil in basal half of hind tibia.

D i s t r i b u t i o n (Fig. 22): This species is widespread, but mostly occurs in the eastern half of southern Africa. There is one unusual record along the Orange River, near Upington.

D e s c r i p t i o n : Measurements: ♀ (lectotype, *C. nigriceps*): wing, 4.3 mm; hamuli, 6; eye, 120: 120: 120: 120; clypeus, 50 × 119: 32: 85; interocellar, 24: 35: 20: 40, D 15; frontal carina, 62; malar area, 0 × 52; interalveolar, 31: 28: 41: 49, D 15; antenna, 45: 15: 12: 7: 10: 10, D 12.

♂ (holotype, *C. penicillifera*): wing, 4.3 mm; hamuli, 6; eye, 120: 110: 110: 100; clypeus, 55 × 95: 25: 85; interocellar, 25: 32: 20: 40, D 19; frontal carina, 60; malar area, 0 × 45; interalveolar, 30: 25: 35: 45, D 19; antenna, 40: 14: 11: 7: 10: 10, D 16.

Colour and Structure: ♀. Integument mostly black, occasionally with ill defined yellow maculation on medioventral region of clypeus (pronotal lobe black/blackish). Head with clypeus moderately to sparsely punctate; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by an ocellus diameter; lower edge of clypeus broadly and gently concave below (Fig. 21a); clypeal region of face convex, in profile (Fig. 21b); clypeus about half as long as maximum width (1: 0.46); mandible with a very large inner, subapical tooth, its length 0.64× maximum clypeus width; pronotum with dorsolateral region rounded, punctured, pubescent, without vertical carina; scutum mostly densely punctate, centre of disk sparsely punctate to impunctate, glabrous (Fig. 21c); pterostigma about half as long as marginal cell (1:0.47); basitibial plate two thirds from base of hind tibia (0.66 tibia length from base); propodeum gently curved, strongly sculptured anteriorly, finely sculptured and shiny posteriorly; tergum 6 weakly convex medially.

♂. Black with yellow triangle on clypeus. Vestiture on mediolongitudinal region of tergum 6 dense and white, pale yellow under tarsi. Head densely punctate; shiny between punctures; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by an ocellus diameter; clypeus flattish, length 0.63× maximum width, upper width distinctly narrower than adjacent paraocular area (cf. Fig. 23d); mandible length

0.57× maximum clypeus width; pronotum near dorsolateral angles rounded, finely punctured, pubescent, without vertical carina; scutal disk completely densely punctured, except impubescent adjacent to notaulus and parapsidal line; pterostigma about half as long as marginal cell (1: 0.53); middle femur not modified, without tuft of hair in ventral view; hind femur without tubercle or facet in ventral view; hind tibia weakly swollen, with unique hair pencil in basal half; basitibial plate near middle of hind tibia (0.55 tibia length from base of tibia); propodeum gently curved, strongly sculptured anteriorly, finely sculptured posteriorly, shiny; tergum 6 unmodified; tergum 7 weakly and narrowly concave posteromedially (Fig. 21d); sternum 6 and genital capsule as illustrated (Figs 21e-f).

B i o l o g y : *Ceratina nigriceps* was collected one nest at Hilton Farm, 22.xi.1970 in Asteraceae. The stem with the nest measured 3.2 mm in outside diameter, burrow 38 cm in depth, 1.5 mm inside diameter at the entrance, 2.5 mm at the sentry chamber, and 2.3 mm at the cells. Six cells measured 6.2 ± 0.21 mm in length and with partitions 1.3 ± 0.06 mm thick. The partitions were firmly packed and uniform in shape with the lower surface flat and the upper surface concave. At the time of collection the cells contained eggs and young larvae.

Parasite: *Chaetodactylus leleupi* [Acari].

M a t e r i a l e x a m i n e d : Type material. Lectotype *C. nigriceps*, ♀: 'Cradock [32.11S 25.37E], Capland, *Ceratina nigriceps* ♀ FR. 1904 Friese det.', MHUB. Holotype *C. penicillifera*, ♂: 'Type, B.M. TYPE HYM 17B-303, *Ceratina penicillifera* CKLL. TYPE, Piet Retief Transvaal [27.00S 30.48E] v.13. L.O., B.M. 1932-324, T.D.A. Cockerell', (NHML). Holotype *C. politula*, ♂: 'Type, Natal National Park [28.44S 28.55E] 3-15.iii.1932 A. Mackie, *Ceratina politula* CKLL. TYPE, B.M. TYPE HYM 17A-2813', NHML. Holotype *C. politula griseipennis*, ♂: 'Type, B.M. TYPE HYM 17B-262, S. Africa, Natal Grey Town [29.04S 30.35E], J. Ogilvie, T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291, *Ceratina politula griseipennis* CKLL. TYPE', (NHML). Holotype *C. holomelas*, ♀: 'Type, B.M. TYPE HYM. 17B 298, *Ceratina holomelas* CKLL. TYPE, AFRICA Upington [28.27S 21.15E] L. Ogilvie 21.ii.1934 B.M. 1934-157', (NHML).

A d d i t i o n a l m a t e r i a l : South Africa. Banga Neck, Kosi Bay, 27.00S 32.53E, 11.ii.1990, C.D. Eardley (5♀♀, 2♂♂, SANC). Weenen [28.51S 30.04E], viii.ix.1923, H.P. Thomasset 870 m (1♀, 1♂, SANC). Kruger National Park, Pafuri, 22.28S 31.12E, 23-29.i.1984, C.D. Eardley (1♀, 1♂, SANC). Idem, Skukuza, 24.59S 31.35E, 4.ix.1985, L. Braak (2♀♀ SANC). Kommatipoort [25.26S 31.56E], 3.vi.1969, L.C. Starke (1♀, 1♂, SANC). Crocodile River road [25.26S 31.58E], 28.v.1969, L.C. Starke (1♀, 1♂, SANC). Langjan Nature Reserve, 22.52S 29.14E, 2.ii.1984, C.D. Eardley (1♀, SANC). Wylliespoort, Ingwe Motel, 2.58S 29.57E, 31.i.1984, C.D. Eardley (6♀♀, 1♂, SANC). Altona Farm, near Tzaneen, 23.45S 30.04E, 7.ix.1992, C.D. Eardley (1♀, SANC). Barberton, xii.1978, C.D. Eardley (2♂♂, SANC). Duiwelskloof, 23.42S 30.06E, 12-14.i.1987, C.D. Eardley (3♀♀, SANC). Lekgalameetse Nature Reserve, 24.10S 30.14E, 13.ii.1989, V.M. Uys (1♀, SANC). Tembe Elephant Park, Sihangwana area, 27.02S 32.25E 100m, 1.i-4.ii.1996, E. Grobbelaar (1♀ SANC). Ben Albert's Nature Reserve, Thabazimbi, 24.37S 27.23E, 24-28.xi.1980, C.D. Eardley (1♀, SANC). Barberton, 26-29.iii.1997, C. Kok (1♀, SANC). Westville [29.50S 30.56E], 29.v.1961, H.N. Empey (1♂, SANC). Amanximtoti [30.03S 30.53E], x.1931, J. Ogilvie (1♂, SANC). Mogol Nature Reserve, Ellisras district, 23.58S 27.45E, 27-29.ii.1984, C.D. Eardley (1♂, SANC). Modjadji Nature Reserve, 23.38S 30.20E, 13-14.i.1987, C.D. Eardley (1♂, SANC). Weltevreden, 25.34S

31.10E, 24.i.1990, G.L. Prinsloo (1♂, SANC). Pietermaritzburg, 5 km N, 3.xii.1966, J.G. Rozen, D.J. Brothers (1♂, AMNH). Table Farm, 13-22.ii.1971, F.W. Gess (2♂♂, AMGC). Howison's Poort, Grahamstown, 14-20.xii.1971, F.W. Gess (2♂♂, AMGC). Hilton Farm, 1-26.ii.1971, F.W. Gess (1♂, AMGC). East London, NE [32.55S 27.55E], 11.ii.2002, M. Halada (1♂, OLML & SC). Zimbabwe. Harare [17.52S 31.02E], i.1900, A.K. Marshall (1♂, NHML). Zambezi Valley, 7 km SE Angwa Bridge, 16.08S 30.15E, 18.vi.-9.ix. 1988, J. Wayrich (2♀♀, 1♂, SANC). Chiredzi, 21.04S 31.40E, 18.iii.1995, A.J. Urban (1♀, SANC). Botswana. Serowe, Farmer's Brigade [22.24S 26.39E], ii.1999, P. Forchhammer (26♀♀, 4♂♂, CAS). Kudiaskam Pan, Baines' Baobabs, 20.06S 24.46E, 21.vii.1990, H.V. Daly (12♀♀, 2♂♂, CAS). Mozambique. Inhaca [26.00S 32.56E], R.F. ii.1924, Lawrence (1♂, SANC).

Ceratina nyassensis STRAND (Figs 22, 23a-h)

Ceratina (*Zaodontomerus*) [!] *nyassensis* STRAND, 1912a: 26-27.
Ceratina nyassensis STRAND: COCKERELL 1937e: 41; DALY 1973: 387.
Ctenoceratina (*Hirashima*) *nyassensis* (STRAND): TERZO & PAULY [In] PAULY et al. 2001: 287, 288, 290, 298, 299-302.
Ceratina rugosifrons COCKERELL, 1937e: 15-16, 32, 35; DALY & ELSE 1988: 88, **nov.syn.**
Ceratina albinasis COCKERELL, 1937e: 2, 33; DALY & ELSE 1988: 87, **nov.syn.**
Ceratina brevimaculata BENOIST, 1962: 139; TERZO & PAULY [In] PAULY et al. 2001: 287, 299.

D i a g n o s i s : ♀ clypeus protuberant and narrowly concave ventrally (Fig. 23a); mandible without a dorsal, basal, angular protuberance; pronotal lobe yellow. ♂ middle femur with tuft of hair near apex of expanded area.

D i s t r i b u t i o n (Fig. 22): This species appears to occur throughout southern Africa.

D e s c r i p t i o n : Measurements: ♀ (Mkomzi): wing, 3.4 mm; hamuli, 5; eye, 108: 101: 96: 85; clypeus, 42 × 77: 34: 77; interocellar, 17: 28: 16: 26, D 11; frontal carina, 53; malar area, 0 × 31; interalveolar, 31: 23: 33: 39, D 9; antenna, 31: 8: 9: 4: 5: 4, D 9.

♂ (Westville): wing, 3.7 mm; hamuli, 6; eye, 108: 96: 101: 93; clypeus, 88 × 43 31: 77; interocellar, 25: 31: 29: 16, D 11; frontal carina, 60; malar area, 0 × 39; interalveolar, 33: 23: 39: 42, D 11; antenna, 36 : 11: 8: 5: 6: 8, D 11.

Colour and Structure: ♀. Integument black, yellow maculation on medioventral region of clypeus (Fig 23a), pronotal lobe, most of dorsal surface of fore tibia, basal spot on middle tibia and basal area of hind tibia. Vestiture yellow on ventral surfaces of tarsi. Head densely punctate, clypeus sparsely punctate (Figs 23a-b); alveolocellar groove absent; lateral ocellus near head summit; lower edge of clypeus narrowly concave (Fig. 23a); lower clypeal region of face convex (Fig. 23b); clypeus length 0.32× maximum width; mandible without large basal tooth, length 0.61× maximum clypeus width; scutum punctation as in Fig. 23c; propodeum distinctly divided between subhorizontal and subvertical regions, strongly sculptured anteriorly, shiny posteriorly.

♂. Integument black with yellow triangle on clypeus, most of labrum (Fig. 23d), almost entire dorsal surface of fore tibia, basal spot on middle tibia and basal part of hind tibia. Vestiture pale yellow on ventral surfaces of tarsi. Head with upper width distinctly wider than adjacent paraocular area; mandible length 0.73× maximum clypeus width; scutal disk completely, densely punctured (Fig. 23e); middle femur expanded, tuft of hair near

apex of expanded area; hind tibia swollen, without tuft of hair; propodeum distinctly divided between subhorizontal and subvertical regions, strongly sculptured anteriorly, shiny posteriorly; tergum 6 with posteromedian tubercle; tergum 7 distinctly concave posteromedially (Fig. 23f); sternum 6 and genital capsule as illustrated (Figs 23g-h).

M a t e r i a l e x a m i n e d : Type material. Holotype *C. nyassensis*, ♂, 'Mozambique, Langenburg [09.11S 34.06E], L. Nyasa'. MHUB. Holotype *C. albinasis*, ♀: 'Type, B.M. TYPE HYM 17B 239, *Ceratina albinasis* CKLL TYPE, Okahandja 1-12.i.1928, S.W. Africa R.E. Turner Brit. Mus. 1928-61', NHML. Holotype *C. rugosifrons*, ♂: 'Type, B.M HYM. 17B 2812, S, Rhodesia Xmas Pass Umtali 20-21.v.1932 J. Ogilvie, *Ceratina rugosifrons* CKLL. TYPE," (NHML).

A d d i t i o n a l m a t e r i a l : Zimbabwe. Harare, 30 km W [17.49S 30.46E], 29.xi.1998, M. Halada (4♂♂, OLML & SC). Harare, 20 km S [17.59S 30.57E], 10.iv.1985, J. Gusenleitner (1♀, OLML & SC). Namibia. Karibib, 23 km N [21.44S 15.57E], 27.ii.1990, M. Schwarz (1♀, OLML & SC). Otavi [19.38S 17.20E], 2.ii.1993, M. Schwarz (1♀, OLML & SC). Okahandja [21.59S 16.55E], 11.ii.1993, M. Schwarz (1♂, OLML & SC). South Africa. Entabeni Forest Reserve, 23.00S 30.16E, 18-19.i.1982, C.D. Eardley (5♀♀, SANC). Happy Rest Nature Reserve, 22.59S 29.46E, 10.iii.1990, C.D. Eardley (2♀♀, SANC). Wylliespoort, Ingwe Motel, 22.58S 29.57E, 31.i.1984, C.D. Eardley (1♀, SANC). Mogoto Nature Reserve, Zebediela, 24.15S 29.13E, 22-25.x.1979, G.L. Prinsloo, M.W. Mansell, C.D. Eardley (1♀, SANC). Welgevonden, 24.52S 30.34E, 11-20.xi.1990, V.M. Uys (3♀♀, SANC). Waterval Onder [25.39S 30.23E], 6.x.1962, H.N. Empey (1♀ SANC). Mac Mac Falls, 10 km N. Sabie, 25.02S 30.48E, 27.ii.1986, V.M. Swain (1♀, SANC). Piet Retief [27.00S 30.48E], 13.x.1931, T.D.A. Cockerell (2♀♀, SANC). Pretoria [25.45S 28.12E], 22.iii.1990, M. Schwarz (2♂♂, OLML & SC). Weenen [28.51S 30.04E], x-xi.1924, H.P. Thomasset (2♂♂, SANC). Durban [29.51S 31.01E], 1902, F. Muir (2♀♀, NHML, SANC). Westville [29.50S 30.56E], 29.v.1961, H.N. Empey (1♀, 1♂, SANC). Umbilo [29.54S 30.59E], 3.xii.1936, A.L. Bevis (1♂, DMSA). Eschowe [28.53S 31.28E], 6-31.v.1926, R.E. Turner (1♀, NHML). Greytown, 20.x.1931, J. Ogilvie (1♀, NHML). Natal National Park, 3-15.iii.1932, A. Mackie (1♀, NHML). Pietermaritzburg, 30.i.1967 (3♀♀), 13.xii.1966 (4♀♀), C.D. Michener (UK); Town Bush [29.37S 30.23E], 13.i.1967, C.D. Michener, D.J. Brothers (4♀♀, UK). Idem, 18 km S, 20.xii.1966, C.D. Michener (1♀, UK). Pietermaritzburg, 5 km N, 3.xii.1966, J.G. Rozen, D.J. Brothers (8♀♀, AMNH). Hattingspruit [28.04S 30.07E], 3.xii.1972, H.N. Empey (1♀, SANC). Table Farm [33.15S 26.25E], Grahamstown, 13-22.ii.1971, F.W. Gess (1♂, AMGC). Howison's Poort [33.20S 26.30E], near Grahamstown, 23-28.xii.1971 & 28.xii.1972, F.W. Gess (7♀♀, AMGC). Belmont Valley, near Grahamstown, 23-28.xii.1971 & 6-31.i.972, F.W. Gess (8♀♀, AMGC). Hilton Farm, 12-16.1975, F.W. Gess (1♀, AMGC). Kenton-on-Sea [33.42S 26.41E], 1-15.iv.1972, R.A. Jupp (2♀♀, AMGC).Katberg [30.52S 24.11E], 11-26.ii.1933 (R.E. Turner) (8♀♀, NHML). Idem, 1230 m, 1-12.iii.1933, 1♀, x.1932 (2♀♀), R.E. Turner (NHML). Port St. John, viii.1916 (1♀), x.1916 (1♂), ix.1916 (1♀), H.H. Swinney (TMSA), 25-31.iii.1923, R.E. Turner (1♀, NHML). Seven Week Poort [33.24S 21.24E], 10.ix.1948, C. Jacot-Guillarmod (1♀, AMGC). Ladismith, 16-28.ix.1948, C. Jacot-Guillarmod (1♀, AMGC). Willowmore, H. Brauns (1♀, TMSA).

Ceratina namibensis EARDLEY & DALY, nov.sp. (Figs 22, 23i)

E t y m o l o g y : This species is named for the area in which it was collected, the Namib Desert.

D i a g n o s i s : ♀ clypeus protuberant ventrally and slightly pointed medioventrally. ♂ with hat shaped mark on clypeus and both fringe and tuft of hairs on ventral surface of hind femur.

D i s t r i b u t i o n (Fig. 22): This species is known only from the type locality. A similar specimen was collected near Barberton, on the east side of South Africa, but further collecting is needed to confirm its identity.

D e s c r i p t i o n : Measurements: ♀ (allotype): wing, 2.7 mm; hamuli, 5; eye, 125: 132: 127: 114; clypeus, 26 × 108: 24: 76; interocellar, 26: 35: 22: 31, D 17; frontal carina, 56; malar area, 0 × 43; interalveolar, 43: 26: 41: 47, D 17; antenna, 37: 15: 11: 7: 7: 7, D 15.

♂ (holotype): wing, 2.7 mm; hamuli, 4; eye, 134: 129: 125: 119; clypeus, 47 × 112: 30: 114; interocellar, 30: 32: 22: 30, D 17; frontal carina, 54; malar area, 0 × 52; interalveolar, 43: 26: 39: 45, D 15; antenna, 32: 15: 11: 7: 7: 7, D 15.

Colour and Structure: ♀. Similar to *C. nyassensis* except as follows: lower edge of clypeus straight and slightly pointed; clypeus length 0.24× maximum width; mandible length 0.52× maximum clypeus width; scutum with centre of disk sparsely punctate; pterostigma less than half as long as marginal cell.

♂. Similar to *C. nyassensis* except as follows: yellow clypeal maculation hat-shaped; vestiture damaged; clypeus length 0.42× maximum width, upper width similar to width of adjacent paraocular area; mandible length 0.64× maximum clypeus width; pterostigma less than half as long as marginal cell (1: 0.53); ventral surface of hind femur with a fringe of hairs on basal half and a tuft of long hairs medially; hind tibia without unique hair pencil on basal half; basitibial plate three-quarters from base of hind tibia (0.75 tibia length from base of tibia); tergum 7 weakly pointed posteromedially (cf. Fig. 23f); sternum 6 as illustrated (Fig. 23i).

M a t e r i a l e x a m i n e d : Type material. Holotype, ♂, allotype, ♀: 'Namibia: Namib/Naukluft Park, Kuiseb River, near Gobabeb, 23.34S 15.03E, 18.ii-20.iii.1983', (SANC).

One ♂ specimen that is possibly conspecific was collected at: South Africa. 20km NE Barberton [25.18S 30.47E], 20-30.xi.2003, M. Halada (OLML & SC). This dramatically extends the distribution of this species.

Ceratina pacis COCKERELL (Fig. 22)

Ceratina pacis COCKERELL, 1937e: 2, 15-16, 26-27, 33; DALY & ELSE 1988: 87.

D i a g n o s i s : ♀ unknown. ♂ similar to *Ceratina nigriceps*, except clypeus black; fore tibia with yellow stripe on basal half only; hind tibia with yellow basal spot only.

D i s t r i b u t i o n (Fig. 22): This species is only known from the type locality, in Zimbabwe.

M a t e r i a l e x a m i n e d : Type material: Holotype *C. pacis*, ♂: "Type, B.M HYM. 17B 295, S. Rhodesia De Beers Ranch [19.58S 29.35E] 11-12.v.1932 A. Mackie *Ceratina pacis* CKLL. TYPE, Pres. by Imp. Inst. Ent. B.M. 1932-291", (NHML).

Ceratina minuta FRIESE (Figs 24a-e, 25), not placed in a species-group.

Ceratina minuta FRIESE, 1905: 3-4, 6, 14-15; FRIESE 1909a: 191, 192, 193, 200; FRIESE 1909b: 135-136, 164; STRAND 1911: 139; STRAND 1912a: 24; COCKERELL 1932a: 277; COCKERELL 1937e: 19, 39, 41; FRIESE 1941: 100; DALY 1973: 386.
Ceratina (*Malgatina*) *minuta* FRIESE: TERZO & PAULY [In] PAULY et al. 2001: 292, 295.
Ceratina alberti COCKERELL, 1937e: 1-2; DALY & ELSE 1988: 87, **nov.syn.**
Ceratina microsoma COCKERELL, 1937e: 16, 18-19; DALY & ELSE 1988: 88, **nov.syn.**

D i a g n o s i s : Both sexes small (♀ wing length, 3.0 mm), metallic green; distinct graduli on terga 2-4. ♂ with tubercle on hind femur.

D i s t r i b u t i o n (Fig. 25): This species occurs in the north-eastern part of southern Africa.

D e s c r i p t i o n : Measurements: ♀ (Duiwelskloof): wing, 3.0 mm; hamuli, 5; eye, 108: 84: 84: 67; clypeus, 53 × 62: 19: 57; interocellar, 19: 26: 8: 16, D 12; frontal carina, 43; malar area, 0 × 28; interalveolar, 28: 17: 31: 39, D 11; antenna, 59: 17: 19: 8: 8: 11, D 17.

♂ (Ellisras): wing, 2.5 mm; hamuli, 5; eye, 101: 82: 74: 59; clypeus, 54 × 56: 16: 54; interocellar, 17: 22: 8: 12, D 11; frontal carina, 43; malar area, 0 × 28; interalveolar, 25: 14: 31: 34, D 11; antenna, 54: 19: 23: 9: 9: 11, D 20.

Colour and Structure: ♀. Integument pale, metallic green with yellow maculation on mediolongitudinal region of clypeus, pronotal lobe, dorsal surface of fore femur, basal spot on middle femur, basal part of hind femur. Head densely punctate, shiny; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by an ocellus diameter; clypeus flattish, length about equal to maximum width (1: 91); mandible without inner, subapical tooth, length 0.59× maximum clypeus width; pronotum near dorsolateral angles finely and densely punctate, pubescent; impunctate area of scutal disk confined to mediolateral region; pronotum wide (not as in *C. braunsi*); pterostigma 0.40× as long as marginal cell; basitibial plate near base of hind tibia (0.27 tibia length from base); propodeum gently curved, entirely finely reticulate or finely and densely punctate; tergum 6 convex.

♂. Integument pale metallic green with yellow maculation forming inverted "T" on clypeus, entire pronotal lobe, dorsal surface of fore femur, basal spot on middle femur, basal part of hind femur. Head densely punctate, shiny; alveolocellar groove absent; lateral ocellus near head summit, separated from occiput by less than ocellus diameter; clypeus flat, length subequal to maximum width, upper width subequal to upper paraocular area; pronotum near dorsolateral angles finely and densely punctate, pubescent, broad; mesoscutal disk punctate; pterostigma less than half as long as marginal cell (1:0.39); middle femur widely and angulately expanded, posterior margin angulate near distal end (Fig. 24a), without tuft of hair in ventral view; hind femur with a basal tubercle on ventral surface (Fig. 24b), but no facet; without basitibial plate; hind tibia neither swollen nor with tuft of hair; propodeum gently curved and entirely finely

reticulate or finely and densely punctate; tergum 6 not modified; tergum 7 with apex truncate (Fig. 24c); sternum 6 and genital capsule as illustrated (Figs 24d-e).

M a t e r i a l e x a m i n e d : Type material. Lectotype *C. minuta*, ♂: 'D.O.-Africa Kigonsera 1903, *Ceratina minuta* FR, ♂ 1904 Friese det, Typus, *Ceratina minuta* Lectotype ♂ Howell V. Daly 1973', ZMHB. Holotype *C. alberti*, ♀: 'Type, *Ceratina alberti* CKLL TYPE, B.M. TYPE HYM 17B 241, T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291, Belgian Congo Albertville 1.ix.1931 Mr. L. Ogilvie', (NHML). Holotype *C. microsoma*, ♂: 'Type, B.M. TYPE HYM 17B 275, *Ceratina microsoma* CKLL TYPE ♂, Kigoma Aug 17 J.O., T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291', (NHML).

A d d i t i o n a l m a t e r i a l : Mozambique, 30 km NW Catandica, 17.47S 33.07E, 12.xii.2005, M. Halada (1♀, OLML & SC). South Africa. Kruger National Park, Pafuri, 22.26S 31.12E, 264m, i.1984, C.D. Eardley (8♀♀, 1♂, SANC). Idem, Skukuza, 24.59S 31.35E, 292m, 24.59S 31.35E, 18.21.i.1984, C.D. Eardley (2♀♀, 1♂, SANC). Idem, Crocodile River road [25.26S 31.58E], 28.v.1969, L.C. Starke (1♀, 1♂, SANC). Idem, Shirombe Pan, 22.44S 31.24E, 24.i.1984, C.D. Eardley (1♀, SANC). Kommatipoort, 3.v.1969, L.C. Starke (1♀, SANC). Duiwelskloof, 23.42S 30.06E, 12-14.i.1987, C.D. Eardley (5♀♀, SANC). Ellisras [23.40S 27.44E], 21.x.1972 (1♀), 20.v.1962 & 19.vi.1962 (2♂♂), H.N. Empey (SANC). Entabeni Forest Reserve, 7-11.i.1987, C.D. Eardley (1♂, SANC). Blyderivierpoort Dam Nature Reserve, 24.32S 30.47E, 25-26.x.1984, C.D. Eardley (1♀, SANC). Scottburgh [30.17S 30.45E], ii.1957, N.L.H. Krauss (1♀, CAS). Kosi Bay, 26.58S 32.48E, 10-11.ii.1990, C.D. Eardley (2♀♀, 3♂♂, SANC). Mtunzini, 28.58S 31.46E, 19.xii.1992, A.J. Urban (3♀♀, SANC). Zimbabwe. Umguza River, 20.05S 28.37E, 22.vii.1997, W.J. Pulawski (1♀, CAS). Botswana. Sukses Range, near Platjan, 22.27S 28.50E, 6.iv.1990, N.C. Pienaar (1♂, SANC).

Ceratina labrosa FRIESE (Figs 24f-h, 25), not placed in a species-group.

Ceratina labrosa FRIESE 1905: 3-4, 11-12; FRIESE 1909a: 191, 192, 197-198; FRIESE 1909b: 134-135; BRAUNS 1926a: 198, 230-231; COCKERELL 1937c: 546; 1937e: 32, 41; DALY 1973: 386.

Ceratina emarginata FRIESE 1905: 3-5, 11-12; FRIESE 1909a: 191, 192, 193, 197, 198; FRIESE 1909b: 135-136; STRAND 1912a: 18; BRAUNS 1926a: 198, 230; COCKERELL 1937e: 11, 23, 32, 41; ANONYMOUS 1958: 31; DALY 1973: 385, **nov.syn.**

D i a g n o s i s : ♀ clypeus flat, broadly concave ventrally (Fig. 24f); large (wing length about 5.9 mm). ♂ tergum 6 and terminalia unique; clypeus entirely pale yellow (cf. Fig. 1d); lower paraocular areas moderately to sparsely punctate, upper region glabrous; tergum 6 with a small tubercle in middle of distal margin.

D i s t r i b u t i o n (Fig. 25): This species is only known from the southern and south-western regions of South Africa.

D e s c r i p t i o n : Measurements: ♀ (Lectotype): wing, 5.9 mm; hamuli, 67; eye, 180: 160: 165: 190; clypeus, 70 × 175: 50: 70; interocellar, 30: 45: 30: 50, D 25; frontal carina, 105; malar area, 0 × 80; interalveolar, 40: 40: 50: 60, D 22; antenna, 70: 20: 20: 12: 15: 15, D 15.

♂ (Februarie Farm): wing, 4.4 mm; hamuli, 6; eye, 127: 105: 98: 99; clypeus, 65 × 96: 20: 70; interocellar, 26: 31: 25: 34, D 17; frontal carina, 54; malar area, 0 × 39; interalveolar, 29: 22: 39: 48, D 16; antenna, 40: 11: 16: 8: 8: 8, D 14.

Colour and Structure: ♀. Integument black, yellow maculation on mediolongitudinal region of clypeus (Fig. 24f), pronotal lobe, basodorsally on fore tibia, basal spots on middle and hind tibiae. Vestiture pale yellow under tarsi. Head moderately punctured, including upper face, shiny between punctures; alveolocellar groove absent; lateral ocellus below head summit, separated from occiput by about 1.5 ocellar diameters; clypeus flat, weakly to strongly concave ventrally, median length much less than maximum width (1:0.38) (Fig. 24f); mandible without inner subapical tooth, length 0.76× maximum clypeus length; gena as in Fig. 24g; pronotum with dorsolateral angles indistinct, no vertical carina, broad (not as in *C. braunsi*); scutal disk densely punctured anteriorly and posteriorly, sparsely punctured medially, shiny between punctures (Fig. 24h); pterostigma 0.32× as long as marginal cell; basitibial plate large, in middle of hind tibia; propodeum gently curved, coarsely sculptured anteriorly, finely sculptured posteriorly; tergum 6 with mediolongitudinal carina.

♂. Integument black, yellow maculation on entire clypeus, labrum, pronotal lobe (cf. Fig. 1d), dorsal surface of fore tibia, basal spot on middle tibia; proximal part of dorsal surface of hind tibia. Vestiture pale yellow under tarsi. Head punctation sparse (on lower paraocular area and vertex) to impunctate (upper face and clypeus), shiny between punctures; alveolocellar groove distinct; lateral ocellus below head summit, separated from occiput by twice ocellus diameter; clypeus flat, length 0.47× maximum width, upper width distinctly wider than adjacent paraocular area; mandible length 0.79× maximum clypeus width; pronotum near dorsolateral angles finely punctured, sparsely pubescent, with anterolateral, vertical carina; pronotum broad; scutal disk mostly impunctate, glabrous, densely punctured anteriorly; pterostigma 0.36× as long as marginal cell; middle femur not swollen, nor with tuft of hair in ventral view; hind femur without tubercle or fascia; hind tibia sometimes with hair pencil at mid-length, weakly swollen; basitibial plate about one-third from base of hind tibia (0.36 tibia length); propodeum gently curved, coarsely sculptured anteriorly, finely sculptured posteriorly; tergum 6 with tuberculate posteromedially; tergum 7 rounded to weakly emarginated posteriorly (Fig. 24i); sternum 6 and genital capsule resemble *C. aloes* (cf. Figs 1g-h).

B i o l o g y : Nests in green *Aloe* peduncle (BRAUNS 1926a).

M a t e r i a l e x a m i n e d : Type material. Lectotype *C. labrosa*, ♀: 'Capland Willowmore 9.6.1904 Dr. Brauns, *Ceratina labrosa* FR. ♀ 1904 Friese det. Type, *Ceratina labrosa*, FRIESE ♀ Lectotype Howell V. Daly 1973', ZMHB. Lectotype *C. emarginata*, ♀: 'Capland Willowmore 20.7.1907 Dr. Brauns, *Ceratina emarginata* FR. ♀ 1904 Friese det. Type', (ZMHB).

A d d i t i o n a l m a t e r i a l : South Africa. Goshen [32.16S 27.03E], near Cathcart, iii.1954 (1♂, SAMC). Umdala, iii.1954 (1♂, SANC). Strowan [33.18S 26.28E], near Grahamstown, 22.x.1969, F.W. Gess (1♂, AMGC). Lynton [33.08S 26.23E], near Grahamstown, 22.x.1969, F.W. Gess, S.K. Gess (1♂, AMGC). Hilton Farm, 21-31.x.1970, F.W. Gess (1♀, AMGC). Resolution, 9.i.1928 (1♀), 26.i.1928 (1♀), 27.xii.1927 (1♀) (TMSA), 1929 (1♀), Walton (SAMC). Fort Brown, 7.iii.1930 (1♂), 29.i.1928 (1♂) Walton (AMGC). Mossel Bay, 12.i.1922 (1♀), 28.xi.1938 (1♀), R.E. Turner (NHML). Graaff-Reinet [32.15S 24.33E], i.1979, C.D. Eardley (1♀, SANC). Willowmore, vi.1904, G. Kobrow (3♀♀, TMSA), 38.vii.1920, R.E. Turner (1♀, NHML), various dates, iii, iv, viii, x, xii.1904-1926 (56♀♀), various dates, vi, viii, xii.1896-1906 (13♂♂), H. Brauns (AMGC, NHML, MHUB, NM, SAMC, DMSA, TMSA, CAS, SM), i.1979 (2♀♀), in *Aloe*

peduncle, C.D. Eardley (SANC). Karoo National Park, 32.20S 22.30E, 13.xii.1988, C.D. Eardley (1♂, SANC). Hopefield, 9 km N, 15.x.1972, J.G. Rozen, R. McGinley, C. Thompson (1♂, AMNH). Van Rhynsdorp, viii.1927, H. Brauns) (1♀, 1♂, TMSA). Farm Arkoep, 1-2.x.1990, C.D. Eardley (1♂, SANC). Februarie Farm, 10-17.ii.2001, S. Van Noort (1♂, SANC).

The *Ceratina speculifrons* species-group

Ceratina speculifrons COCKERELL (Figs 26, 27a-c)

Ceratina speculifrons COCKERELL, 1920: 247-248; COCKERELL 1932a: 277; COCKERELL 1937e: 23, 40; ANONYMOUS 1958: 33; DALY & ELSE 1988: 88.
Ceratina speculifons var. *a* COCKERELL, 1920: 248; COCKERELL 1932a: 277.
Ceratina natalensis COCKERELL, 1937e: 22-23, 33; DALY & ELSE 1988: 87, **nov.syn.**

D i a g n o s i s : Axilla with a long, sharp, posterior spine, mesal margin anterior to spine convex (Fig. 27a); fore tibia partly yellow.

D i s t r i b u t i o n (Fig. 26): *Ceratina* speculifrons is know only from the east coast of South Africa.

D e s c r i p t i o n : Measurements: ♀ (*C. speculifrons* holotype): wing, 6.5 mm; hamuli, 8; eye, 193: 183: 174: 193; clypeus, 87 × 158: 45: 103; interocellar, 39: 58: 32: 42, D 19 ; frontal carina, 81; malar area, 0 × 64; interalveolar, 65: 48: 58: 61, D 16; antenna, 62: 10: 15: 7: 10: 10, D 20.

♂ (Kosi Bay): wing, 5.6 mm; hamuli, 7; eye, 175: 149: 158: 116; clypeus, 73 × 107: 54: 93; interocellar, 29: 43: 28: 39, D 17; frontal carina, 70; malar area, 0 × 62; interalveolar, 48: 39: 53: 60, D 14; antenna, 39: 11: 11: 8: 8: 16, D 19.

Colour and Structure: ♀. Head, mesosoma and metasoma and appendages black, except mediolongitudinal region of clypeus with a small yellow area, fore tibia with yellow stripe on dorsal surface, mid and hind tibiae with basal yellow spot. Vestiture white, including scopa (mostly naked). Head and mesosoma, including centre of scutum, mostly densely punctate, punctures large; integument shiny between punctures, clypeus (frontal view) sparsely punctate, with coarse, striate sculpture, centre of scutum sparsely punctate and shiny, propodeum with fine, dense punctation; metasoma with granular sculpture; clypeus moderately protuberant ventrally, ventral edge (frontal view) broadly concave but with narrow median area convex, ventro-horizontal area (ventral view) glabrous, long, about one third width, as wide as labrum, hypostomal carina normal; labrum flattish, unmodified; axilla with large, acutely pointed, posterior spine, mesal area anterior to spine convex (Fig. 27a); distal point of basitibial plate distinct, glabrous, simple, but with three small proximal spines, and 0.63 tibia length from base of tibia; propodeum with narrow, horizontal, basal margin with striate sculpture demarked with a distinct carina, remainder of propodeal triangle with reticulate sculpture; T2-T4 and S2-S3 each with a distinct gradulus; terga and sterna with no obvious distal fringes, and no modified hairs; median region of T6 convex.

♂. Similar to ♀ except as follows: legs mostly reddish-black, yellow maculation on yellow, entire clypeus, most of labrum, dorsal surface of for tibia only; centre of scutum densely punctate; clypeus not protuberant without ventro-horizontal area; without a basitibial plate; T2-T3 and S2 with distinct graduli, T3-T4 without graduli, S3-S4 not visible; T6 with medio-longitudinal carina; T7 broadly concave posteriorly (Fig. 27b); terminalia as in Figs 27c-d.

Material examined: Type material: Holotype *C. speculifrons*, ♀: 'Type, B.M HYM. 17B 221, Eshowe, 17-16, Marley, *Ceratina speculifrons* CKLL. TYPE,' (NHML). Holotype *C. natalensis*, ♀: 'Type, B.M HYM. 17B 277, S. AFRICA, Natal, Amanzimtoti, 16.x.1931, J. Ogilvie, *Ceratina natalensis* CKLL. TYPE, T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291,' (NHML).

Additional material: South Africa: Lake Sibaya, E. shore, 27.22S 32.43E, 18-20.i.1981, M. Mansell (1♂), 10.xi.1984, R. Oberprieler (1♀) (SANC). Kosi Bay, 26.58S 32.48E, 10-11.ii.1990, C. Eardley (1♀, 2♂♂, SANC). Kuleni farm, Hluhluwe, 27.54S 32.22E, 14.ii.1990, C. Eardley (1♀, SANC). Richards Bay, 8.viii.1973, H. Empey (1♀, SANC). Umtentwini [30.44S 30.29E], 20.iv.1973, H. Empey (1♀ SANC). Mozambique: Inhaca Island, 26.01S 32.58E, 3.ix.1985, G. Walter (1♀, SANC). Zimbabwe. Chirinda Forest [19.14S 32.14E], 26.i.1998, M. Halada (3♀♀, 2♂♂, OLML & SC). Vumba Mountains [19.01S 32.42E], 18.iv.1985, J. Gusenleitner (1♂, OLML & SC). Chimanimani [19.30S 32.33E], 18.iv.1985, J. Gusenleitner (1♂, OLML & SC).

Ceratina nativitatis COCKERELL (Fig. 26)

Ceratina nativitatis COCKERELL, 1937e: 23; DALY & ELSE 1988: 88; DALY 1988: 7.

Diagnosis: Both sexes with axilla weakly pointed posteriorly. ♀ with tibia back.

Distribution (Fig. 26): *Ceratina nativitatis* is endemic to the eastern highlands of Zimbabwe.

Description: Measurements: ♀ (allotype): wing, 5.0 mm; hamuli, 6; eye, 151: 132: 142: 132; clypeus, 39 × 108: 39: 403; interocellar, 31: 42: 8: 31, D 17 ; frontal carina, 65; malar area, 0 × 57; interalveolar, 45: 33: 50: 40, D 14; antenna, 50: 16: 8: 8: 8: 9, D 16.

♂ (holotype): wing, 5.3 mm; hamuli, 6; eye, 142: 116: 119: 96; clypeus, 64 × 90: 37: 84; interocellar, 25: 31: 19: 26, D 16; frontal carina, 60; malar area, 0 × 45; interalveolar, 40: 26: 45: 50, D 14; antenna, 31: 11: 11: 6: 8: 16, D 19.

Colour and Structure: ♀. Head, mesosoma and metasoma and appendages black, except medioventral region of clypeus yellow. Vestiture white, including scopa (mostly naked). Head and mesosoma, including centre of scutum, mostly densely punctate, punctures large; integument shiny between punctures; metasoma with granular sculpture; clypeus moderately protuberant ventrally, ventral edge narrowly straight (frontal view), ventro-horizontal area (ventral view) glabrous, short, less than one fifth of its width, as wide as labrum; hypostomal carina normal; labrum flattish, unmodified; axilla with mesal edge convex, a small, obtuse angle behind (not spinose); distal point of basitibial plate distinct, glabrous, bifurcate and 0.63 tibia length from base of tibia; propodeum with narrow, horizontal, basal margin with striate sculpture demarked with a distinct carina, remainder

of propodeal triangle glabrous; T2-T4 with a distinct gradulus; T2-T4 and S2-S4 with distal fringes with sparse, unmodified hairs.

♂. Similar to ♀ except as follows: appendages reddish-black; yellow maculation on most of lower half of clypeus (hat-shaped mark), clypeus not protuberant with ventro-horizontal area; without a basitibial plate; T2-T3 and S2 with distinct graduli, T3-T4 without graduli, S3-S4 not visible; T6 with medio-longitudinal carina; T7 broadly concave posteriorly; S7, genitalia not visible.

Material examined: Type material: *C. nativitatus*, ♂: 'Type, B.M HYM. 17B 279, S, Rhodesia Xmas Pass Umtali 20-21.v.1932 J. Ogilvie, *Ceratina nativitatus* CKLL. TYPE, T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291', (NHML).

Additional material: Zimbabwe: Christmas Pass [18.55S 32.38E], Umtali, 20-21.v.1932, A. Mackie (1♀ NHML). Inyangombe Falls, 28.17S 32.44E, 29.i.1986, C. Bellamy (1♀ SANC).

Ceratina durbanensis COCKERELL (Figs 26, 27e)

Ceratina durbanensis COCKERELL, 1934: 1-2, ♂ holotype (AMNH) South Africa; COCKERELL 1937e: 40; DALY & ELSE 1988: 88.

Ceratina opaca FRIESE, 1905: 3-5, 13, ♂ lectotype (ZMHB) South Africa; FRIESE 1909a: 191, 192, 193, 198-199; FRIESE 1909b: 134-135; COCKERELL 1937e: 23, 41; DALY 1973: 386, **nov.syn.**

Ctenoceratina opaca (FRIESE): TERZO & PAULY [In] PAULY et al. 2001: 298.

Diagnosis: ♀ unknown. ♂ with axilla sharply pointed posteriorly spine, and strongly concave mesally, separated from scutellum (Fig. 27e).

Distribution (Fig. 26): *Ceratina durbanensis* is known only from the type locality.

Description: Measurements: ♂ (holotype): wing, 2.7 mm; hamuli, 7; eye, 77: 74: 76: 62; clypeus, 31 × 54: 22: 50; interocellar, 16: 22: 11: 11, D 9; frontal carina, 33; malar area, 0 × 22; interalveolar, 26: 17: 23: 28, D 9; antenna, 23: 5: 8: 5: 8: -: -.

Colour and Structure: ♂. Similar to *C speculifrons*, except axilla strongly concave mesally (Fig. 27e).

Material examined: Type material: Holotype *C. durbanensis*, ♂: 'Durban Natal Africa 1917, *Ceratina durbanensis* CKLL. TYPE, Compared with type of *Ceratina opaca* FR. Det. H. Daly 1973', (AMNH). Lectotype *C. opaca*, ♂: 'Algoa Bay, Capland, *Ceratina opaca* ♂ FR., 1904 Friese det., *Ceratina opaca* Friese Lectotype designated Daly and Else, 1987', (ZMHU).

Ceratina (*Protopithitis*)

Pithitis (*Protopithitis*) HIRASHIMA, 1969: 651. Type species: *Ceratina aereola* VACHAL
Ceratina (*Protopithitis*) HIRASHIMA: MICHENER 1997: 49; MICHENER 2000: 68, 595, 598.

This subgenus has not been recorded from southern Africa before. The species *Ceratina daressalamica* does not fit comfortably in *Ceratina* (*Protopithitis*) because it has a weak gradulus on T3 and a carina between the subhorizontal and subvertical parts of the

propodeum. The species also does not fit into in *Ceratina* (*Pithitis*) because the mandible is straight and the axilla is not modified, and from most species in the other *Ceratina* subgenera it differs in that it is strongly metallic and does not have a basitibial plate.

Ceratina (*Protopithitis*) *daressalamica* STRAND (Figs 27f-i, 28)

Ceratina daressalamica STRAND, 1912a: 18; COCKERELL 1937e: 41; DALY 1973: 385.
Ceratina furcilinea STRAND, 1912a: 25-26; COCKERELL 1937e: 41; DALY 1973: 387, **nov.syn.**
Ceratina pallidipes COCKERELL, 1937e: 3-4, 27; DALY & ELSE 1988: 87, **nov.syn.**

D i a g n o s i s : Both sexes metallic blue, axilla not pointed behind, weak gradulus on tergum 3 and no gradulus on tergum 4.

D i s t r i b u t i o n (Fig. 28): This species is known in southern Africa from the Mozambique and KwaZuluNatal coasts. It was described from Tanzania.

D e s c r i p t i o n : Measurements: ♀ (Inhambane): wing, 4.2 mm; hamuli, 5; eye, 123: 141: 152: 153; clypeus, 147 × 62: 16: 74; interocellar, 40: 40: 46: 54, D 14 ; frontal carina, 56; malar area, 0 × 37; interalveolar, 42: 39: 57: 62, D 12; antenna, 39: 16: 12: 12: 12: 14, D 16.

♂ (Holotype): wing, 4.2 mm; hamuli, 5; eye, 108: 103: 99: 99; clypeus, 50 × 79: 16: 67; interocellar, 31: 29: 16: 20, D 12 ; frontal carina, 46; malar area, 0 × 23; interalveolar, 31: 19: 43: 46, D 11; antenna, 22: 8: 8: 8: 14: 14, D 16.

Colour and Structure: ♀. Colour: head, mesosoma and metasoma metallic blue, mostly on rim of punctures, generally black or orange between punctures but sometimes metallic blue, antenna black to orange; labrum, mandible and legs orange; pronotal lobe partly orange; yellow maculation on clypeus hat-shaped, ventrolateral regions reduced (Fig. 27f), ventral surface and distal end of dorsal surface of fore femur, proximal region of dorsal surface fore tibia, proximal region of dorsal surfaces of hind tibia and hind basitarsus. Head capsule large, gena a little wider than eye and vertex a little shorter than clypeus; mandible straight; labrum width more than twice length; centre of scutum sparsely punctate, punctures several diameters apart; axilla not modified; anterior region of propodeum similar in width as metanotum, finely sculptured (mat-appearance), with several longitudinal carinae; anterior, subhorizontal region separated from posterior region by a distinct carina; propodeal triangle distinct.

♂. Similar to ♀ except: yellow maculation on entire clypeus, ventral surface and distal end of dorsal surface of fore femur, entire dorsal surface fore tibia; head capsule not enlarged, gena narrower than eye and vertex much shorter than clypeus; labrum width twice length; tergum 7 as illustrated (Fig. 27g); sternum 6 (Fig. 27h); genital capsule as illustrated (Fig. 27i).

M a t e r i a l e x a m i n e d : Type material: Lectotype *C. daressalamica*, ♂: 'D.O. Afrika Daressalam Pangani u. hinterld. Regner S.G., *Ceratina daressalamica* m. ♂ Strand det., type, *Ceratina daressalamica* STRAND ♂ Lectotype Howell V. Daly 1973', (MHUB). Holotype *C. pallidipes*, ♀: 'Type, B.M HYM. 17B 267, *Ceratina pallidipes* CKLL. TYPE, T.D.A. COCKERELL Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291, Portug. E. Africa, Mozambique, 6.vi.1932, J. Ogilvie', (NHML).

A d d i t i o n a l m a t e r i a l : Mozambique: Inhambane [23.52S 35.23E], R.F. Lawrence, January 1924, (1♀, SAMC). Guro, 15 km S, 17.33S 33.16E, 30.xi.2005, Kadiecova (3♂♂,

OLML & SC). Catandica, 30 km NW, 17.47S 33.07E, J. Halada (1♂, OLML & SC). Massinga, 25 km N, 23.07S 35.17E, 22.xii.2005, J. Halada (1♀, OLML & SC). South Africa: SW Emanguzi [26.52S 32.52E], 29.i.2003, M. Snizek (1♂, OLML & SC).

Ceratina (*Pithitis*)

Pithitis KLUG in ILLIGER, 1807: 198. Type species: *Apis smaragdula* FABRICIUS 1787, monobasic; DALY 1983a: 58-61; 1983b: 499-505; 1988: 7; TERZO & PAULY [In] PAULY et al. 2001: 287.
Ceratina (*Pithitis*) KLUG: MICHENER 1997: 47; 2000: 68, 595, 598.

Ceratina (*Pithitis*) is represented in southern Africa by two species. The most conspicuous diagnostic feature of *Ceratina* (*Pithitis*) is the metallic blue colour, and mostly this is enough. Five specimens of *C.* (*Pithitis*) *nasalis* that are metallic gold and red, all from Namibia, have been studied. *Ceratina minuta* is weakly metallic green, and is lightly sculptured, whereas *Ceratina* (*Pithitis*) are strongly sculptured. *Ceratina daressalamica* is also metallic, but differs from *Pithitis* in that the axilla is rounded posteriorly and the mandible is straight. The features that in combination separate *Ceratina* (*Pithitis*) from the other subgenera of *Ceratina* are the mandible curved distinctly inwards by about 45 degrees, the axilla pointed behind (this also occurs in the *C. speculifrons* species-group), there is no basitibial plate and no graduli on T2-T3.

Key to the southern African species of *Ceratina* (*Pithitis*)

1. Scutum densely punctate, punctures about a puncture diameter apart; pronotal lobe black; axilla very sharply pointed posteriorly; ♀ with yellow clypeal mark usually longitudinally oval, occasionally hat-shaped; ♂ T7 truncate posteriorly .... *Ceratina nasalis* FRIESE

- Scutum sparsely punctate medially, punctures several puncture diameters apart; pronotal lobe yellow; axilla pointed posteriorly, but not spinose; ♀ with hat-shaped yellow clypeal mark; ♂ T7 gently convex posteriorly..... .....*Ceratina inermis* FRIESE

Ceratina (*Pithitis*) *nasalis* FRIESE (Figs 28, 29a-j)

Ceratina viridis nomen nudem: ILLIGER, 1806.
Ceratina viridis GUÈRIN, 1845: 449; COCKERELL 1920: 247; COCKERELL 1932a: 273-274 [incorrectly recorded from southern Africa].
Pithitis viridis (GUÈRIN): DALY 1983b: 500, 502, 504-505.
Ceratina viridissima DALLA TORRE, 1896: 201 [unnecessary name change].
Ceratina nasalis FRIESE, 1905: 3, 5, 8; FRIESE 1909a: 191, 192, 194; FRIESE 1909b: 132, 134-135; COCKERELL 1910: 220; STRAND 1912a: 15, 21, 23; FRIESE 1915: 270; COCKERELL 1932a: 273; COCKERELL 1937e: 23-24, 36, 41; FRIESE 1941: 100; ANONYMOUS 1958: 32; DALY 1973: 386.
Ceratina nasalis var. *viriditincta* STRAND, 1912a: 23-24; COCKERELL 1937e: 41; DALY 1973: 387, **nov.syn.**
Ceratina nasalis var. *arida* COCKERELL, 1937e: 24; DALY & ELSE 1988: 87, **nov.syn.**

Ceratina nasalis viridior COCKERELL, 1937e: 24; DALY & ELSE 1988: 91, **nov.syn.**
Ceratina acutipyga STRAND, 1912a: 22-23; COCKERELL 1937e: 41; DALY 1973: 387, **nov.syn.**
Ceratina pileifera COCKERELL, 1935: 2; COCKERELL 1937e: 3-4, 11, 25, 28-29, 37; COCKERELL 1937c: 544; DALY & ELSE 1988: 90, **nov.syn.**
Ceratina pileifera var. COCKERELL, 1935: 2.

The type material of *Ceratina viridis* GUÈRIN was not studied. This species was first described by GUÈRIN (1845) from Senegal. It was first recorded from southern Africa by COCKERELL (1920). The holotype of *C. viridis* has not been located. FRIESE (1905) does not separate *C. viridis* and *C. nasalis* on the colour of the clypeus, which is the most conspicuous difference between the southern African species of *Ceratina* (*Pithitis*). Therefore, *C. viridis* recorded from southern Africa are understood to be *C. nasalis* that were misidentified as *C. viridis*. It is unlikely that *C. viridis*, which was described from Senegal, is conspecific with *C. nasalis*, which was described from south-eastern region of South Africa.

The type specimen of *nasalis* var. *arida* COCKERELL was not located in the NHML by CDE but HVD recorded the type number as BM17B 1254 indicating that he had seen it. The type material of *Ceratina pileifera* was studied.

In southern Africa this species is the most common *Ceratina* (*Pithitis*), especially the metallic blue variety. Some are metallic pale green (not bright green), some have the metallic colour confined to the punctures on the dorsal surfaces of the mesosoma and metasoma, and in Namibia there are metallic brass and metallic red specimens.

Diagnosis. Both sexes axilla with long, acutely pointed, posterior spine, and central part of scutum is densely punctate. ♀ mediolongitudinal region of clypeus yellow and ♂ clypeus maculation weakly hat-shaped.

D i s t r i b u t i o n (Fig. 28): This species is widespread in southern Africa.

D e s c r i p t i o n : Measurements: ♀ (Mogol): wing, 5.1 mm; hamuli, 5; eye, 145: 152: 145: 129; clypeus, 71 × 113: 23: 90; interocellar, 39: 48: 32: 45, D 16 ; frontal carina, 58; malar area, 0 × 48; interalveolar, 42: 32: 58: 65, D 16; antenna, 48: 16: 7: 7: 7: 10, D 16.

♂ (Mogol): wing, 5.6 mm; hamuli, 4; eye, 158: 168: 158: 139; clypeus, 77 × 113: 48: 94; interocellar, 36: 48: 32: 48, D 16; frontal carina, 77; malar area, 0 × 58; interalveolar, 45: 39: 58: 68, D 19; antenna, 42: 16: 10: 7: 10: 6, D 19.

Colour and Structure: ♀. Head, mesosoma and metasoma with metallic blue-green mostly on rim of punctures, generally black between punctures but sometimes metallic blue-green (Figs 29a-c), sometimes reddish non-metallic between punctures on metasoma; sometimes (Namibia only) head, mesosoma and metasoma metallic gold and metallic red, or metallic bright green (latter colour variety common north of southern Africa); antenna black to orange; labrum and mandible black; fore femur metallic and concolorous with metasoma, except orange and not metallic in gold and red specimen; for tibia and tarsus and entire middle and hind legs mostly black, sometimes metallic blue-green, orange in gold and red specimen; yellow maculation occurs on mediolongitudinal region of clypeus, sometimes expanded ventrolaterally and weakly hat-shaped, and proximal regions of dorsal surface of fore and hind tibiae (maculation varies in extent, mostly more extensive in northern parts of southern Africa, that on legs sometimes absent in south). Vestiture confined to legs and white, including scopa

(mostly naked). Centre of scutum densely punctate, punctures about a puncture diameter apart; axilla very sharply pointed posteriorly (spinose); anterior region of propodeum shorter than or as wide as metanotum, glabrous with distinct, longitudinal carinae, separated from posterior region of propodeum by a lateral carina; propodeal triangle clearly visible behind propodeal carina.

♂. Similar to ♀ except as follows: yellow maculation on almost entire clypeus (hat-shaped mark), mediobasal region of labrum and more extensive markings than in ♀ on proximal regions of dorsal surface of fore and hind tibiae (Figs 29d-f); Middle tibia not concave ventrally (Fig. 29g); tergum 7 truncate (Fig. 29h); sternum 6 and gonostylus as in Figs 29i-j.

B i o l o g y : It has been collected on flowers of *Aspalathus spinescens*, *Berkheya heterophylla*, *Berkheya* sp., *Crotalaria* sp., *Petalidium variabilis*, *Psoralea pinnata*, *Senecio* sp. and orchid. Nest were found in the stem of *Berkheya* sp.

M a t e r i a l e x a m i n e d : Type material: Holotype *C. nasalis*, ♀: 'Algoa bay Capland 16.7.96, Dr. Brauns, *Ceratina nasalis* FR. ♀ 1904 Friese det. Type, Zool. Mus. Berlin', (MHUB). Holotype *C. nasalis* var. *viriditincta*, ♂: 'Sansibar, Hilderbrandt S., *Ceratina nasalis* var. *viriditincta* m. ♂ Strand det., *Ceratina nasalis* FR. var. ♂ 1909 Friese det., *Ceratina nasalis* var. *viriditincta* ♂ Holotype Howell V. Daly 1973', (MHUB). Lectotype *C. nasalis viridior*, ♂: 'Type, B.M HYM. 17B 299, *Ceratina nasalis viridior* CKLL. TYPE, Pres. by Imp. Inst. Ent. B.M. 1935-492, Cape Province, Ceres, Mitchell's Pass, 9-17.ii.1932, J. Ogilvie, *Ceratina nasalis viridior* Cockerell lectotype designated Daly and Else 1987', (NHML). Holotype *C. acutipyga*, ♀: 'Kapland Krebs S., *Ceratina acutipyga* m. ♀ Strand det., Type, *Ceratina acutipyga* STRAND holotype ♀ Howell V. Daly 1973', (ZMHB). Lectotype *Ceratina pileifera*, ♂: 'Type, B.M HYM. 17B 313, *Ceratina pileifera* CKLL. TYPE, T.D.A. Cockerell Exp. to Africa 1931. Pres. by Imp. Inst. Ent. B.M. 1932-291, Portug. E. Africa, Beira, 11.vi.1932, *Ceratina pileifera* COCKERELL lectotype designated DALY & ELSE 1987', (NHML).

A d d i t i o n a l m a t e r i a l : Mozambique: Chimoio, 40 km SW, 19.23S 33.11E, 16.xii.2005, J. Halada (8♂♂, OLML & SC). 65 km S Vlongne, 15.13S 34.19E, 8.xii.2005, Kadlecova (2♀♀, 5♂♂, OLML & SC). Tete, 100 km NE, 15.26S 34.20E, Kadlecova (2♀♀, 4♂♂, OLML & SC). Manje, 15 km SSE, 15.29S 33.16E, J. Halada (1♀, 5♂♂, OLML & SC). Nyaca [26.00S 32.56E], ii.1924, R. Lawrence (3♂♂, SAMC). Zimbabwe: Chimanimani [19.30S 32.33E], 25.iv.1985, J. Gusenleitner (1♀, OLML & SC). Harare, 30 km W [17.49S 30.46E], 29.xi.1998, M. Halada (1♂, OLML & SC). Chinhoyi, 15 km NW [17.22S 30.12E], 11.iv.1985, J. Gusnleitner (3♀♀, 1♂, OLML & SC). Lake Kyle [20.11S 31.01E], 16.iv.1985, J. Gusenleitner (1♀, OLML & SC). Shamva (Bindura) [17.18S 31.20E], 17& 29.xii.1998, M. Halada (3♀♀, 1♂, OLML & SC). Victoria Falls [17.56S 25.50E], 17.56S 5.50E, 28-3.iii.1998 (1♀, AMNH). Lonely Mine [19.30S 28.45E], 9.xi.1919 (2♀♀, SAMC). Sawmills [19.35S 28.02E], 29.xii.1929 (2♀♀, 1♂, SAMC). Bulawayo [20.09S 28.35E], 12.x.1912, G. Arnold (1♀, SAMC). Matetsi [18.03S 26.36E], 17.x.1934, R. Stevenson (1♀, SAMC). De Beer's Ranch, Umgusa River [19.30S 27.46E], 9.vi.1924 (1♂, SAMC). Charara [16.33S 28.57E], 20.xii.1998, M. Halada (1♂, OLML & SC). Botswana: Okavango Delta, Xaxaba Island, 19.32S 23.02E, 15-17.vii.1990, H. Daly (4♀♀, 1♂, CASC). Okavango Delta, Chief's Island, 19.32S 23.05E, 15-17.vii.1990, H. Daly (1♀, 1♂, CASC). Crocodile Camp Lodge, 13Km NE Maun, 19.55S 23.30E, 14.vii.1990, H. Daly (4♂♂, CASC). Farmers Brigade, 5KM S.E. Serowe, 1300m, P. Forchhammer (1♂, SANC). Maun [19.59S 23.25E], 930m, 6.xi.1967, E. Ross, A. Stephen (2♂♂, CASC). Namibia: Otavi, SW [19.38S 17.20E], 27.i.1993, M. Schwarz (1♂, OLML & SC). Tsumeb [19.14S 17.43E], 7-8.iii.1990, M. Schwarz, (2♀♀, OLML & SC). Rundu [17.56S 19.46E], 19-29.ii.1993, M. Schwarz (9♀♀, 9♂♂, OLML & SC). Hoarusib

[19.04S 12.33E], iii.1926 (1♀, bright green, SAMC). Windhoek [22.35S 17.05E], 5.ii.1972 (1♀, NHML). Kuiseb Canyon, 23.18S 15.45E, 22-23.i.1972 (1♂, gold and red, NHML). 38-61km E from C14, 23.15S 16.16E, 23.15S 16.17E, 23.17S 16.07E, F. Gess, S Gess, on *Crotalaria* sp. (3♂♂, gold and red, AMGC). Uis to Omaruru, 21.14S 15.00E, F. Gess, S. Gess, on *P. variabilis* (1♀, gold and red, AMGC). Ongandjera [17.53S 15.04E], iii.1923 (1♂, SAMC). Lesotho: Mamathes [29.08S 27.51E], 13.i.1951, 27.xii.1946, C. Jacot-Guillarmod (2♂♂, AMGC). South Africa: Pafuri, 22.26S 31.12E, 264m, 20-24.i.1985, N.C. Pienaar (2♀♀, SANC). Entabeni Forest Reserve, 7-11.i.1987, C.D. Eardley (1♀, SANC). Happy Rest Nature Reserve, 22.59S 29.46E, 10.iii.1990, (1♀, SANC). Langjan Nature Reserve, 22.52S 29.24E, 10-20.i.1980, C.D. Eardley (1♂, SANC). Fanie Botha Nature Reserve, near Tzaneen, 23.50S 30.10E, 2-6.iii.1986, J.S. Donaldson (1♂, SANC). Bourkes Luck, 24.40S 30.40E, 28.ii.1986, B. Grobbelaar (2♀♀, 1♂, SANC). Kruger National Park, Pretoriuskop, 25.09S 31.16E, 591m, 17.i.1985, G.L. Prinsloo (1♀, 1♂, SANC). Loskop Dam Nature Reserve, 25.25S 29.20E, 12-13.xii.1985, C.D. Eardley (2♂♂, SANC). Die Hel, Olifants River near Loskop Dam [25.26S 29.18E], 26-27.vii.1975, R.H. Watmough (2♀♀, SANC). Weltevreden, 25.34S 31.10E, 24.i.1990, G.L. Prinsloo (1♂, SANC). Lapalala Nature Reserve, 23.51S 28.17E, 21-22.i.1987, B. Grobbelaar (1♂, SANC). Kommatipoort, 3.vi.1969, L.C. Starke (2♀♀, SANC). Barberton, xii.1978, C.D. Eardley (1♀, SANC). Barberton, 13.ii.1968, D. Brothers (1♀, 1♂, AMGC). Pongolapoort, 27.02S 31.57E, 7.ii.1990, C.D. Eardley (1♀, 2♂♂, SANC). Kommatipoort, 29.v.1969, M.W. Strydom (1♂, SANC). Tugela Ferry [28.44S 30.27E], 13.xi.1971, H. Empey (1♀, SANC). Drakensberg Botanical Gardens, Harrismith, 28.17S 29.09E, 2.xii.1986, C.D. Eardley (1♀, 1♂, SANC). Weenen [28.51S 30.04E], 873m, vii-viii.1923, iii.1924, H.P. Thomasset (2♂♂, SANC). Mt Gilboa, summit [29.17S 30.16E], xi. 1999-ii.2000, S.D. Johnson (1♀, SANC). Mfongosi [27.18S 32.10E], W. Jones, iii.1917 (2♀♀, 1♂, SAMC). Nylsvley Nature Reserve [24.39S 28.40E], vi.1978, S. Nunn (1♀, SANC). Warmbad [24.53S 28.17E], 15.xi.1969, H. Empey (1♀, SANC). Tswaing Crater, 38 km NNE Pretoria, 25.24S 28.06E, 27.ii.1998, W. Pulawski (1♀, 2♂♂, CASC). Roodeplaat Horticulture Research Institute, 25.41S 28.18E, 7.i.1983, N. Grobelaar (1♂, SANC). Pretoria [25.45S 28.10E], xii.1978, C.D. Eardley (1♀, SANC). Stoffberg, 5 km N, 25.23S 29.48E, 16.i.1989, V. Uys (1♀, SANC). Rustenburg Nature Reserve, 25.40S 27.12E, 7-8.ii.1983, C.D. Eardley (1♀, SANC). Magaliesberg, Castle Gorge, 25.48S 27.34E, 17.ii.1993, R. Urban (1♀, SANC). Mogol Nature Reserve, Ellisras, 23.58S 27.45E, 27-29.ii.1984, C.D. Eardley (2♀♀, SANC). Mica [24.09S 30.50E], 10.xii.1974, J. Rozen, B. Rozen (1♀, 3♂♂, AMNH). Groenfontein, 35km E. Thabazimbi 24.34S 27.45E, 27.xi.1980, C. Kok (1♂, SANC). Swartruggens [25.39S 26.42E], 12.x.1963, H. Empey (2♀♀, 6♂♂, SANC). Mondeor [26.12S 28.05E], Johannesburg, 23.ii.1963, H. Empey (1♀, 1♂, SANC). Klerksdorp [26.52S 26.40E], 11.i.2001, M. Snizek (2♀♀, 1♂, OLML & SC). Severn, 43 km S [26.55S 22.43E], 2622DB, 3.iii.1980, V. Whitehead (1♀ SAMC). Algoa Bay, 19.viii.1994, H. Brauns (2♀♀, CASC). Cold Springs [33.19E 26.30S], SW Grahamstown, 2-9.ii.1975, C. Jacot-Guillarmod, on *P. pinnata* (3♀♀, AMGC). Zuurberg, 33.24S 26.45E, 4.v.1994, A. Weaving (4♀♀, AMGC). Table Farm, 31.xii.1986, R. Gess, on *Senecio* sp. (1♂, AMGC). Hilton Farm, from *Berkheya* sp. stalk (1♂, AMGC). Strowan, 16.x.1972, F. Gess, on *B. heterophylla* (5♀♀, 3♂♂, AMGC). Ratelfontein, 32.02S 18.35E, 7.x.1995, F Gess, S. Gess, on *A. spinescens* (1♀, AMGS). Tsitsikama Forest [34.01S 23.55E], 28.xii.1966, C. Jacot-Guillarmod (1♀, 1♂, AMGC). Wilderness [33.58S 22.34E], 11.iii.1970, L.C. Starke (1♀, SANC). Hermanus, Fernkloof Nature Reserves, 34.24S 19.14E, 14.xi.1982, C.D. Eardley (1♀, SANC). Ladismith, 16-28.ix.1948, C. Jacot-Guillarmod (17♀♀, AMGC). Villiersdorp Botanical Gardens, 33.59S 19.17E, 20.xi.1982, C.D. Eardley (1♀, SANC). Cape Town, 1914, F. Foly (6♀♀, 10♂♂, SAMC). 15km E. Citrusdal, 32.37S 19.08E, 4.x.1990, C.D. Eardley (1♀, SANC). Jonkershoek [33.26S 18.54E], Stellenbosch, 2.ii.1981, L.M. duPreeze (1♀, SANC). Pierboom Pass, 32.52S 19.39E, near Ceres, 8.xii.1988, C.D. Eardley (1♀, SANC).

Ceratina (*Pithitis*) *inermis* FRIESE (Figs 28, 30a-d)

Ceratina inermis FRIESE, 1905: 3, 5, 8; FRIESE 1909a: 191, 192, 195; FRIESE 1909b: 135; STRAND 1912a: 18; STRAND 1912b: 133; STRAND 1912c: 285; COCKERELL 1932a: 274; COCKERELL 1937e: 13, 24, 40; FRIESE 1941: 100; DALY 1973: 385.

Ceratina turneri COCKERELL, 1935: 2, 36; COCKERELL 1937c: 544; 1937e: 3-4; DALY & ELSE 1988: 88, **nov.syn.**

D i a g n o s i s : Both sexes axilla with obtusely angled, posterior spine, central part of scutum densely punctate, clypeus maculation hat-shaped.

D i s t r i b u t i o n (Fig. 28): This species is only known from the northern part of the sub-continent.

D e s c r i p t i o n : Measurements: ♀ (Wylliespoort): wing, 5.1 mm; hamuli, 5; eye, 148: 155: 148: 139; clypeus, 74 × 123: 19: 87; interocellar, 42: 42: 39: 55, D 16; frontal carina, 65; malar area, 0 × 48; interalveolar, 39: 32: 55: 61, D 19; antenna, 48: 16: 13: 7: 7: 13, D 16.

♂ (Mica): wing, 4.1 mm; hamuli, 5; eye, 123: 123: 119: 100; clypeus, 65 × 90: 23: 75; interocellar, 32: 32: 19: , D 32; frontal carina, 52; malar area, 0 × 32; interalveolar, 32: 23: 42: 48, D 16; antenna, 29: 11: 11: 12: 16: 19, D 17.

Colour and Structure: ♀. Similar to *C. nasalis*, except as follows: scutum more sparsely punctate (punctures several puncture diameters apart) and therefore more black; yellow maculation on almost entire clypeus (hat-shaped mark), pronotal lobe, ventral surface and distal end of dorsal surface of fore femur, proximal region of dorsal surface fore tibia, proximal region of dorsal surface of hind tibia and hind basitarsus; axilla pointed, but not spinose, posteriorly; anterior region of propodeum wider than metanotum, finely sculptured (mat-appearance, longitudinal carinae weakly developed) and propodeal triangle not clearly visible behind propodeal carina.

♂. Similar to ♀ except as follows: yellow maculation also occurs on mediolongitudinal region of labrum, mandible and more extensively on fore femur, fore tibia and hind tibia; all tarsi yellowish-orange; anterior region of propodeum somewhat glabrous, with a few well developed longitudinal carinae; middle femur concave ventrally (Fig. 30a); tergum 7 gently convex posteriorly (Fig. 30b); sternum 6 and genital capsule as in Figs 30c-d.

B i o l o g y : It has been collected on flowers of *Crotalaria doidgeae*.

M a t e r i a l e x a m i n e d : Type material. Lectotype *C. inermis*, ♂: 'Shilouvane N. Transvaal /D. (Junod), *Ceratina inermis* FR. ♂ 1904 Friese det., Type, *Ceratina inermis* Friese ♂ Lectotype Howell V. Daly 1973', (ZMHB). Holotype *C. turneri*, ♀: 'Okahandja, 17-23.ii.1928, S.W. AFRICA, R.E. Turner, Brit. Mus. 1928-144, *Ceratina turneri* CKLL. TYPE, Type, B.M. HYM. 17B 1193, (NHML).

A d d i t i o n a l m a t e r i a l : Mozambique: NE Guro, 30 km, 17.14S 33.27E, 11.xii.2005, J. Halada (2♀♀, 5♂♂, OLML & SC). Tete, 70 km S, 16.39S 33.20E, 10.xii.2005, J Halada (1♂, OLML & SC). South Africa: Wylliespoort, Ingwe Motel, 22.58S 29.57E, 31.i.1984, C.D. Eardley (1♀, SANC). Barberton, iii.1979, C. Moolman, C.D. Eardley (2♀♀, 1♂, SANC). Mica, 10.xii.1974, J. Rozen, B. Rozen (1♂, AMNH). Blyderivierspoort Dam, 24.32S 30.47E, 25-26.x.1984, C.D. Eardley, On *C. doidgeae* (1♀, SANC). Pretoria, x.1972, R.H. Watmough (1♀, SANC). Zimbabwe: Penkridge [19.31S 32.44E], 21.i.1928, R. Lawrence (1♀, SAMC). Victoria Falls, 6.xii.1931, (1♀, SAMC). Chiredzi, 21.04S 31.40E, 18.iii.1995, A.J. Urban (2♂♂, SANC).

Acknowledgments and Acronyms

The research by HVD was supported in part by the National Science Foundation (Research Grants GB-7933, GB-34089). He is indebted to his wife, Barbara Boole Daly, and his daughter, Diane Daly, who assisted him in the field work during 1970-1971. Professor Charles D. Michener gave invaluable information on places to visit and persons to contact. Special thanks go to persons who helped HVD during his visit in Southern Africa: the late C. Jacot-Guillarmod and F.W. Gess (Albany Museum, Grahamstown), F.J. Stayner (Karoo Gardens, Worcester), Professor H.B. Rycroft (Kirstenbosch Gardens, Cape Town), B.R. Stuckenberg (Natal Museum, Pietermaritzberg), and the late Dr. V.B. Whitehead (South African Museum, Cape Town) who welcomed them to Africa as his personal guests.

Thanks go to M. Kiese for producing the distribution maps, S. Buchmann for the photographs and Ms E. van Niekerk for help producing the plates; for specialist identification of organisms associated with *Ceratina*, Z. Boucek (Eupelmidae, Leucospidae), A. Fain (Acarina) and J. Pasteels (Gasteruptiidae).

The following persons kindly loaned specimens for study: R. Zuparko, Essig Museum of Entomology, University of California, Berkeley (UCB); the late E. Königsmann and F. Koch, Museum fur Naturkunde der Humboldt-Universitat, Berlin (MHUB); M. Cochrane and the late A.J. Hesse, C.A. Car and the late V.B. Whitehead, South African Museum, Cape Town, South Africa (SAMC), including bees from the National Museums and Monuments of Rhodesia, Bulawayo; F.L. Farquharson, Durban Museum, Durban, South Africa (DMSA); the late C. Jacot-Guillarmod and F.W. Gess, Albany Museum, Grahamstown, South Africa (AMGC); C.D. Michener, University of Kansas, Lawrence, Kansas (UK); G.R. Else, Natural History Museum, London (NHML); R.R. Snelling, Los Angeles County Museum, Los Angeles (LACM); J.G. Rozen, Jr., American Museum of Natural History, New York (AMNH); M.W.R. de V. Graham, University Museum, Oxford (UM); B. Dombrowsky and the late L. Vari, Transvaal Museum, Pretoria (TMSA); P. Arnaud, Jr., California Academy of Sciences, San Francisco (CAS); M. Fischer, Naturhistorisches Museum, Vienna (NM); M. Kuhlmann, Germany, private collection (KC); M. Schwarz, Austria, private collection and collection of Biology Centre Linz (OLML & SC); Plant Protection Research Institute, Pretoria (SANC).

References

ANONYMOUS (1958): A list of zoological and botanical types preserved in collections in southern and east Africa. Vol. **1** Zoology, Part I, 147pp. – Published by the South African Museum's Association, Pretoria.

BENOIST R. (1962): Apides (Hyménoptères) recueillis à Madagascar par le Dr Fred Keiser en 1957-1958. – Verhandlungen der Naturforschenden Gesellschaft in Basel **73** (1): 107-148.

BRAUNS H. (1913): Biologie südafrikanischer Apiden. – Zeitschrift für wissenschaftliche Insektenbiologie **9**: 116-120.

BRAUNS H. (1926a): V. Nachtrag zu 'Friese, Bienen Afrikas'. – Zoologische Jahrbücher **52**: 187-230.

BRAUNS H. (1926b): A Contribution to the Knowledge of the Genus *Allodape*, St. Farg. and Serv. Order Hymenoptera; Section Apidae (Anthophila). – Annals South African Museum **23** (3): 417-434.

BROWN W.L. & E.O. WILSON (1956): Character displacement. – Systematic Zoology **5**: 49-65.

CAMERON P. (1905): On the Hymenoptera of the Albany Museum, Grahamstown, South Africa. – Albany Museum Records **1**: 185-203.

COCKERELL T.D.A. (1910): New and Little-Known Bees. – Transactions of the American Entomological Society **36** (3): 199-249.

COCKERELL T.D.A. (1912): Percy Sladen Trust Expedition. No. II.-Hymenoptera, Apoidea. – Transactions of the Linnaean Society **15**: 29-41.

COCKERELL T.D.A. (1920): XXII. On South African Bees, chiefly collected in Natal. – Annals of the Durban Museum **2**: 247-262.

COCKERELL T.D.A. (1922): XXXIII. - Descriptions and Records of Bees.-XCV. – The Annals and Magazine of Natural History (ser. 9) **9**: 265-269.

COCKERELL T.D.A. (1932a): XXXI. - Descriptions and Records of Bees. - CXXXVI. – Annals and Magazine of Natural History (ser. 10) **10**: 267-278.

COCKERELL T.D.A. (1932b): XLVII. - Descriptions and Records of Bees. - CXXXVII. – Annals and Magazine of Natural History (ser. 10) **10**: 429-440.

COCKERELL T.D.A. (1934): Some Bees of the Genus *Ceratina* from Africa. – American Museum Novitiates **736**: 1-4.

COCKERELL T.D.A. (1935): Bees from Eritrea, Northwest Africa. – American Museum Novitates **809**: 1-6.

COCKERELL T.D.A. (1937a): VIII. - Descriptions and Records of Bees. - CLIX. – Annals and Magazine of Natural History (ser. 10) **19**: 136-143.

COCKERELL T.D.A. (1937b): XLVIII. - Descriptions and Records of Bees.- CLX. – Annals and Magazine of Natural History (ser. 10) **19**: 495-505.

COCKERELL T.D.A. (1937c): LXVI. - Descriptions and Records of Bees. - CLXV. – Annals and Magazine of Natural History (ser. 10) **20**: 544-549.

COCKERELL T.D.A. (1937d): Records of African Bees. – American Museum Novitates **929**: 1-12.

COCKERELL T.D.A. (1937e): African Bees of the Genera *Ceratina*, *Halictus* and *Megachile*. – Wiliam Clowes and Sons, Limited, London and Beccles. 254 pp.

COCKERELL T.D.A. (1939): IV. - Descriptions and Records of Bees. - CLXX. – Annals and Magazine of Natural History (ser. 11) **3**: 36-43.

COCKERELL T.D.A. & W. PORTER (1899): XLVIII. - Contributions from the New Mexico Biological Station.-VII Observations on Bees, with Descriptions of new Genera and Species. – Annals and Magazine of Natural History (ser. 7) **4**: 403-421.

DALLA TORRE C.G. de (1896): Catalogus Hymenopterorum huscusque descriptorum systematicus et synonymicus **10**: I-VII & 1-643. – Engelmann, Leipzig.

DALY H.V. (1973): Lectotype designations of African bees of the genus *Ceratina* and allies. – The Pan-Pacific Entomlogist **49** (4): 383-388.

DALY H.V. (1983a): Taxonomy and ecology of Ceratinini of North Africa and the Iberian Peninsula (Hymenoptera: Apoidea). – Systematic Entomology **8**: 29-62.

DALY H.V. (1983b): Bees of the Genus *Pithitis* from Northeast Africa and the Arabian Peninsula. (Hymenoptera: Apoidea). – Journal of the Kansas Entomological Society **56** (4): 499-505.

DALY H.V. (1985): Bees of the Genus *Megaceratina* in Equatorial Africa (Hymenoptera, Apoidea). – The Pan-Pacific Entomologist **61** (4): 339-344.

DALY H.V. (1988): Bees of the New Genus *Ctenoceratina* in Africa South of the Sahara (Hymenoptera: Apoidea). – Unversity of California Publications in Entomology **108**: 1-69.

DALY H.V. & G.R. ELSE (1988): Lectotype Designations for African Bees of the Genus *Ceratina* described by T.D.A. Cockerell. Pan-Pacific Entomologist **64** (1): 87-91.

DALY H.V., MICHENER C.D., MOURE J.S. & S.F. SAKAGAMI (1987): The relictual bee genus *Manuelia* and its relation to other Xylocopinae (Hymenoptera, Apoidea) – Pan-Pacific entomologist **63** (2): 102-124.

EARDLEY C.D. (2000): Apoidea (Hymenoptera). – Cimbebasia **9**: 365-370.

FABRICIUS J.C. (1793, 1794): Entomologia Systematica Emendata et Aucta, 2 and 4. – Christ. Gottl. Proft., Copenhagen.

FAIN A. (1974): Nouveaux Hypopes phoretiques d'Hymenopteres africains (Acarina: Sarcoptiformes). – Revue de Zoologie Africaine **88** (1): 213-219.

FRIESE H. (1901) (1899): Hymenoptera von Madagascar, Apidae und Fossores. – Abhandlungen Herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft **26** (1): 259-268.

FRIESE H. (1903): *Meliturgula*, eine neue Bienengattung aus Süd-Afrika. (Hym.). – Zeitschrift für systematische Hymenopterologie und Dipterologie **3**: 33-34.

FRIESE H. (1905): Die Keulhornbienen Afrikas. Genus *Ceratina* (Hym.). – Wiener Entomologische Zeitung **24** (1, 2): 1-18.

FRIESE H. (1909a): Die Bienen Afrikas nach dem Stande unserer heutigen Kenntnisse. – In: SCHULTZE L., Zoologische und Anthropologische Ergebenisse einer Forschungsreise im westlichen und zentralen Südafrika ausgeführt in den Jahren 1903-1905, Band 2. – Denkschriften der Medizinisch-naturwissenschaftlichen Gesellschaft zu Jena **14**: 83-476, pls. IX-X.

FRIESE H. (1909b): 8. Hymenoptera. 5. Apidae. – In: SJOSTEDTS B.Y., Kilimandjaro-Meru Expedition. Stockholm **8** (5): 119-168.

FRIESE H. (1911): Die Maskenbienen der äthiopischen Region (*Prosopis*, Hym.). – Archiv für Naturgeschichte **77** (1): 120-134.

FRIESE H. (1915): Zur Bienenfauna von Abessinien. (Hym.). – Deutsche entomologische Zeitschrift **1915**: 265-298.

FRIESE, H. (1916): Hymenoptera. 5. Apidae. – In: MICHAELSEN U., Beitrage zur Kenntnis der Land-und Süsswasserfauna Deutsch-Südwestafrikanischen Studierreise **1911**: 415-452.

FRIESE H. (1921): Ergebnisse der "Zweiten Deutschen Zentral- Afrika-Expedition 1910-1911, Apidae. – Hamburgische Wissenschaft Zeitung **1**: 1091-1112.

FRIESE H. (1925): Die *Sphecodes*-Arten des tropischen Afrika. – Zoologische Jahrbücher **49**: 530-533.

FRIESE H. (1941)(1939): Apidae aus Süd-Ost-Africa gesammelt von Missionar Henri A. Junod Dr phil. h.c. (1863-1934) (Hym. Apid.). – Eos Madrid **15**: 95-107.

GESS F.W. (1981): Some aspects of an ethological study of the aculeate wasps and the bees of a karroid area in the vicinity of Grahamstown, South Africa. – Annals of the Cape Provincial Museums of Natural History **14** (1): 1-80.

GESS S.K. 1996): The Pollen Wasps. Ecology and Natural History of the Masarinae. – Harvard University Press. 340pp.

GESS F.W. & S.K. GESS (1990): Solitary bees: the little known and unsung thousands. – The Naturalist **34** (1): 23-32.

GUÉRIN-MÉNEVILLE F.E. (1845)(4): Iconographie du Règne Animal de G. Cuvier, VII Insects, 576pp. – Paris: Bailliere.

HESSE A.J. (1934): Some Insects associated with the Plant *Gnidia* (*Arthrosolen*) *laxa* GILG. – Annals of the South African Museum. **30**: 397-440.

HIRASHIMA Y. (1969): Synopsis of the genus *Pithitis* KLUG of the world (Hymenoptera: Anthophoridae). – Pacific Insects **11**: 649-669.

ILLIGER K. (1807): Vergleichung der Gattungen der Hautflügler, Piezata FABR. Hymenoptera LINN. JUR. – Magazin für Insektenkunde **6**: 189-199.

KLUG J.C.F. (1807): Species apiarium familiae novas, descripsit, generumque characteres adjecit. – Magazin des Gesellschaft naturforscher Freunde zu Berlin **1**: 263-265, 1 pl.

KOHL F.F. (1894): Zur Hymenopterenfauna Afrikas. – Annales des k.k. naturhistorischen Hofmuseums Wien **9** (3): 279-350.

LATREILLE P.A. (1802-1803): Histoire Naturelle Generale et Particuliere des Crustaces et des Insectes, 3. – Paris.

MASON C.A. (1989): Division of Labour and Adult Interactions in Eusocial Colonies of Two Allodapine Bee Species (Hymenoptera: Anthophoridae). – Journal of the Kansas Entomological Society **61** (4): 477-491.

MEADE-WALDO G. (1913): LXI. Four new Species of Apidae (Hymenoptera), with Notes on other Species. – Annals and Magazine of Natural History (series 8) **14**: 491-497.

MICHENER C.D. (1969): Immature stages of a chalcidoid parasite tended by allodapine bees (Hymenoptera: Perilampidae & Anthophoridae). – Journal of the Kansas Entomological Society **42** (3): 247-250.

MICHENER C.D. (1970): Nest sites of stem and twig inhabiting African bees (Hymenoptera: Apoidea). – Journal of the Entomological Society of Southern Africa **33** (1): 1-22.

MICHENER C.D. (1971): Biologies of African allodapine bees (Hymenoptera, Xylocopinae). – Bulletin of the American Museum of Natural History **145** (3): 223-300.

MICHENER C.D. (1973): Size and form of eggs of allodapine bees. – Journal of the Entomological Society of Southern Africa **36** (2): 281-285.

MICHENER C.D. (1997): Genus-Group Names of Bees and Supplemental Family-Group Names. – Scientic Papers, Natural History Museum, The University of Kansas **1**: 1-81.

MICHENER C.D. (2000): The Bees of the World. – The John Hopkins University Press. Baltimore and London. 913pp.

PAULY A. (1998): Hymenoptera Apoidea du Gabon. – Musée Royal de l'Afrique Centrale Tervuren, Belgique. Annales Sciences Zoologique **282**: 1-121.

PAULY A. (2001): Notes on phoretic deutonymphs of mites (Acari) associated with Old World Megachilidae and Anthophoridae (Insecta Hymenoptera), mainly Madagascar. 1. Families Chaetodactylidae, Acaridae, Histiostomatidae and Winterschmidtiidae (Astigmata). – Belgian Journal of Entomology **3**: 125-142.

PAULY A., BROOKS R.W., NILSSON L.A., PESENKO Y.A., EARDLEY C.D., TERZO M., GRISWOLD T., SCHWARZ M., PATINY S., MUNZINGER J. & Y. BARBIER (2001): Hymenoptera Apoidea de Madagascar et des Iles Voisines. – Musee Royal de L'Afrique Centrale- Tervuren, Belgique Annales Sciences Zoologiques **286**: 1-390, 16 planche.

PRINS A.J. (1978): Hymenoptera. – In: WERGER M.J.A. & A.C. van BRUGGEN (Ed.), Biogeography and Ecology of southern Africa. W. Junk Publishers. The Hague.

ROSSI P. (1792): Mantissa Insectorum. – 1. Polloni, Pisa.

ROZEN J.G. & R. MCGINLEY (1974): Phylogeny and Systematics of Melittidae based on the Mature Larvae (Insecta, Hymenoptera, Apoidea). – American Museum Novitates **2545**: 1-31.

SAKAGAMI S.F. & C.D. MICHENER (1987): Tribes of Xylocopinae and Origin of the Apidae (Hymenoptera: Apoidea). – Annals of the Entomological Society of America **80** (3): 439-450.

SANDHOUSE G.A. (1943): The type species of the genera and subgenera of bees. – Proceedings of the United States National Museum **92** (3156): 519-619.

SKAIFE S.H. (1953): African Insect Life. – Longmans Green and Co. London, Cape Town, New York.

SMITH F. (1854): Catalogue of Hymenopterous Insects in the collection of the British Museum. – London, Part II, Apidae. pp. 198-465, pls. VII-XII.

SPINOLA M. (1843): Notes sur quelques Hyménoptéres peu connus, recueillis en espagne, pendant l'année 1842, par M. Victor Ghiliani, voyageur-naturaliste. – Annales de la Société entomologique de France (2) **1**: 111-144.

STRAND E. (1911): Faunistische und systematische Notizen über afrikanische Bienen. – Wiener entomologische Zeitung **30** (6, 7): 135-159.

STRAND E. (1912a) (1911): Neue afrikanische Bienen der Gattungen *Sphecodes* und *Ceratina*. – Archiv für Naturgeschichte **77** (1): 12-27.

STRAND E. (1912b): Ein neueres Werk über afrikanische Bienen kritisch besprochen. – Archiv für Naturgeschichte **78** (1): 126-144.

STRAND E. (1912c): Zoologische Ergebisse der Expedition des Herrn G. Tessmann nach Süd-Kamerun und Spanisch-Guinea. Bienen. – Mitteilungen aus dem Zoologische Museum in Berlin **6**: 265-312.

STRAND E. (1921): Apidoloisches, insbesondere über paläarktische *Andrena*-Arten, auf Grund von Material des Deutschen Entomologischen Museums. – Archiv für Naturgeschichte (A) **87** (3): 266-324.

STRUCK M. (1992): Pollination Ecology in the arid winter rainfall Region of southern Africa: a case study. – Mitteilungen aus dem Institut fuer Allgemeine Botanik Hamburg **24**: 61-90.

STRUCK M. (1994): A check-list of flower visiting insects and their host plants of the Goegab Nature Reserve, Northwestern Cape, South Africa. – Bontebok **9**: 11-21.

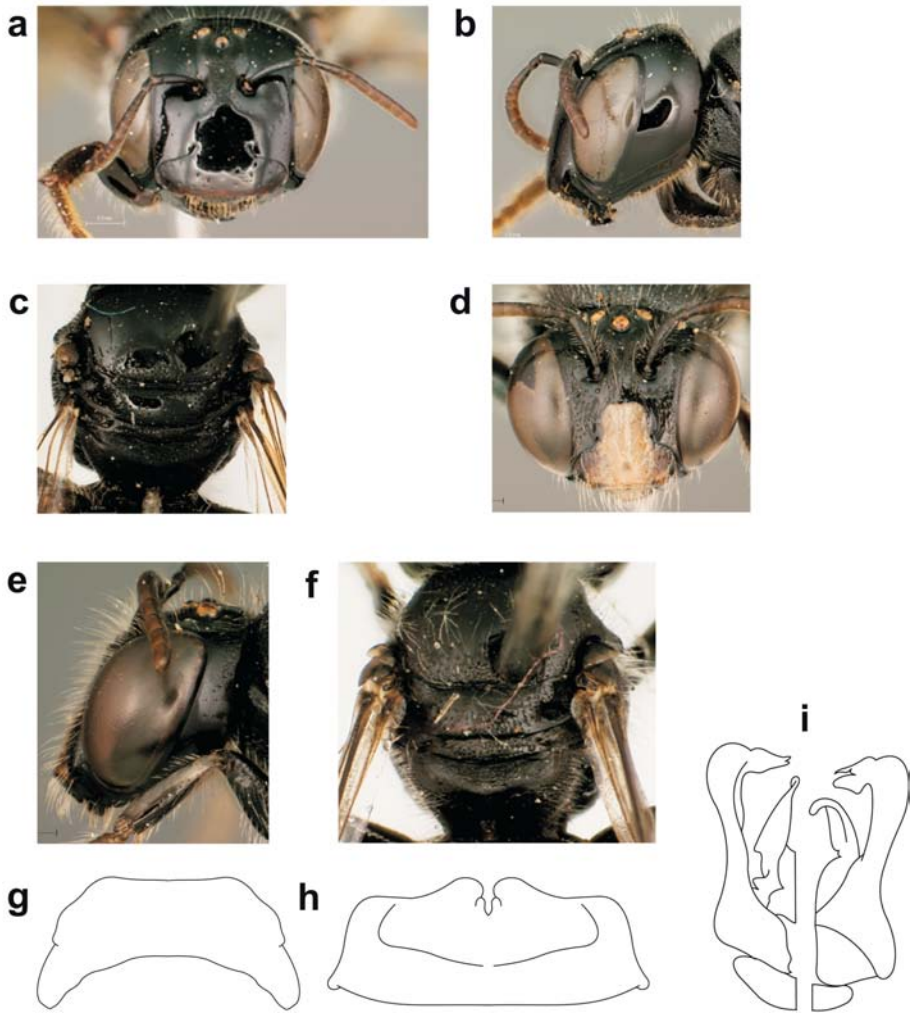
TERZO M., ISERBYT S. & P. RASMONT (In press): Révision des Xylocopinae de France et de Belgique (Hymenoptera: Apidae). In press.

WATMOUGH R.H. (1974): Biology and behavior of carpenter bees in southern Africa. – Journal of the Entomological Society of Southern Africa **37**: 261-281.

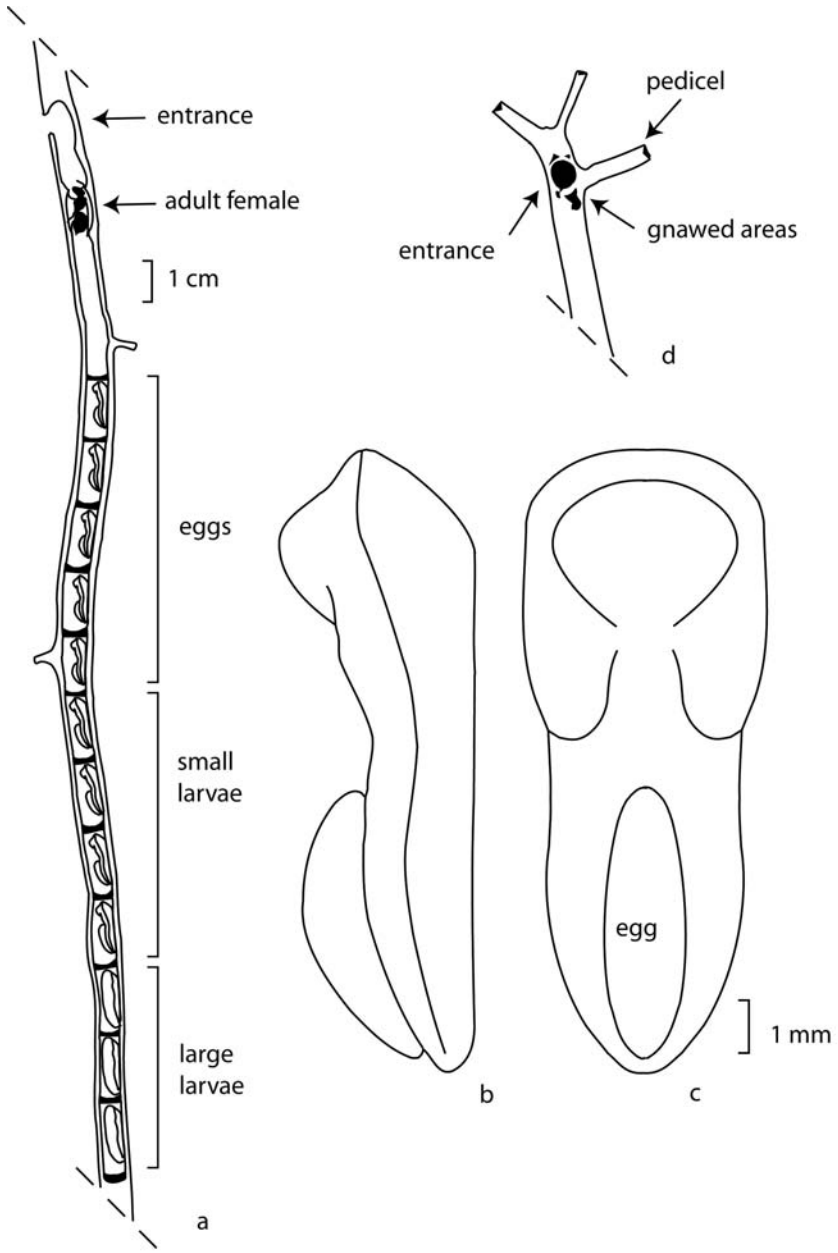
Appendix

The family names of the plants documented herein, an * indicates nest plants.

Aloe* sp. *Aloe mitriformis- Aloaceae
Anchusa capensis - Boraginaceae
Aptosimum sp. - Scrophulariaceae
**Artemisia afra* - Asteraceae
Aspalathus spinescens - Fabaceae
**Ballota africana* - Lamiaceae
*Berkeya fruticosa**, *Berkheya heterophylla**, *Berkheya* sp. - Asteraceae
Blepharis sp. - Acanthaceae
Cephalophyllum sp. - Mesembryanthemaceae
Chrysocoma tenuifolia - Asteraceae
**Cotyledon paniculatum*, **Cotyledon orbiculata* -Crassulaceae
Crotalaria sp., *Crotalaria doidgeae* - Fabaceae
Drosanthemum sp. - Mesembryanthemaceae
**Foeniculum vulgare* - Apiaceae
Galenia papulose, Galenia sarcophylla - Aizoaceae
Gazania uniflora - Asteraceae
Geigeria sp. - Asteraceae
Hermannia sp. - Sterculiaceae
Herrea sp. - Mesembryanthemaceae
Jacaranda sp. - Bignoniaceae
**Kniphofia* sp. - Asphodelaceae
Lasiospermum bipinnatum - Asteraceae
**Melia azedarach* - Meliaceae
Mesembryanthemum sp. - Mesembryanthemaceae
Monechma sp. - Acanthaceae
Peliostomum leucorrhizum - Scrophulariaceae
Petalidium variabilis - Acanthaceae
Prenia pallens - Mesembryanthemaceae
Psilocaulon salicornioides, Psilocaulon sp. - Mesembryanthemaceae
Psoralea pinnata - Fabaceae
Pteronia divaricata - Asteraceae
Rhigozum trichototum - Bignoniaceae
**Ricinus communis* - Euphorbiaceae
**Rubus* sp. - Rosaceae
**Salvia africana* - Limiaceae
Senecio cinerascens, Senecio sp. - Asteraceae
Sisyndite spartea - Zygophyllaceae
Stachys aurea - Limiaceae
Wahlenbergia cf. *constricta, Wahlenbergia* sp. - Campanulaceae
Watsonia sp. - Caesalpiniaceae
Zygophyllum simplex - Zygophyllaceae



Figs 1a-i: *Ceratina aloes*. 1a-c. ♀. (**1a**) Face. (**1b**) Head, profile. (**1c**) Mesosomal dorsum. 1d-i. ♂. (**1d**) Face. (**1e**) Head, profile. (**1f**) Mesosomal dorsum. (**1g**) Tergum 7. (**1h**) Sternum 6. (**1i**) Genital capsule, left dorsal view, right ventral view.



Figs 2a-d: *Ceratina aloes*. (**2a**) Nest in the dead flowering stalk of *Cotyledon paniculatum*. (**2b**) Lateral view of pollen loaf. (**2c**) Dorsal view of pollen loaf. (**2d**) The unique side entrance gnawed open by the ♀ near a lower pedicel.

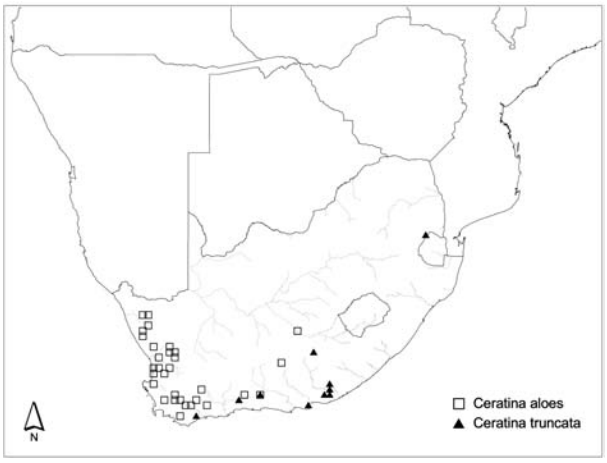
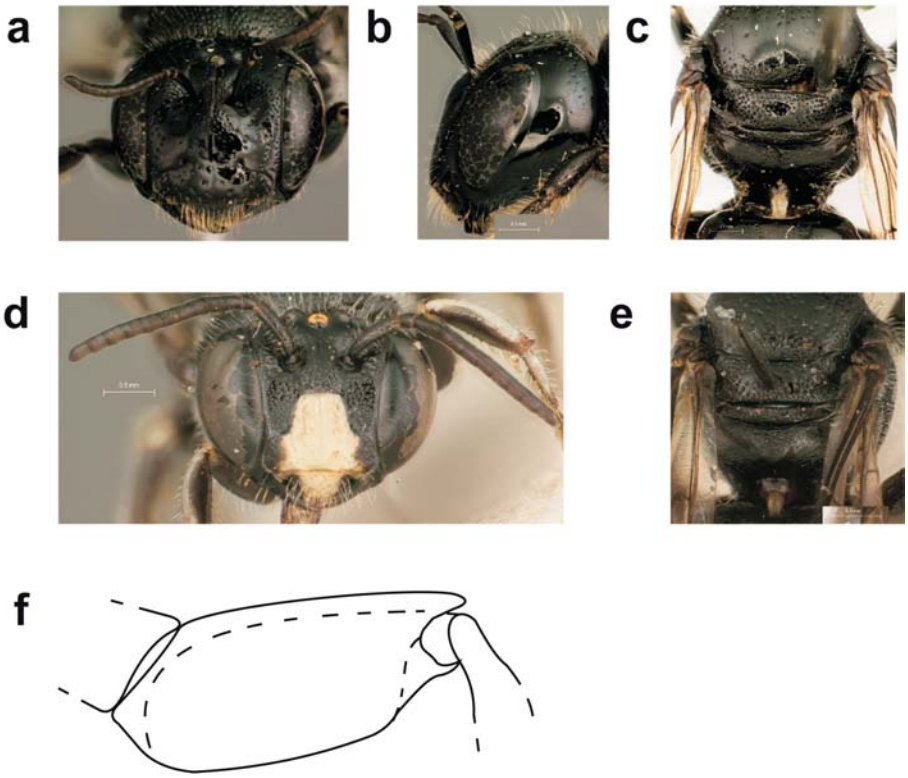


Fig. 3: Distribution of *Ceratina aloes*, *Ceratina truncata*.



Figs 4a-f: *Ceratina truncata*. 4a-c. ♀. (**4a**) Face. (**4b**) Head, profile. (**4c**) Mesosomal dorsum. 4d-f. ♂. (**4d**) Face. (**4e**) Mesosomal dorsum. (**4f**) Middle femur.

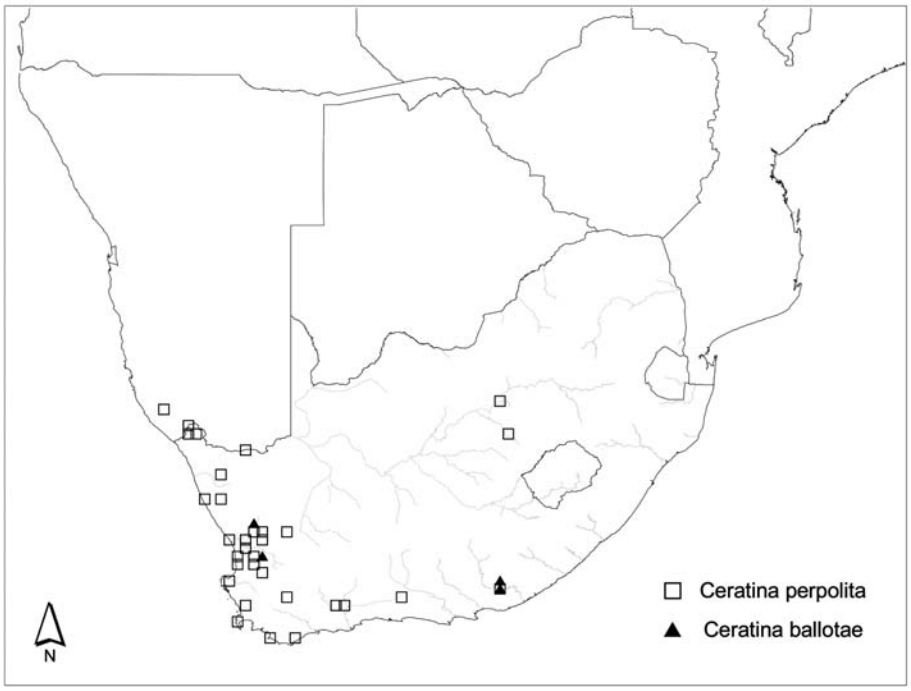
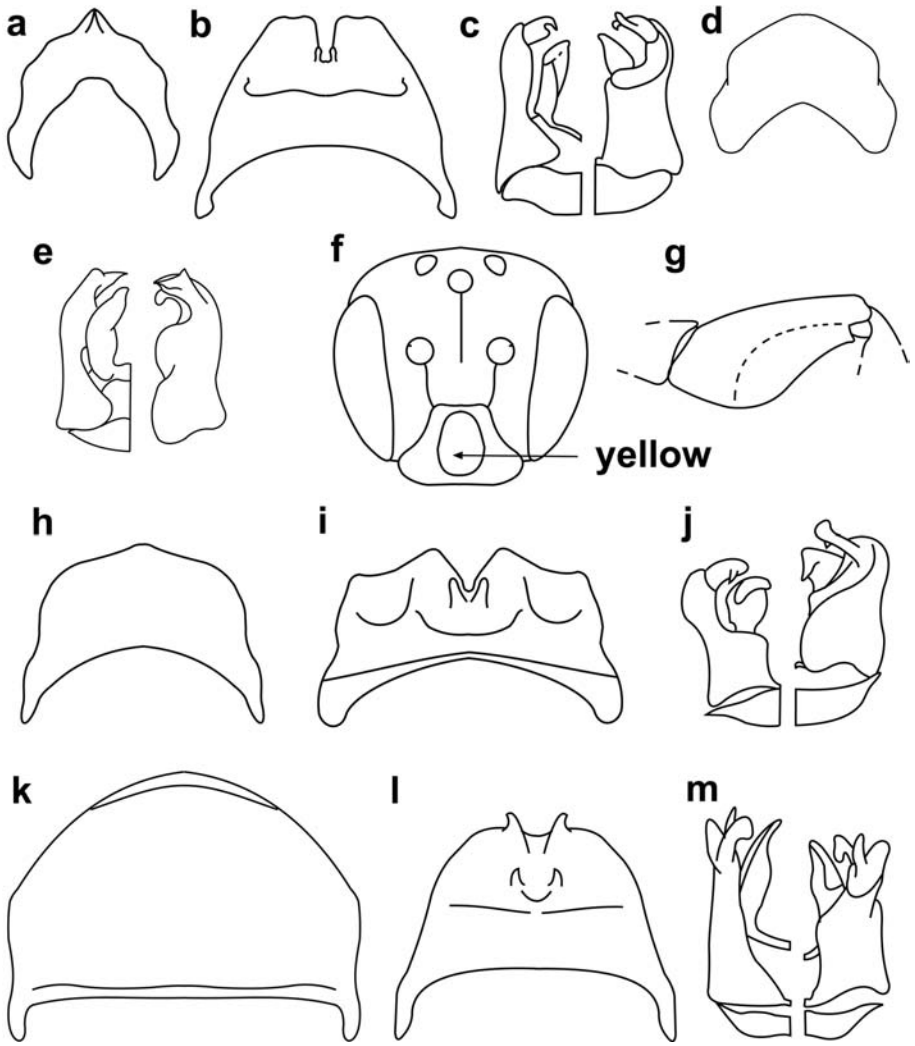
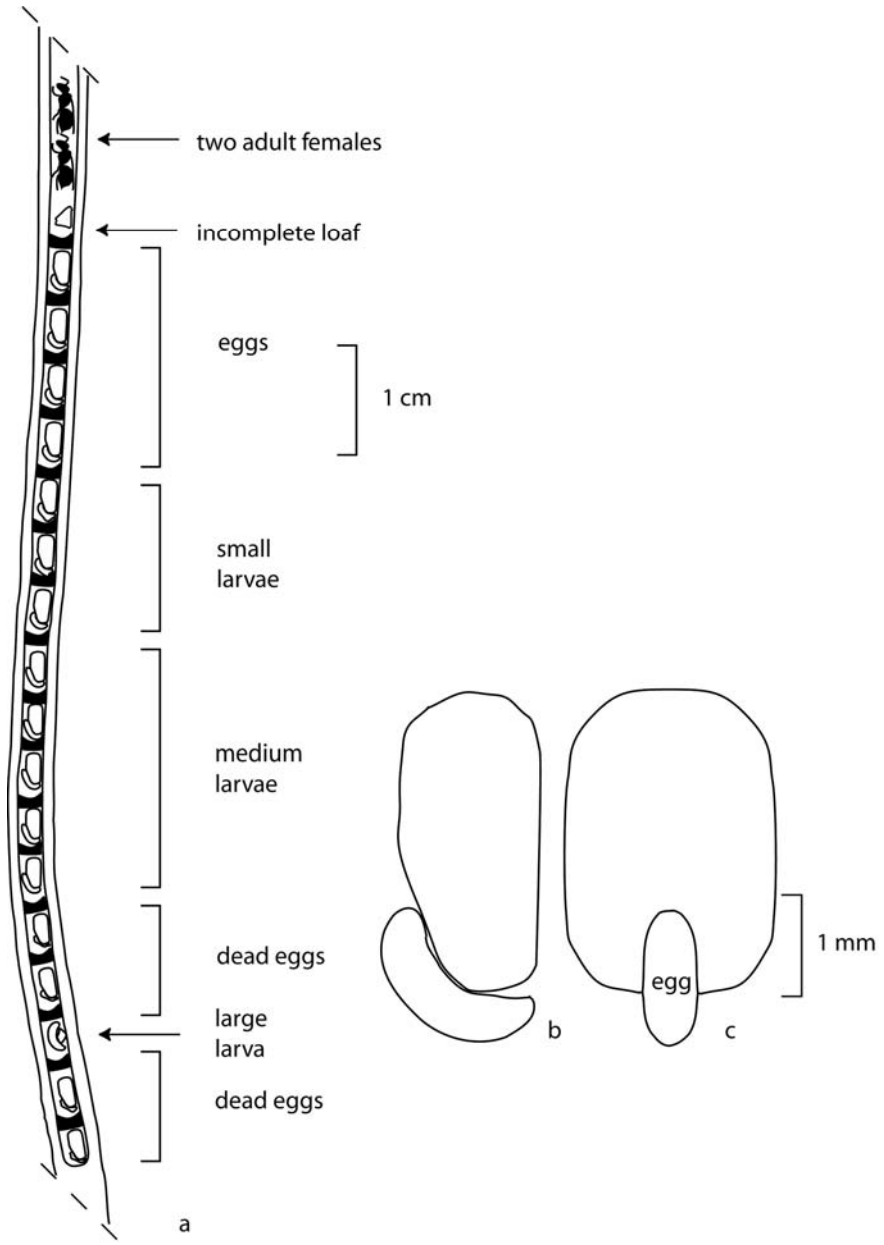


Fig. 5: Distribution of *Ceratina perpolita*, *Ceratina ballotae*.



Figs 6a-m. 6a-c: *Ceratina subscintilla*, ♂. (**6a**) Tergum 7. (6b) Sternum 6. (6c) Genital capsule, left dorsal view, right ventral view. 6d-e *Ceratina gnoma*, Tergum 7. e. Genital capsule, left dorsal view, right ventral view. 6f-j. *Ceratina hexae*, ♂. (**6f**) Face. (**6g**) Middle femur, ventral view. (**6h**) Tergum 7. (**6i**) Sternum 6. (**6j**) Genital capsule, left dorsal view, right ventral view. 6k-m. *Ceratina whiteheadi*, ♂. (**6k**) Tergum 7. (**6l**) Sternum 6. (**6m**) Genital capsule, left dorsal view, right ventral view.



Figs 7a-c: *Ceratina hexae* new species. (**7a**) Nest in dead stem of *Salvia africana* showing 17 cells that are probably the work of two ♀♀. (**7b**) Lateral view of pollen loaf. (**7c**) Dorsal view of pollen loaf.

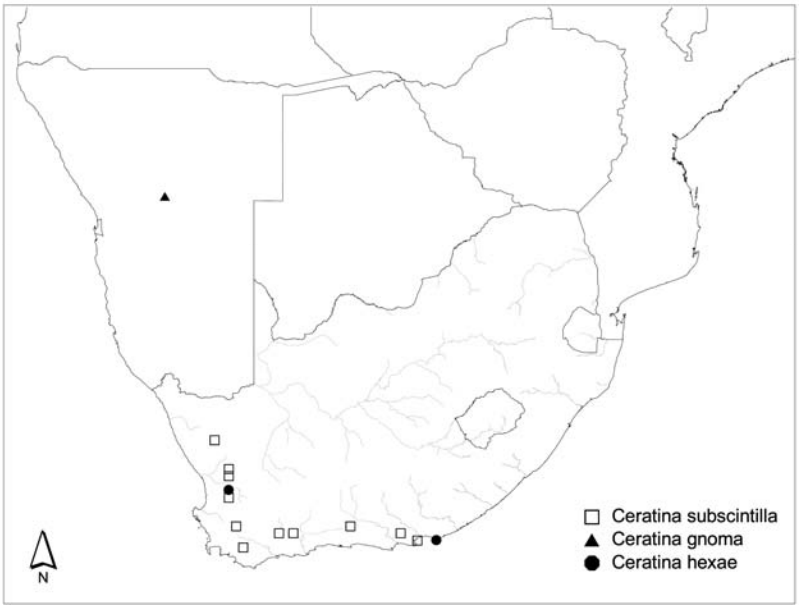


Fig. 8: Distribution of *Ceratina subscintilla*, *Ceratina gnoma*, *Ceratina hexae.*

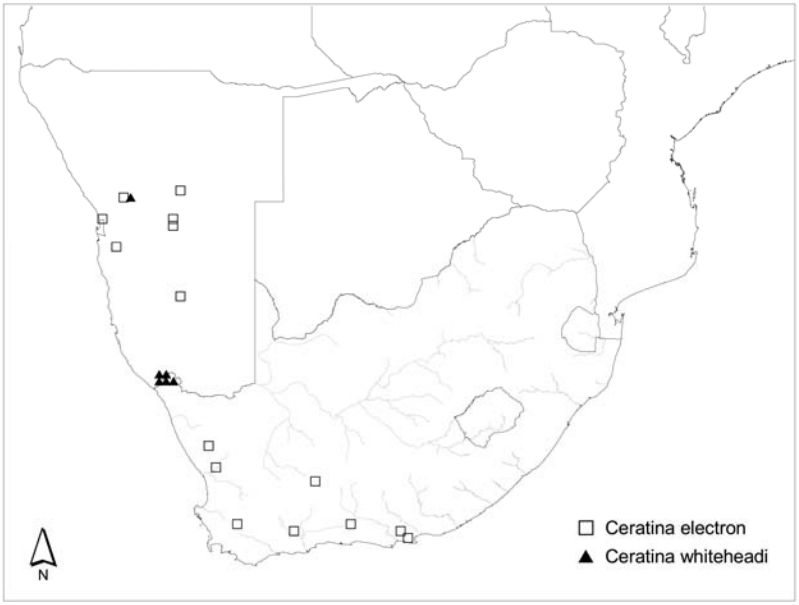
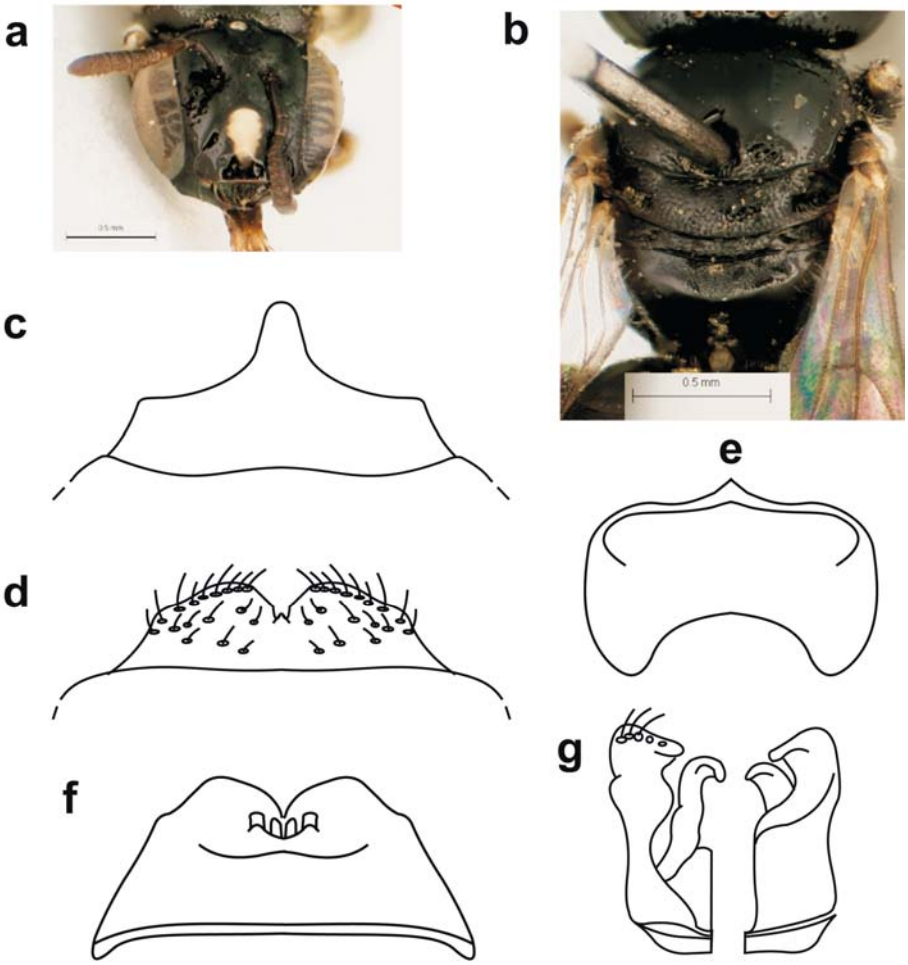
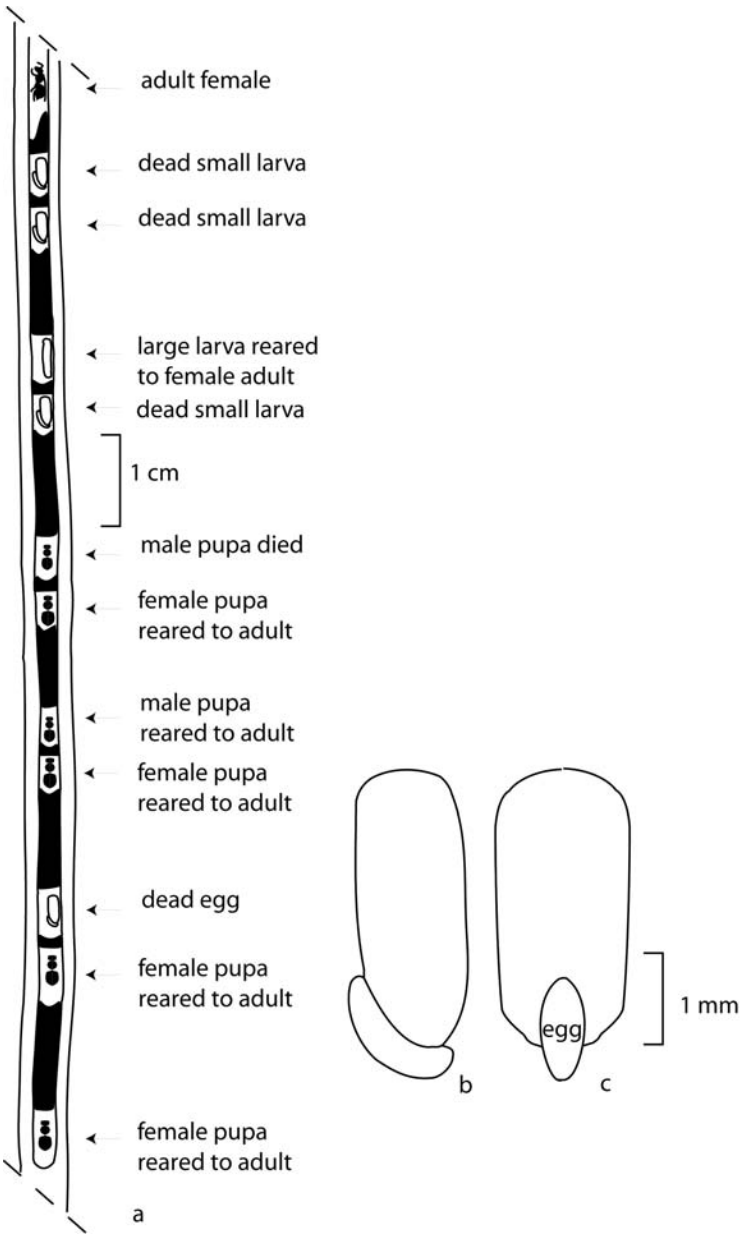


Fig. 9: Distribution of, *Ceratina electron*, *Ceratina whiteheadi*.



Figs 10a-g: 10a-b. *Ceratina citrinifrons*. (**10a**) ♀ face. (**10b**) ♀ scutum. 10c. *Ceratina liliputana*, ♂ tergum 7. 10d-e. *Ceratina barbarae*, ♂. (**10d**) Tergum 7. (**10e**) Sternum 6. 10f-g. *Ceratina aliceae*, ♂. (**10f**) Sternum 6. (**10g**) Genital capsule, left dorsal view, right ventral view.



Figs 11a-c: *Ceratina barbarae* new species. (**11a**) Nest in dead stem of a weedy Asteraceae showing the unique distribution of sexes in the pairs of cells. (**11b**) Lateral view of pollen loaf. (**11c**) Dorsal view of pollen loaf.

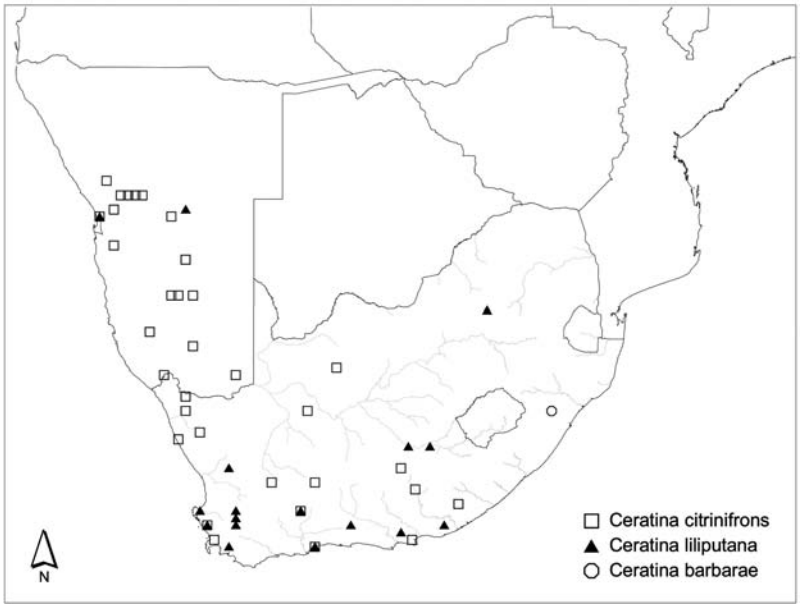


Fig. 12: Distribution of *Ceratina citrinifrons*, *Ceratina liliputana*, *Ceratina barbarae.*

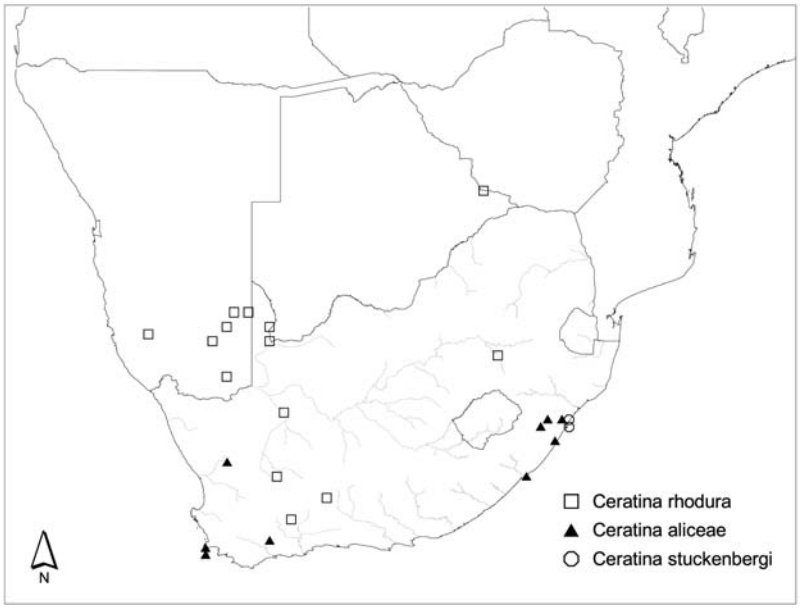
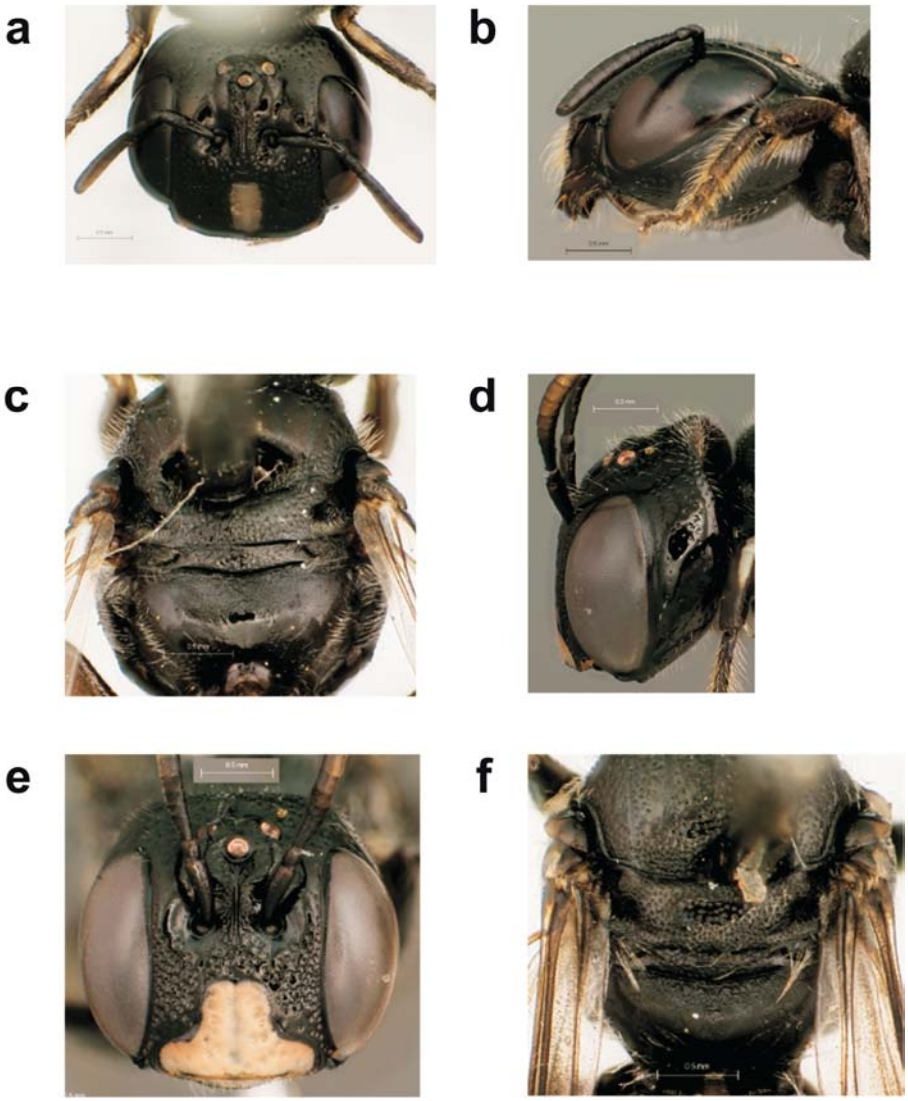
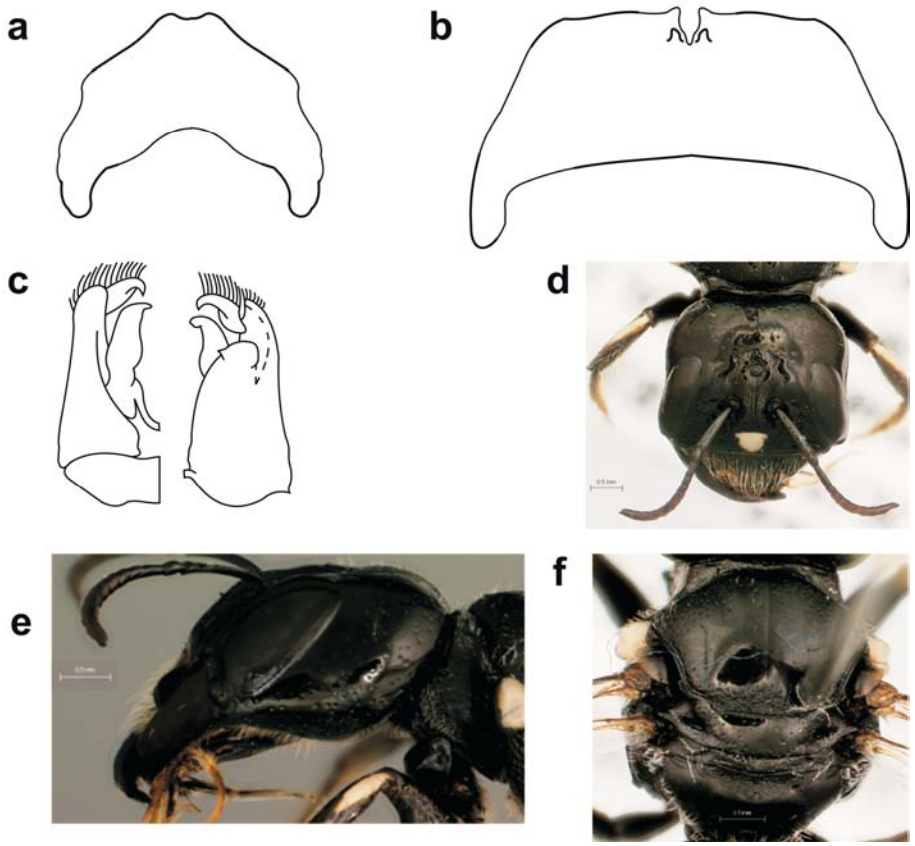


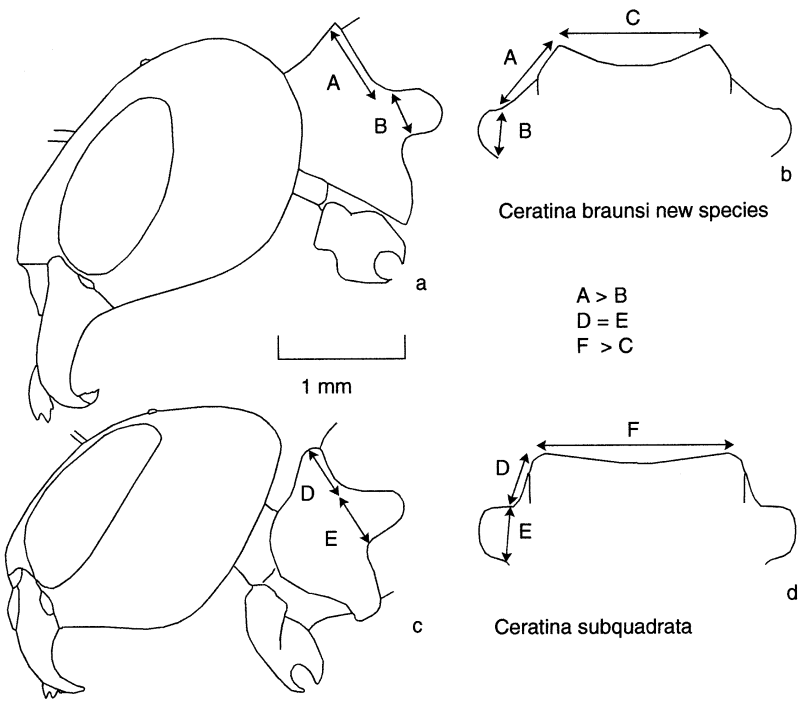
Fig. 13: Distribution of *Ceratina stuckenbergi*, *Ceratina aliceae*, *Ceratina rhodura.*



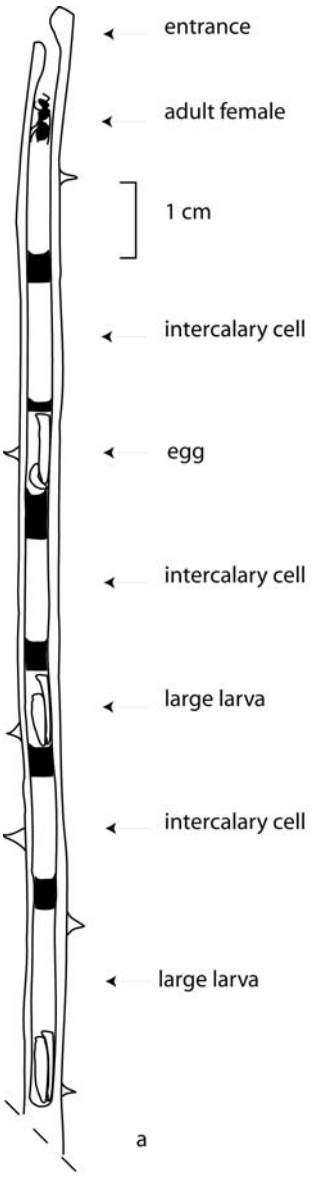
Figs 14a-f: 14a-c. *Ceratina subquadrata*, ♀. (**14a**) Face. (**14b**) Head, profile. (**14c**) Mesosomal dorsum. 14d-f. ♂. (**14d**) Face. (**14e**) Head, profile. (**14f**) Scutum.



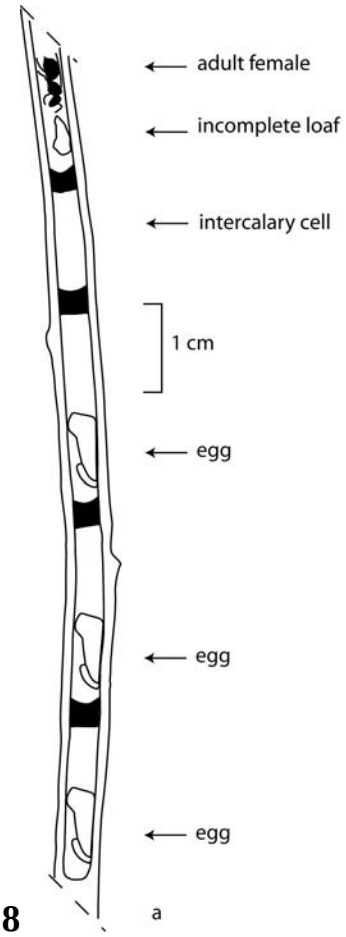
Figs 15a-f: 15a-c. *Ceratina subquadrata*, ♂. (**15a**) Tergum 7. (**15b**) Sternum 6. (**15c**) Genital capsule, left dorsal view, right ventral view. 15d-f. *Ceratina braunsi*, ♀. (**15d**) Face. (**15e**) Head and pronotum, profile. (**15f**) Scutum.



Figs 16a-d: Comparison of the head and prothorax of *Ceratina braunsi* new species and *Ceratina subquadrata* showing the distinctive prothorax of *C. braunsi*. (**16a**) Lateral view of head and prothorax of *C. braunsi*. (**16b**) Anterior view of prothorax of *C. braunsi*. (**16c**) Lateral view of head and prothorax of *C. subquadrata*. (**16d**) Anterior view of prothorax of *C. subquadrata*. The following proportions distinguish the two species: A>B in *C. braunsi*; D=E in *C. subquadrata*; and F>C, i. e., the width F of the prothorax of *C. subquadrata* is relatively greater than the width C of the prothorax of *C. braunsi*.



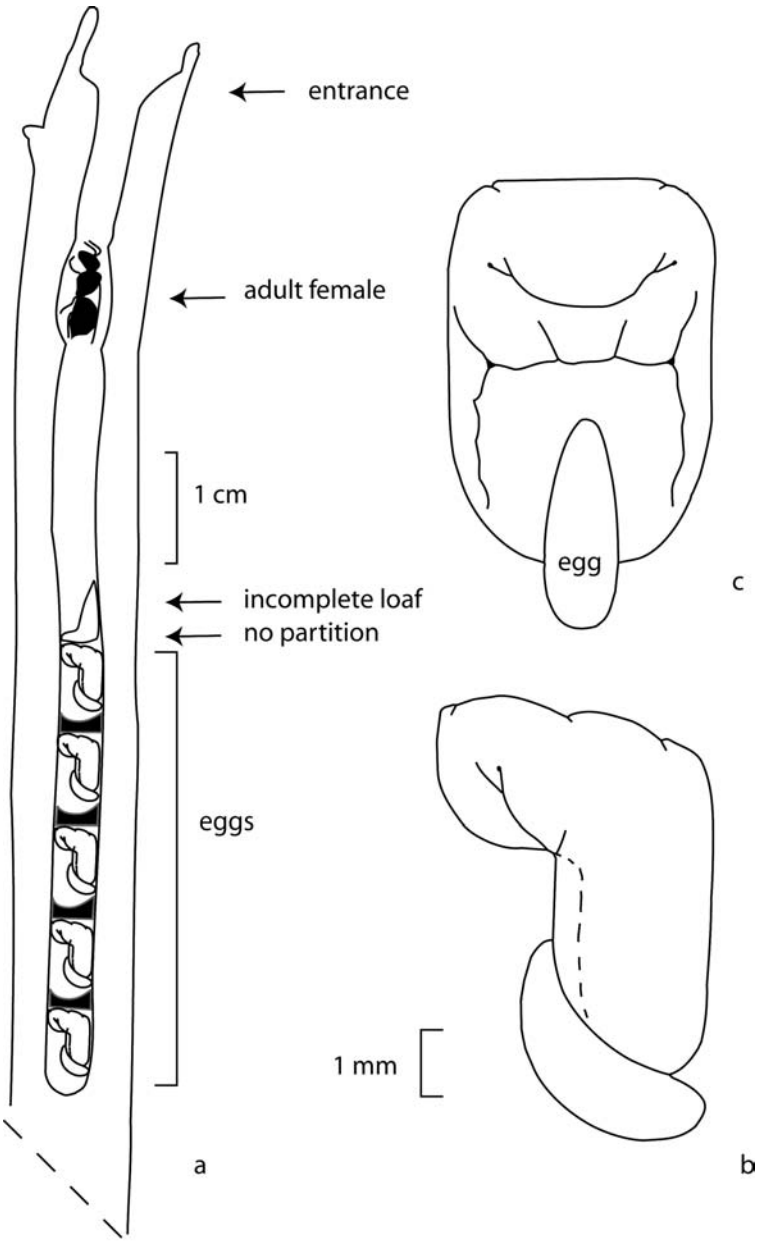
17



18

Fig. 17: Nest of *Ceratina subquadrata* in dead stem of *Rubus* sp. showing intercalary cells.

Fig. 18: Nest of *Ceratina braunsi* new species in dead stem of *Cotyledon paniculatum* showing normal pollen loaves in long cells.



Figs 19a-c: *Ceratina braunsi* new species. (**19a**) Nest in dead stem of *Ricinus communis* showing misshapen pollen loaves in short cells (**19b**) Lateral view of pollen loaf. (**19c**) Dorsal view of pollen loaf.

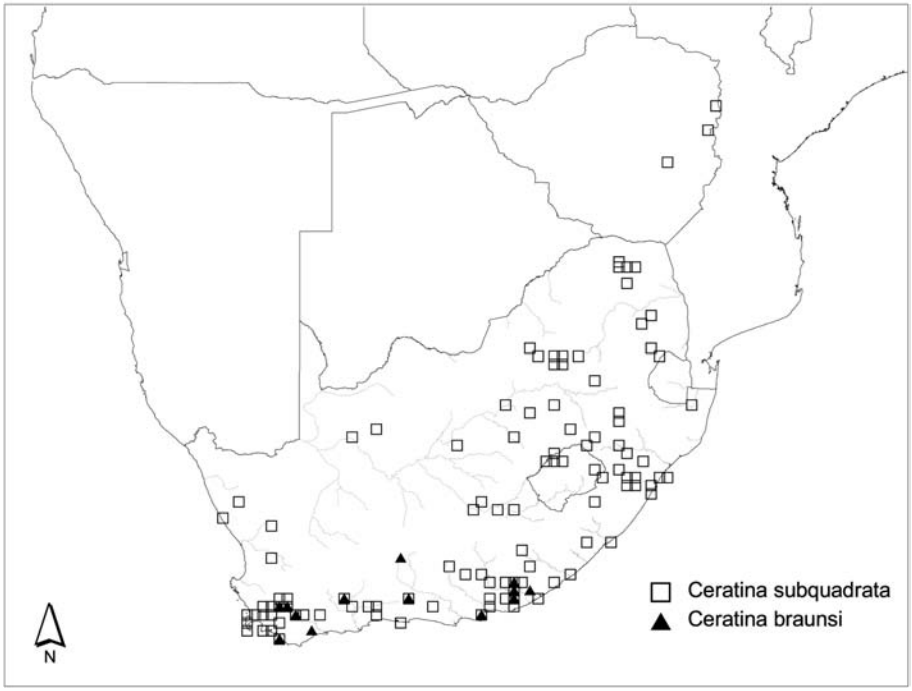
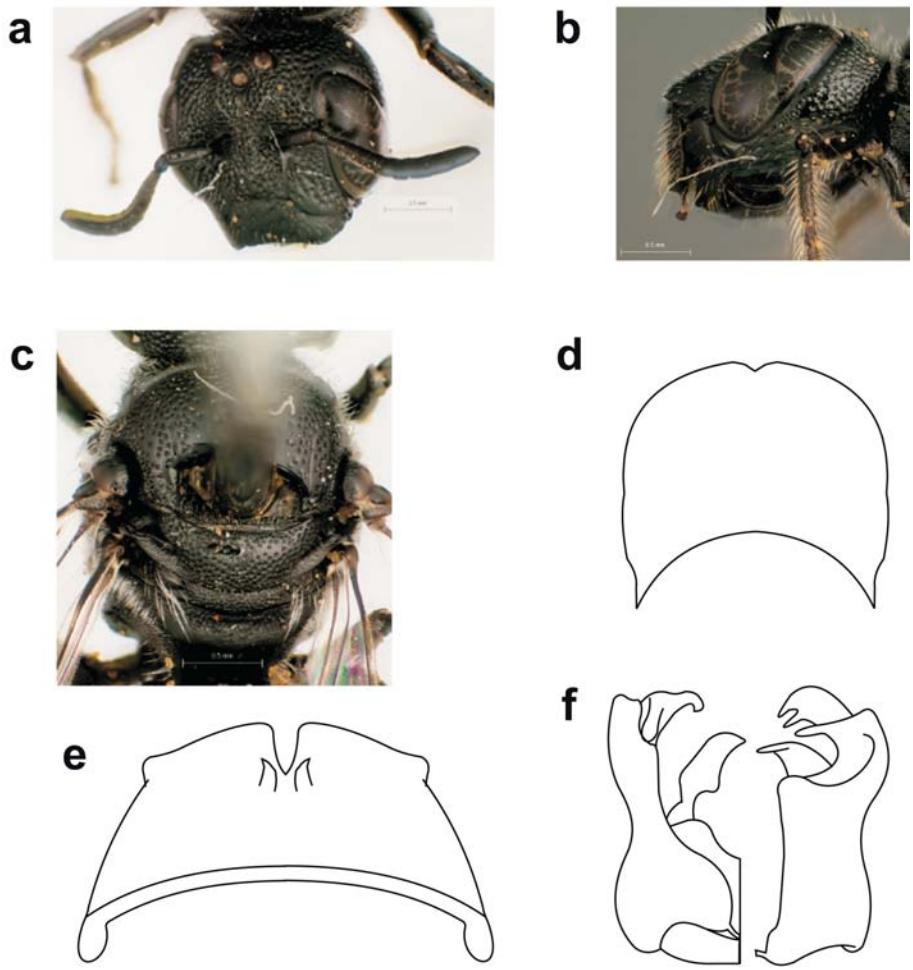


Fig. 20: Distribution of *Ceratina subquadrata*, *Ceratina braunsi*.



Figs 21a-f: *Ceratina nigriceps*. 21a-c. ♀. (**21a**) Face. (**21b**) Head, profile. (**21c**) Mesosomal dorsum. 21d-f. ♂. (**21d**) Tergum 7. (**21e**) Sternum 6. (**21f**) Genital capsule, left dorsal view, right ventral view.

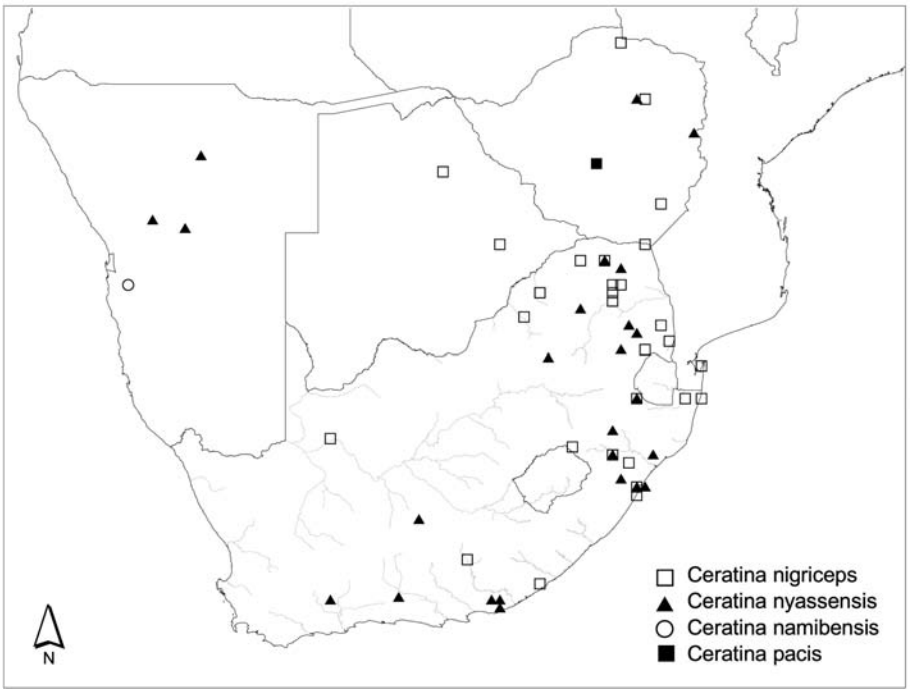
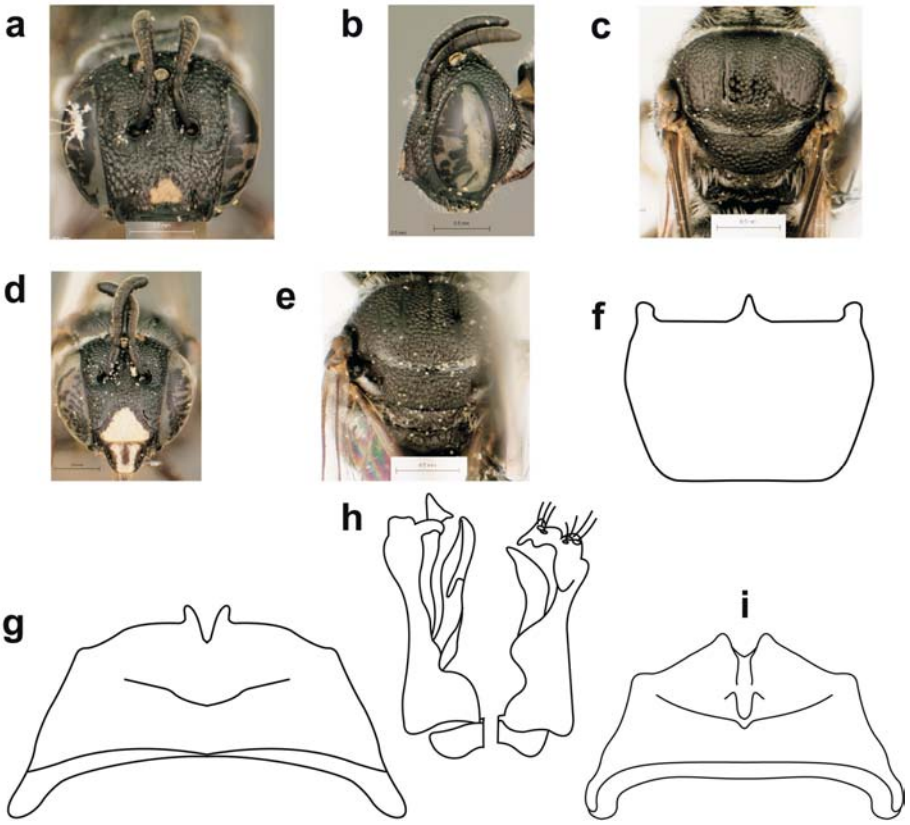
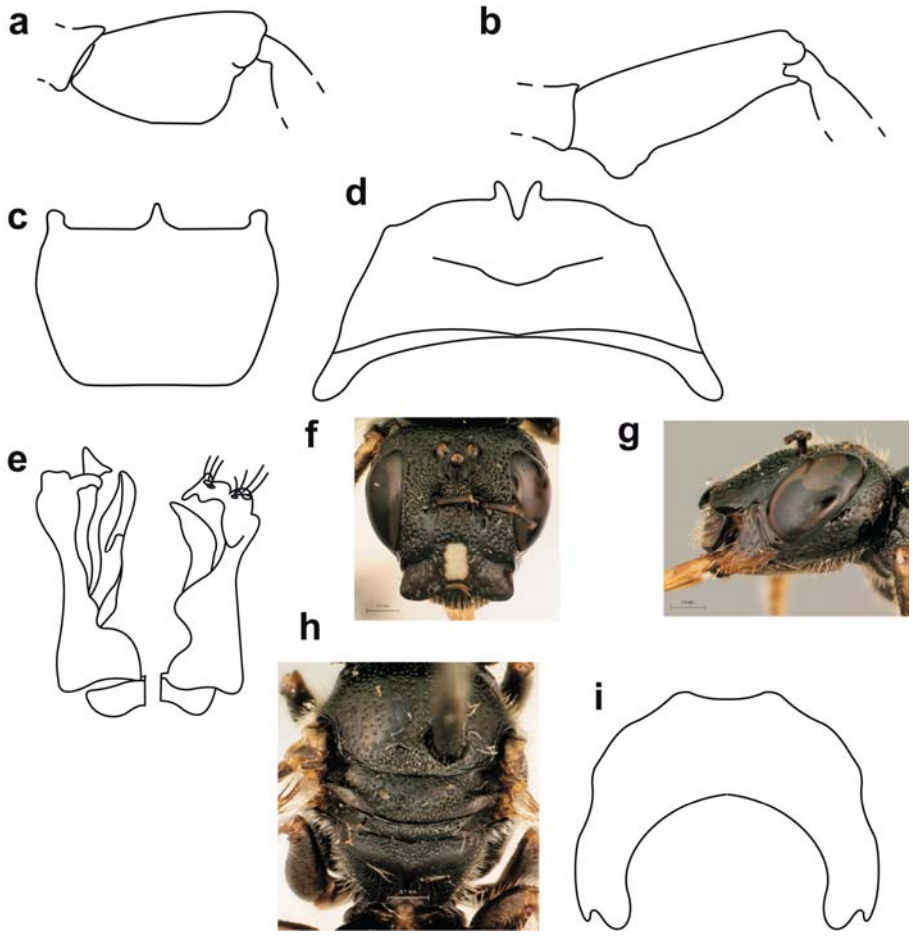


Fig. 22: Distribution of *Ceratina nigriceps, Ceratina nyassensis, Ceratina namibensis, Ceratina pacis.*



Figs 23a-i: 23a-c. *Ceratina nyassensis*, ♀. (**23a**) Face. (**23b**) Head, profile. (**23c**) Mesosomal dorsum. 23d-h. ♂. (**23d**) Face. (**23e**) Mesosomal dorsum. (**23f**) Tergum 7. (**23g**) Sternum 6. (**23h**) Genital capsule, left dorsal view, right ventral view. (**23i**) *Ceratina namibensis*, ♂, sternum 6.



Figs 24a-i: 24a-e. *Ceratina minuta*, ♂. (**24a**) Mid femur. (**24b**) Hind femur, ventral view. (**24c**) Tergum 7. (**24d**) Sternum 6. (**24e**) Genital capsule, left dorsal view, right ventral view. 24f-i. *Ceratina labrosa.* 24f-h ♀. (**24f**) Face. (**24g**) Head, profile. (**24h**) Mesosomal dorsum. (**24i**) ♂, tergum 7.

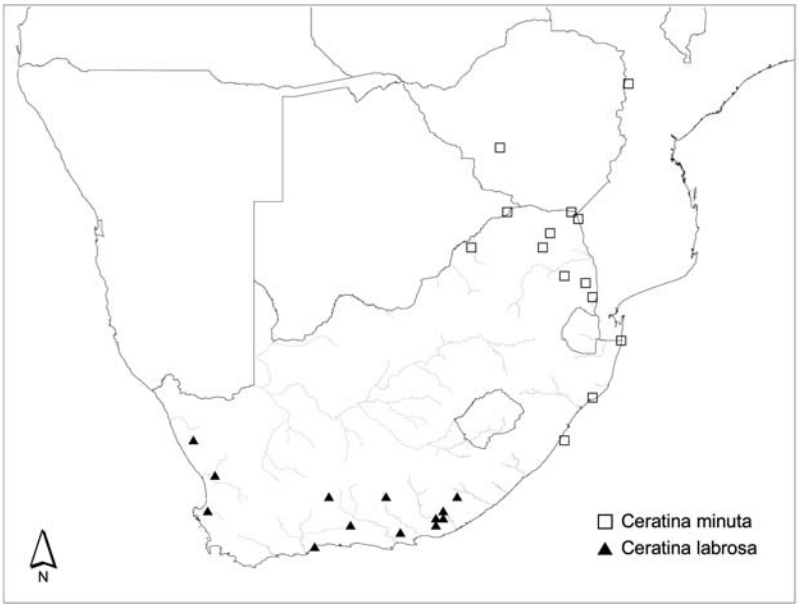


Fig 25: Distribution of *Ceratina minuta*, *Ceratina labrosa*.

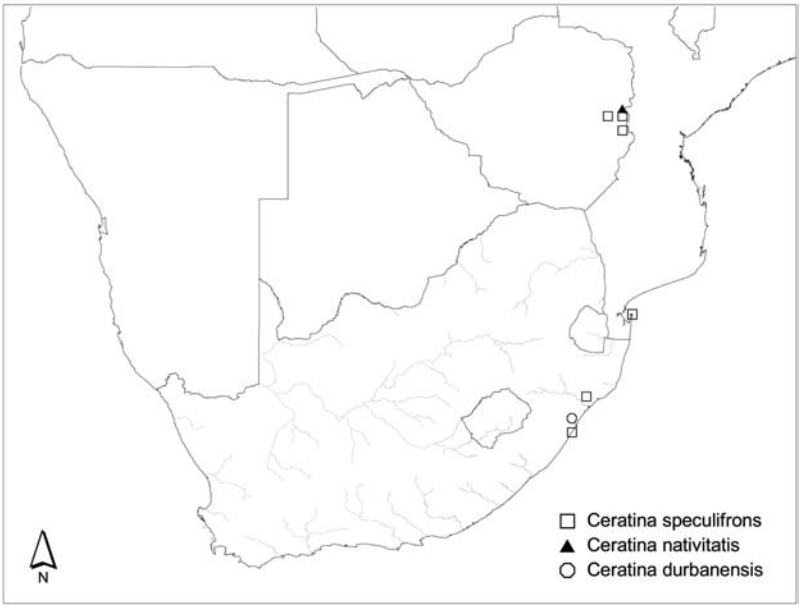
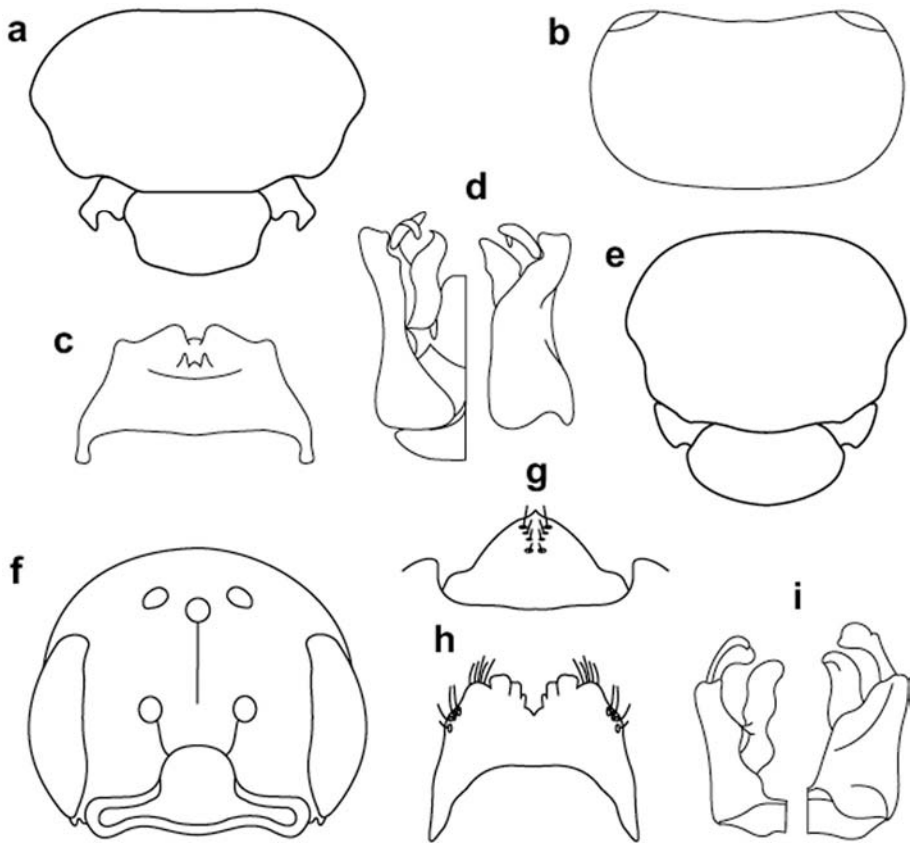


Fig. 26: Distribution of *Ceratina speculifrons*, *Ceratina nativitatus*, *Ceratina durbanensis*.



Figs 27a-i: 27a-d. *Ceratina speculifrons*, ♂. (**27a**) Axilla, dorsal view. (**27b**) Tergum 7. (**27c**) Sternum 6. (**27d**) Genital capsule, left dorsal view, right ventral view. 27e *Ceratina durbanensis*, ♂ axilla, dorsal view. 27f-h. *Ceratina daressalamica*. (**27f**) ♀ face. 27g-i. ♂. (**27g**) Tergum 7. (**27h**) Sternum 6. (**27i**) Genital capsule, left dorsal view, right ventral view, excluding penis valve.

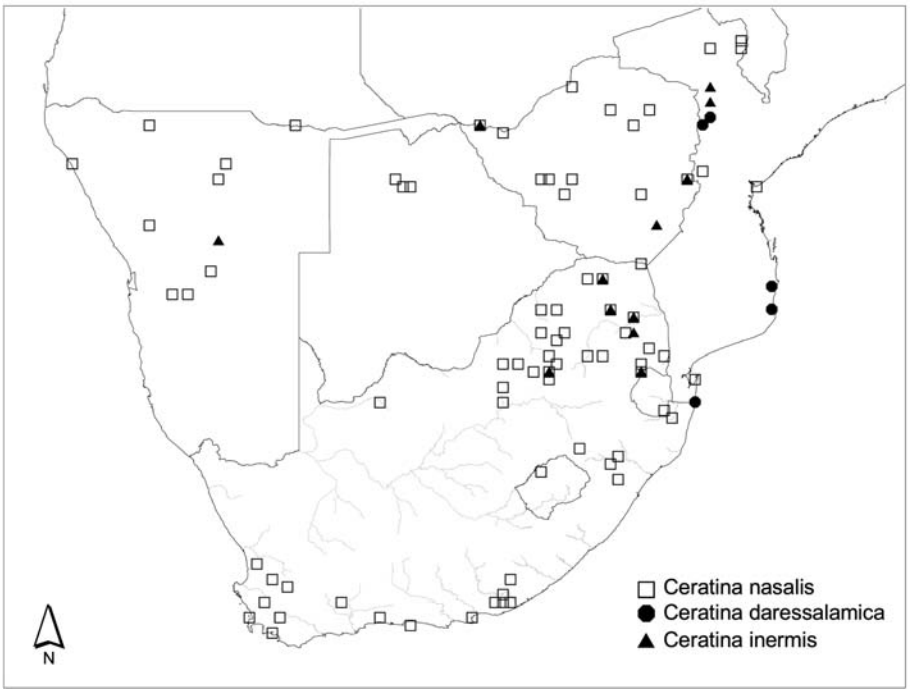
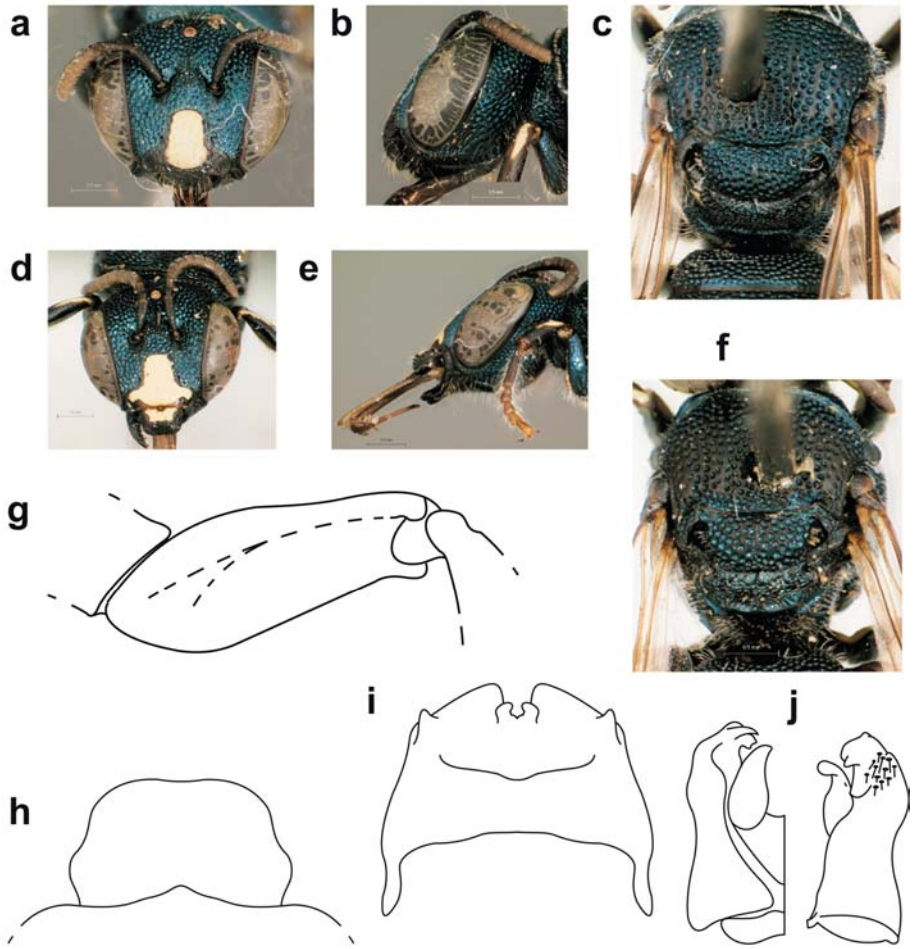
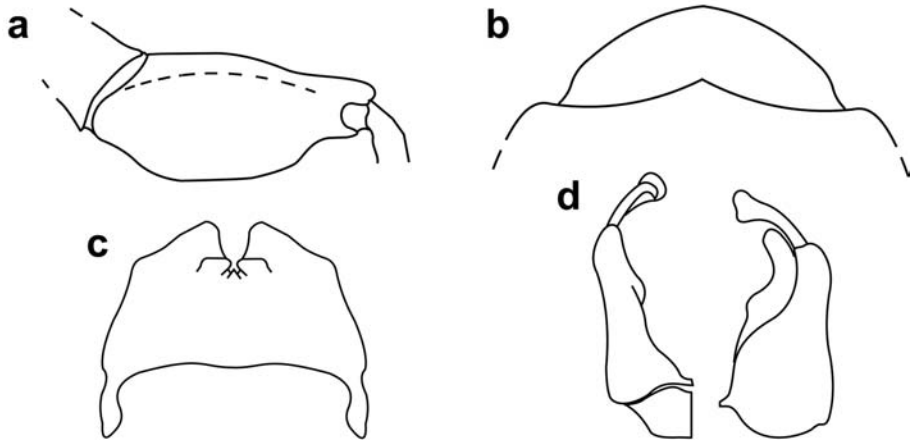


Fig. 28: Distribution of *Ceratina daressalamica*, *Ceratina nasalis*, *Ceratina inermis*.



Figs 29a-j: *Ceratina nasalis.* 29a-c. ♀. (**29a**) Face. (**29b**) Head, profile. (**29c**) Mesosomal dorsum. 29d-j. ♂. (**29d**) Face. (**29e**) Head, profile. (**29f**) Mesosomal dorsum. (**29g**) Middle femur, ventral view. (**29h**) Tergum 7. (**29i**) Sternum 6. (**29j**) Genital capsule, left dorsal view, right ventral view, excluding penis valve.



Figs 30a-d: *Ceratina inermis*, ♂. (**30a**) Middle femur, ventral view. (**30b**) Tergum 7. (**30c**) Sternum 6. (**30d**) Genital capsule, left dorsal view, right ventral view, excluding penis valve.

Author's addresses:

Connal EARDLEY
Agricultural Research Council,
Private Bag X134, Queenswood, 0121, Pretoria, South Africa,
E-mail: eardleyc@arc.agric.za

Howell V. DALY
c/o Essig Museum of Entomology,
201 Wellman Hall, University of California, Berkeley,
California 94720-3112, USA,
E-mail: hvdaly@pacbell.net

Correspondence to C. Eardley

Druck, Eigentümer, Herausgeber, Verleger und für den Inhalt verantwortlich:
Maximilian SCHWARZ, Konsulent f. Wissenschaft der O.Ö. Landesregierung, Eibenweg 6,
A-4052 Ansfelden, E-Mail: maximilian.schwarz@liwest.at.

Adresse: Entomofauna (ZSM), Münchhausenstr. 21, D-81247 München; Tel. (089) 8107-0, Fax 8107-300.