

# On the genera of African Cetoniinae II : *Eudicella* White, and the related genera with horned males (Coleoptera : Scarabaeidae)

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The former genus *Cyprolais* Thomson is relegated to subgeneric status under the genus *Eudicella* White, and *Ceratorrhina* Allard is synonymized with *E. (Cyprolais)*. *Chelorrhina* Burmeister is synonymized with *Mecynorrhina* Hope, and *Megalorrhina* Westwood with *Amaurodes* Westwood. *Chelorrhina savagei* Harris and *C. kraatzi* Moser are transferred to *Amaurodes*. *Amaurodes* Westwood is considered to be a subgenus of *Mecynorrhina* Hope. *Rhamporrhina* Klug and *Neptunides* Thomson are regarded as subgenera of *Taurhina* Burmeister. The phylogenetic relationships of and within the group of genera near *Eudicella* are discussed. The following synonymies on species level are proposed : *E. (E.) euthalia natalensis* Allard = *E. (E.) smithii* (McLeay); *E. (C.) loricata* (Janson) = *E. (C.) quadrimaculata* (F.); *E. (E.) bertherandi* Fairmaire is reinstated for the species misidentified as *E. (E.) smithii* by recent authors. *Mecynorrhina ugandensis* Moser is considered to be a subspecies of *M. torquata* Drury.

*Sur les genres de Cetoniinae africains II. Eudicella White, et les genres proches à mâles cornus (Coleoptera : Scarabaeidae).* - L'ancien genre *Cyprolais* Thomson est rabaissé au rang de sous-genre au sein du genre *Eudicella* White, et *Ceratorrhina* Allard est mis en synonymie avec *E. (Cyprolais)*. *Chelorrhina* Burmeister est placé en synonymie avec *Mecynorrhina* Hope, et *Megalorrhina* Westwood avec *Amaurodes* Westwood. *Chelorrhina savagei* Harris et *C. kraatzi* Moser sont transférés au genre *Amaurodes*. *Amaurodes* Westwood est considéré comme un sous-genre de *Mecynorrhina* Hope et *Rhamporrhina* Klug et *Neptunides* Thomson comme des sous-genres de *Taurhina* Burmeister. Les relations phylogénétiques du, et au sein du, genre *Eudicella* sont discutées. Au niveau spécifique, les synonymies suivantes sont proposées : *E. (E.) euthalia natalensis* Allard = *E. (E.) smithii* (McLeay); *E. (C.) loricata* (Janson) = *E. (C.) quadrimaculata* (F.); *E. (E.) bertherandi* Fairmaire est remise en usage pour l'espèce mal identifiée sous le nom de *E. (E.) smithii* par des auteurs récents. *Mecynorrhina ugandensis* Moser est considérée comme une sous-espèce de *M. torquata* Drury.

Key words : Genera, Coleoptera, Cetoniinae, review, new subgenus, new synonymy, Africa

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## INTRODUCTION

The problems around the generic classification of the Goliathini have recently been reviewed (Holm, in press). The specific group of genera treated in this paper exemplify the general lack of

consistency in the generic classification of this tribe in particular.

Schein (1952) enumerated 27 names for *Eudicella*, without committing himself to specific or subspecific ranking. In the introduction to his key (which is virtually exclusively based on colour and clypeal horns of the males)

he states that it may be possible that all *Eudicella* species should be considered subspecies of *E. daphnis* Buquet. He also points out that the females of *Eudicella* and *Cyprolais* (= *Coelorrhina*) cannot be distinguished, and that even the generic status of *Eudicella* is a matter of doubt. Ruter (1967) distinguishes the females of the two genera, but on rather weak characters.

In his recent key and compendium of Cetoniinae genera of the world Krikken (1984) recognises *Eudicella* with 16 species and *Cyprolais* with 8 species. While revisions of these two genera were announced by Krikken at that time, these have not yet appeared.

In the last compilation of the group Allard (1985a) recognises three genera: *Eudicella* with 18 species and 27 additional subspecies (to which he adds another 21 - Allard, 1991), *Coelorrhina* (not noting Krikken's (1984) correction of the name to *Cyprolais*) with 10 species and 10 additional subspecies, and a reinstated *Ceratorrhina* "Westwood" (which however does not include a possible type species of Westwood, and therefore must be construed to be a new genus as well as a homonym created by Allard) with 2 species and one additional subspecies.

The synonymies of Schein (1952) are dubious, as they are based on very unreliable characters. Those of Allard are not to be taken seriously either, since in many cases they were based on dubiously identified amateur collectors material, with little reference to types (see *E.(E.) smithii* below) or to male genitalia (see *E.(E.) eutbalia natalensis* below). It is beyond the scope of this study to revise all species synonymies in this group, and regrettably these well-known collectors items must remain questionably named until such time as a thorough revision is done. The unequivocal synonyms which came to my attention are pointed out below, but

probably constitute only a fraction of the synonyms and misidentifications which still persist on species and subspecies level.

In the genera closely related to *Eudicella* the problems are mainly on the generic level. Thus *Chelorrhina* Burmeister is based on the terminal furcation of the male cephalic horn only (fig. 47) while it is separated from two other species placed in the same genus by four apomorphic characters. These two species, together with *Megalorrhina* and *Amaurodes* form a closely related group with no more than subgeneric differences from *Mecynorrhina* Hope.

*Dicronorrhina* Hope and *Cheirolasia* Westwood are two closely related but well defined genera. The former was recently thoroughly revised (Lekkerkerk & Krikken, 1986). In the key to horned genera attached to that study, the generic problems and relationships are unfortunately not addressed, and females are not considered.

The genera *Neptunides*, *Taurbina* and *Rhamphorrhina* (with two species each) form a close cluster when analysed cladistically (fig. 91). They are separated by distinct but phylogenetically very weak characters (differential reductions and hypertrophies, see Holm in press) and should best be considered subgenera of one genus.

The remaining "horned" genera in the African *Coryphocerina* are all either relatively conservative to the group treated here (see fig. 91), or completely different radiations (e.g. *Melinesthes*, *Anisorrhina*, *Stephanorrhina*, *Dymusia*). These will be analysed elsewhere.

## GENUS *EUDICELLA* WHITE

When the principles outlined in a previous paper (Holm, in press) are applied to *Eudicella* White, *Cyprolais*

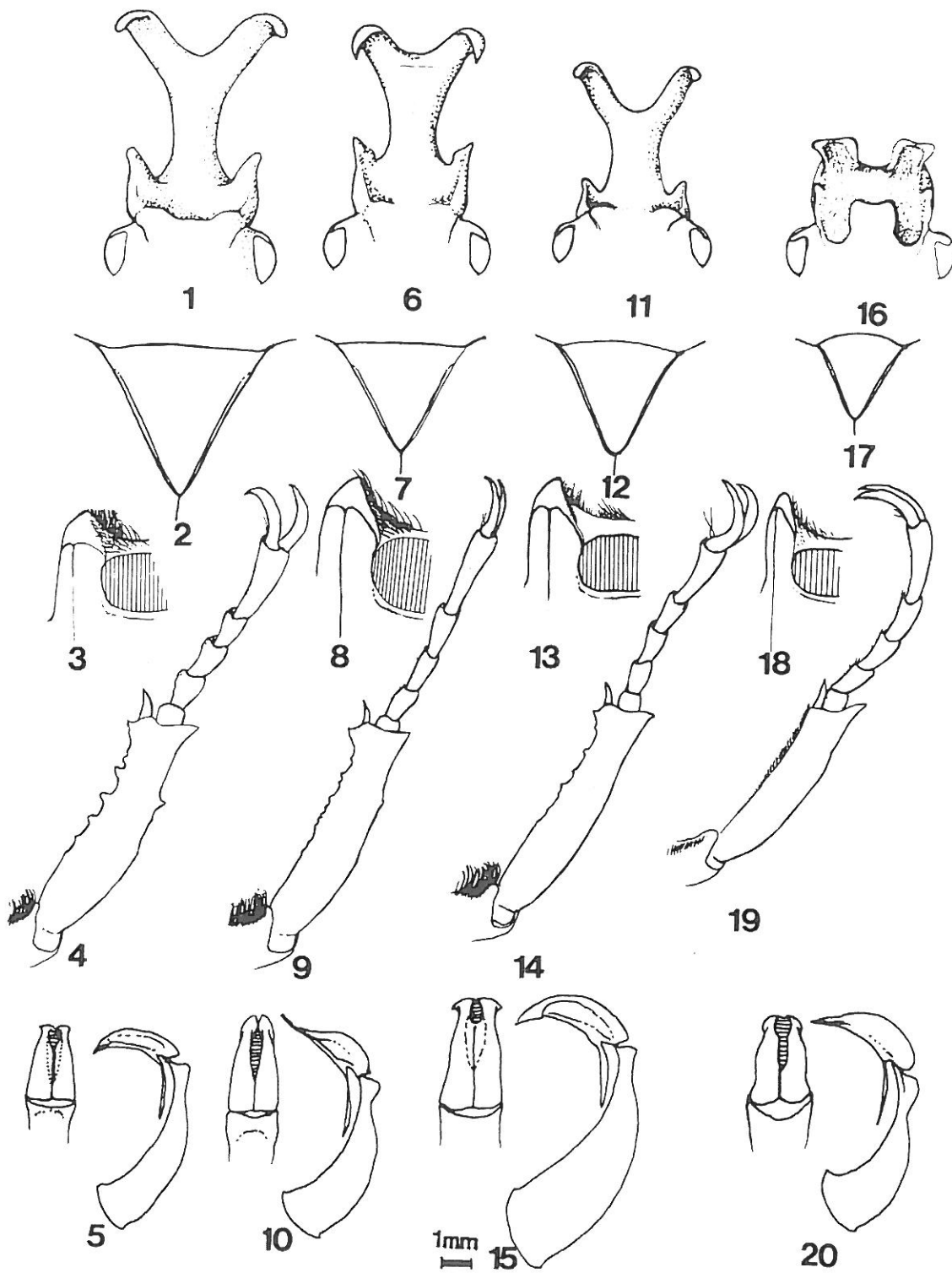
Thomson and *Ceratorrhina* Allard it is clear that these three genera were founded on very weak grounds (development of cephalic and protibial armature of males). At the same time they share several unique apomorphies (abbreviated aedeagal parameres; mesometasternal process; basic colour zoning; setation on male profemur, etc.). Phylogenetically there is no doubt that they form a monophyletic group. Taxonomically this group satisfies the criterion of greater morphological proximity between its members than between any of its members and any members of similar groups (e.g. *Stephanorrhina*, figs. 16-20). Lastly the nature and magnitude of differences within the group does not exceed that which is traditionally accepted within other genera of Goliathini and large Cetoniinae generally (viz. *Melinesthes*, *Pseudinca* etc.). There is therefore no sound reason to split this species assemblage into separate genera.

The characters that combinedly separate the genus *Eudicella* sens. lat. from other Goliathini are the following (for specific synapomorphies, see fig. 91):

1. Dorsum and venter shiny, without tomentose spots.
2. Clypeus of males armed (except in *E.(C.) mutica* (Janson) (figs 1, 6, 11, 21, 26, 31, 36), flat, weakly bilobate and wide in females.
3. Frons concave in males, often with basofrontal horns, with prominent clypeolateral angles (except in *E.(C.) mutica* (Janson)) (figs 1, 6, 11, 21, 26, 31, 36), anteriorly straight with mildly rounded angles in females.
4. Pronotum with base trisinate but weakly curved in middle, widest at base, with basal angles slightly forward of middle section.
5. Scutellum broad, with lateral grooves exposed (figs 2, 7, 12, 22, 27, 32, 37).

6. Elytra glabrous, without costae and with striae reduced to fine lines of punctures, sutural costa elevated near apex but apicosutural angles not spinose, with apical declivity more densely sculptured but not transversely rugulose.
7. Protibia of males unidentate (with rarely a rudimentary second denticle) on outside, asetose and smooth to finely denticulate to coarsely and irregularly serrated on inside, with internal distal angle always angularly produced (figs 4, 9, 14, 24, 29, 34, 39), broadly tridentate in females; profemur of males with characteristic setal brush.
8. Meso- and metatibia with small or without median outer denticle in males, both with one median outer denticle in females.
9. Mesometasternal process broad and parallel between mesocoxae, with mesometasternal suture anterior of mesocoxa and on a level with setose mesometasternal declivity, apically pointed (figs 3, 8, 13, 23, 28, 33, 38).
10. Abdominal sternites of males deeply depressed medially, the depression usually with contrasting colour.
11. Aedeagal parameres short, with orifice apico-dorsal; pars basalis with elongated basal section (figs 5, 10, 15, 25, 30, 35, 40).

The decision of whether subgenera should be defined within the genus is complicated by the somewhat intermediate position of *E. cupreosuturalis* Bourgoin and *E. preissi* Moser between two otherwise natural subgroups. These two species share cephalic armature, reduction of internal armature on protibia and aedeagal type with some species formerly assigned to *Cyprolais*, but clypeal armature, large size and general body shape with most *Eudicella* s. str. species. It is however still possible to define two subgenera of *Eudicella* as follows:



Figs. 1-20. - Morphological details of *Eudicella* s. str. and *Stephanorrhina* spp. From top to bottom: male head, dorsal aspect; scutellum; mesometasternal process, 45° left lateral aspect; left protibia of male, frontal aspect; aedeagus, left (parameres only) dorsal aspect, right left lateral aspect. (1-5) *E. (E.) trimeni* Janson; (6-10) *E. (E.) smithii* (McLeay); (11-15) *E. (E.) beveroensis* Kraatz; (16-20) *S. simplex* Péringuey.

### Key to the subgenera of *Eudicella* White

1. – Basofrontal horns of males prominent (figs 21, 26, 31, 36) (but absent in *E. (C.) mutica*); aedeagal parameres mostly with a distinct vertical projection (figs 25, 30, 35, 40); interior protibial margin of males smooth to finely denticulate (figs 24, 29, 34, 39) ..... *Eudicella (Cyprolais)* Thomson
- Basofrontal horns undeveloped in males (figs 1, 6, 11); aedeagal parameres always without ventral projection (figs 5, 10, 15); interior protibial margin strongly and unevenly serrated (figs 1, 9, 14) .....  
..... *Eudicella* White s. str.

### Subgenus *Eudicella (Eudicella)* White

*Eudicella* White, 1839 : 24; Burmeister, 1842 : 191; Westwood, 1842 : 174; Schoch, 1894 : 196; 1895 : 7; Péringuey, 1907 : 390; Schenkling, 1921 : 20; Schein, 1952 : 702; Krikken, 1984 : 54; Allard, 1985a : 47. - TYPE SPECIES : *E. morgani* White (by original monotypy)  
*Ceratorrhina* Westwood, 1842 : 171 (pars); Schenkling, 1921 : 20 (= *Eudicella*); Allard, 1985a : 47 (= *Eudicella*).

The subgenus is characterized by the three characters of the subgeneric key. It is very uniform, with differences between species limited to colour, minor sculptural details and slight differences in armature of males. The male aedeagi, however, show distinct species differences. One species group can be isolated by the externally parallel clypeal horns of males (*colmani*; *frontalis*), another by presence of median external metafemoral denticles on males (*aethiopica*, *trimenti*). As the armature of major and minor males differs extensively, these characters are, however, of limited use.

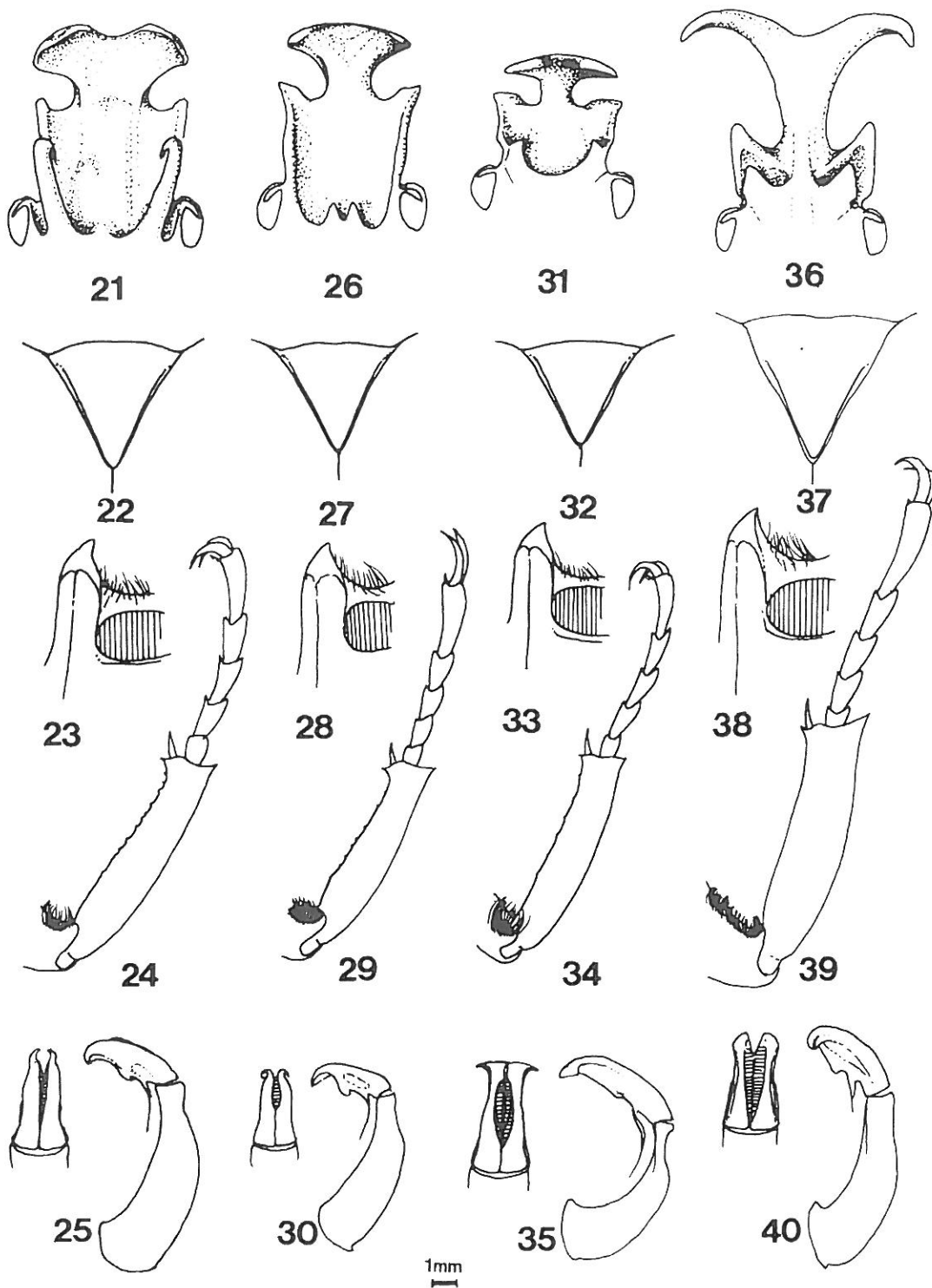
The type of *E. (E.) smithii* (McLeay) (a male from "Delagoa", housed in Canberra) is the same species described as *E. euthalia natalensis* Allard (1985a). This species has a reddish pronotal underside, and the aedeagus is apically flattened

and upturned (fig. 10). The species from Zimbabwe which has persistently been misidentified as *E. smithii* is a quite distinct species, *E. (E.) bertherandi* Fairmaire, with pronotum concolourous and aedeagal apex curved down as in figs. 5 and 15. This also implies that *E. natalensis* Allard, 1985 is a synonym of *E. smithii* McLeay, 1835 (**syn. nov.**). There are certainly many more confusions and synonymies to be corrected with a thorough revision, notably amongst the subspecies described by Allard, which according to the descriptions, constitute no more than colour variations.

### Subgenus *Eudicella (Cyprolais)* Thomson

*Cyprolais* Thomson, 1880 : 294; Kraatz, 1881 : 175; Schenkling, 1921 : 30 (= *Coelorrhina* Burmeister); Krikken, 1984 : 54. - TYPE SPECIES : *C. chloropyga* Thomson (= *quadrimaculata* F.) (by original monotypy)  
*Coelorrhina* Burmeister, 1842 : 206; Westwood, 1842 : 179; Lacordaire, 1856 : 481; Kraatz, 1880 : 146; Schoch, 1894 : 196; 1895 : 10; Péringuey, 1907 : 395; Schenkling, 1921 : 30; Krikken, 1984 : 54 (= *Cyprolais* Thomson 1880, misspelling of *Coelorrhina* Hope 1941); Allard, 1985 : 56. - TYPE SPECIES : *C. quadrimaculata* F. (Marais & Holm, 1992)  
*Ceratorrhina* Allard, 1985 : 55 (nec Westwood, 1842). - TYPE SPECIES : A type designation is superfluous, since Allard created both a homonym and a synonym. The two species which constitute *Ceratorrhina* Allard were not part of the definition of *Ceratorrhina* Westwood - see *Eudicella* s. str. above).

The subgenus is defined by the three characters mentioned in the subgeneric key. It contains three aberrant species, however. The two which Allard (1985) placed under *Ceratorrhina* (*preissi* Moser; *cupreosuturalis* Bourgoïn) are exceptionally large, have males with long clypeal horns and completely smooth internal protibial margins. *E. (C.) mutica* Janson on the other hand is very small and males lack all cephalic armature as well as the ventral process on aedeagal paramere. The remaining species form two groups : The *aurata-selene* group has the ventral process on aedeagal parameres reduced and the frontal horns triangular and flat (placing



Figs 21-40. - Morphological details of *Eudicella* (*Cyprolais*) spp. From top to bottom: male head, dorsal aspect; scutellum; mesometasternal process, 45° left lateral aspect; left protibia of male, frontal aspect; aedeagus, left (parameres only) dorsal aspect, right left lateral aspect (21-25) *E. (C.) cornuta* (Heath), (26-30) *E. (C.) quadrimaculata* (F.); (31-35) *E. (C.) aurata* Westwood, (36-40) *E. (C.) cupreosuturalis* Bourgoïn.



them closest to *E. (C.) mutica*). The *quadrinaculata*-group has males with thin, curved frontal horns and distinct ventral processes on the aedeagal parameres.

### GENUS *MECYNORRHINA* HOPE

As in the case of *Eudicella*, several species with phylogenetically weak differences, such as colouration and minor details of cephalic armature of males, have in the past been accorded generic status. These species share two synapomorphic generic traits, e.g. fusion of aedeagal parameres and presence of supraocular horns (least developed but present in *M. (A.) passerinii*), while they agree in many pleisiomorphic traits. Along the same criteria which were applied to *Eudicella* above, it is impossible to retain the species formerly assigned to *Mecynorrhina*, *Megalorrhina*, *Cheborrhina* and *Amaurodes* in separate genera. The genus *Mecynorrhina* is defined by the following characters (for specific synapomorphies see fig. 91):

1. Dorsum tomentose, with differently coloured spots and bands, sometimes with white ornamentation.
2. Clypeus of males armed with a single (fig. 42) or bifurcate horn (figs 47, 52, 57, 62).
3. Frons concave in males (figs 42, 47, 52, 57, 62), with supra-ocular horns pointedly developed (least in *M. (A.) harrisi* - fig. 57), rarely with additional basofrontal horns (*M. (A.) passerinii* - fig. 62). Females with bi-angulate clypeal margin (figs 43, 48, 53, 57), these two angles least pronounced but discernible in *M. (A.) passerinii* (fig. 63).
4. Pronotum with base trisinate, with posterolateral corners anterior of middle, widest at base.
5. Scutellum broad, with lateral grooves exposed and entire.
6. Elytra velutinous, without discernible costae or sculpture.
7. Protibia of males externally strongly

tridentate to smooth (figs 44, 49, 54, 59, 64), with inside dentate and sometimes provided with a basal hook (figs 44, 49); male profemur with setal brush; female protibia normally tridentate.

8. Meso- and metatibia each with one small or without median outer denticle in males; mesotibia with two and metatibia with one median outer denticle in females.
9. Mesometasternal process broad and parallel between mesocoxae, with mesometasternal suture at anterior end of coxa, apically bluntly pointed (figs 41, 46, 51, 56, 61).
10. Abdominal sternites of males deeply depressed.
11. Aedeagal parameres fused at base, with orifice dorso-anterior.

Although the most important apomorphic and pleisiomorphic characters for generic diagnosis (aedeagal type; mesometasternum; female head, etc.) define the genus quite well, it is possible to divide it into either five or two subgenera. As these large beetles display extreme hypertrophy, I am inclined not to attach too much significance to the resulting allometric differences, and recognise only the following two major subdivisions on subgeneric level:

#### Key to the subgenera of *Mecynorrhina* Hope

1. - Male with inner basal hook on protibia (figs 44, 49); dorsum velutinous with white tomentose spots; venter velutinous; apices of aedeagal parameres modified (figs 45, 50); metatarsomeres never with orange and black bands ..... *Mecynorrhina* s. str.
- Male without inner basal hook on protibia (figs 54, 59, 64); dorsum velutinous but without white tomentose spots; venter velutinous or glabrous; apices of aedeagal parameres blunt (figs 55, 60, 65); metatarsomeres with orange and black bands in some colour forms of all the species ..... *Mecynorrhina (Amaurodes)*

### Subgenus *Mecynorrhina* (*Mecynorrhina*) Hope

*Mecynorrhina* Hope, 1837 : 60; Burmeister, 1842 : 183; Westwood, 1842 : 168; Lacordaire, 1856 : 479; Schoch, 1894 : 195; 1895 : 6; Schenkling, 1921 : 16; Krikken, 1985 : 54; Allard, 1986 : 34.- TYPE SPECIES : *Scarabaeus polyphemus* F. (by original designation)

*Chelorrhina* Burmeister, 1842 : 185; Westwood, 1842 : 169 (= *Mecynorrhina*); Schoch, 1894 : 195; 1895 : 6; Schenkling, 1921 : 17; Krikken, 1985 : 54 (? = *Mecynorrhina*); Allard, 1985 : 34.- TYPE SPECIES : *Scarabaeus polyphemus* F. (by original monotypy)

*Mecynorrhinella* Marais & Holm, 1992 : 107. **syn. nov.** - TYPE SPECIES : *Mecynorrhina oberthueri* Fairmaire (by original designation)

The subgenus is characterized by the key characters and comprises the largest species of the genus. Although *M. polyphemus* (F.) is slightly different from the remaining *Mecynorrhina* species in having the apex of the male clypeal horn split, it agrees in all other characters with *Mecynorrhina* s. str. and not with *M. (Amaurodes)*. The other two species traditionally held in *Chelorrhina* (*C. kraatzi* Moser and *C. savagei* Harris) on the other hand are unequivocal *M. (Amaurodes)* species. The objective synonymy between *Chelorrhina* and *Mecynorrhina* led Marais and Holm (1992) to describe *Mecynorrhinella* as a replacement name for *Mecynorrhina*. This name is now redundant.

One of the traditionally accepted species in this subgenus, *M. (M.) ugandensis* Moser (type in the Humboldt collection, Berlin) is certainly only a subspecies of *M. (M.) torquata* Drury (type not traced, but identity well established).

The number of redundant infraspecific names in the whole genus is appalling (see Allard 1985), and few of the subspecies now recognized will probably bear scrutiny. (For type depositories see Marais & Holm, 1992).

The three valid species that now resort in this subgenus are : (infraspecific names omitted)

1. *M. (M.) oberthueri* Fairmaire, 1903.
2. *M. (M.) polyphemus* (F., 1781) **comb. nov.**
3. *M. (M.) torquata* (Drury, 1782).

### Subgenus *Mecynorrhina* (*Amaurodes*) Westwood

*Amaurodes* Westwood, 1844 : 71; Lacordaire, 1856 : 481; (Schoch, 1894 : 195; 1895 : 7; Péringuey, 1907 : 388; Schenkling, 1921 : 26; Krikken, 1984 : 53; Allard, 1985 : 46.- TYPE SPECIES : *A. passerinii* Westwood (by monotypy)

*Callopietes* Schaum, 1841 : 401; Schenkling, 1921 : 28 (= *Amaurodes*); Allard 1985 : 46 (= *Amaurodes*).- TYPE SPECIES : *A. passerinii* Westwood (by monotypy)

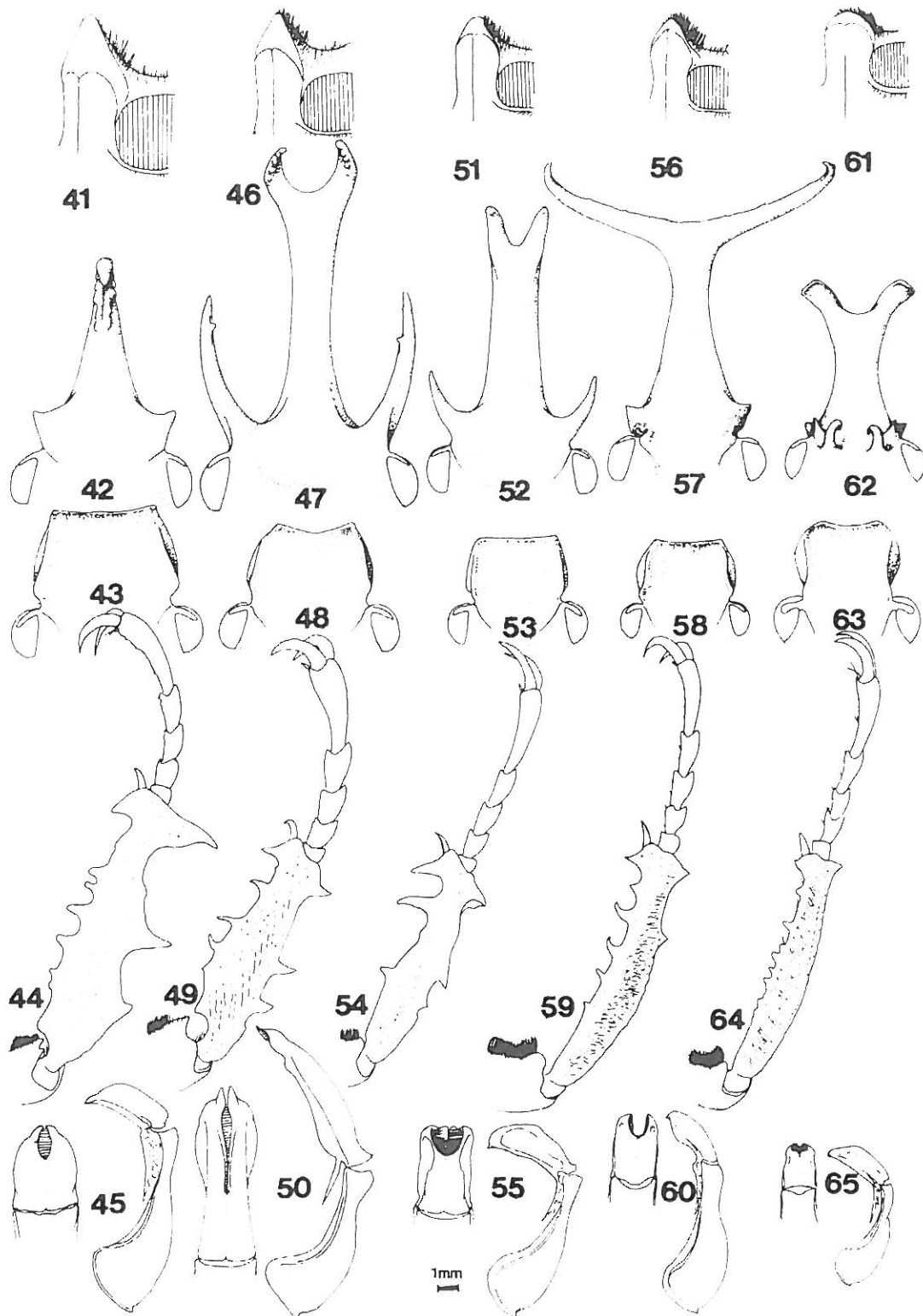
*Megalorrhina* Westwood, 1847 : 19; Schoch, 1984 : 195; 1985 : 7; Schenkling, 1921 : 18; Krikken, 1984 : 54 (? = *Mecynorrhina*); Allard, 1985 : 34; Allard, 1991 : 68. **syn. nov.** - TYPE SPECIES : *M. harrisi* Westwood (by monotypy)

The subgenus as here defined consists of four species, of which two are closely related (*M. (A.) savagei*, *M. (A.) kraatzi*) and the other two phenetically about equidistant from each other. The synapomorphies connecting these four species (fig. 91) are convincing (see also figs 51-65). The only structure that varies by more than degree is the presence of basofrontal horns in *M.(A.) passerinii* - but this character is variable within many other goliathine genera. The widening of the lateral clypeal declivity in females forms a transformation series from *M. (A.) savagei* over *M. (A.) harrisi* to *M. (A.) passerinii*, with a concomitant inward displacement and reduction of clypeal angles (figs 53, 58, 63).

The four valid species that now resort in this subgenus are :

1. *M. (A.) harrisi* (Westwood, 1847) **comb. nov.** (for infraspecific names see Allard, 1991)
2. *M. (A.) kraatzi* (Moser, 1905).
3. *M. (A.) passerinii* (Westwood, 1844) **comb. nov.** (for infraspecific names see Allard, 1985).
4. *M. (A.) savagei* Harris, 1844.





Figs 41-65. - Morphological details of *Mecynorrhina* spp. From top to bottom: mesometasternal process, 15° left lateral aspect; male head, dorsal aspect; female head, dorsal aspect; left protibia of male, frontal aspect; aedeagus, left (parameres only) dorsal aspect, right left lateral aspect. ( 41-45) *M. (M.) torquata* (Drury); ( 46-50) *M. (M.) polyphemus* (F.); ( 51-55) *M. (Amaurodes) savagei* (Harris); ( 56-60) *M. (A.) harrisi* (Westwood); ( 61-65) *M. (A.) passerinii* (Westwood)

**GENUS *DICRONORHINA* HOPE**

*Dicronorhina* (Hope, 1837 : 119; MacLeay, 1838 : 32; Westwood, 1842 : 171; Distant, 1911 : 255; Lekkerkerk & Krikken, 1986 : 6.

*Dicranorhina* Burmeister, 1842 : 156; Lacordaire, 1856 : 480; Schoch, 1894 : 196; 1895 : 6; Péringuey, 1907 : 367; Kolbe, 1909 : 133; Distant, 1911 : 255; Schenkling, 1921 : 23.

*Atlas* Castelnau, 1840 : 162; Schenkling, 1921 : 23 (= *Dicranorhina*).

*Ceratorrhina* Thomson, 1880 : 293; Kraatz, 1881 : 176; Schenkling, 1921 : 23 (= *Dicranorhina*). - TYPE SPECIES : *Scarabaeus micans* Drury (by original designation).

This genus was recently and adequately revised by Lekkerkerk & Krikken (1986). It will suffice to enumerate the main characters here :

1. Dorsum and venter glabrous, shiny, mostly with some white tomentose areas; much more coarsely sculptured in females.
2. Clypeus of males armed as in fig. 87, female clypeus bi-angulate with a medially bilobately produced anterior margin (fig. 88).
3. Frons with median crest in males (fig. 87), evenly rounded in females (fig. 88).
4. Pronotum with base trisinuate.
5. Scutellum broadly triangular, with lateral grooves not sharply edged.
6. Elytra glabrous, mostly with longitudinal white bands, sometimes unornamented.
7. Male protibia externally smooth to mildly uneven, internally dentate, without basal inner hook, without internal setal brush (fig. 89); female protibia tridentate.
8. Meso- and metatibia unarmed in males, with one median outer denticle on each in females.
9. Mesometasternal process broad and parallel between mesocoxae, bluntly pointed, with mesosternal declivity not curved forward, not densely setose (fig. 86).
10. Abdominal sternites of males weakly depressed along middle.
11. Aedeagal parameres basally fused and apically highly modified; pars basalis short (fig. 90).

Lekkerkerk & Krikken (1986) recognised three species in the genus, one of which was further differentiated into five subspecies. Phylogenetically the genus is closest to *Cheirolasia*, with which it forms the sister group of *Neptunides* (fig. 91). Shared characteristics of *Cheirolasia* and *Dicronorhina* are the large supraocular outgrowths and medially carinate frons of males; relatively plesiomorphic mesometasternal process; weakly depressed male sternites; shortened pars basalis of aedeagus; protarsal brushes in males. There are, however, significant differences (dorsal setation in *Cheirolasia*; very different aedeagal parameres; sexually dimorphic sculpture in *Dicronorhina*; metatibial denticle in males of *Cheirolasia* etc.) which places the two genera well apart.

**GENUS *CHEIROLASIA* WESTWOOD**

*Cheirolasia* Westwood, 1842 : 178; Lacordaire, 1856 : 481; Schoch, 1895 : 69; Péringuey, 1907 : 386; Schenkling, 1921 : 28; Schein, 1961 : 85; Krikken, 1984 : 53; Allard, 1985 : 64. - TYPE SPECIES : *C. burkei* Westwood (by monotypy).

*Chirolasia* Kolbe, 1897 : 183; 1914 : 383.

This monotypic genus is well separated from the other genera in the group (see fig.91, and *Dicronorhina* above). The diagnostic characters are as follows:

1. Dorsum and venter setose, shiny, with white to yellow tomentose spots.
2. Clypeus of males armed as in fig. 82; of females as in fig. 83.
3. Frons with median crest in males (fig. 82); rounded in females (fig. 83).
4. Pronotum with base weakly trisinuate, nearly straight.
5. Scutellum triangular, with lateral grooves not sharply edged.
6. Elytra glabrous, setose, mostly bicoloured and always ornamented with white to yellow tomentose spots, with punctures distinctly coarser in females.
7. Male protibia externally more or less

- smooth, internally without denticles but with a dense setal brush on proximal half (fig. 84); female protibia normally tridentate.
8. Mesotibia unarmed in males, with one median outer denticle in females; metatibia with one distinct median outer denticle in both sexes.
  9. Mesometasternal process broad, bluntly rounded apically, diffusely setose all over (fig. 81).
  10. Abdominal sternites of males weakly depressed along the middle.
  11. Aedeagal parameres asymmetrical; pars basalis short (fig. 85).

The single species of this genus is easily recognized, and quite unique in this group by virtue of its dorsal setation (a character only shared by *Gnorimimus* Kraatz, which, however, is quite different in other respects). Allard (1985) lists six subspecies, these should be regarded with doubt.

### GENUS TAURHINA BURMEISTER

Together with *Cheirolasia* and *Dicronorbina*, this genus forms a sister group to the *Mecynorbina* - *Eudicella* complex (fig. 91), and many plesiomorphic characters recur in members of both groups. *Taurhina* s. lat. as defined here is characterized by the following characters (for specific synapomorphies, see fig. 91) :

1. Dorsum and venter glabrous, with or without white tomentose areas, more coarsely punctured in females.
2. Clypeus of males expanded laterally and/or forward, with genal apices pointed (figs 67, 72, 77).
3. Frons of males concave (figs 67, 72, 77), in females concave (fig. 78) to feebly rounded (figs 68, 73).
4. Pronotum with base hardly sinuate, virtually straight.
5. Scutellum with lateral grooves variable.
6. Elytra glabrous, with or without white tomentose areas.
7. Male protibia slightly uneven to

- weakly bidentate on outside, denticulate with basal hook on inside, with a small basal setal brush; male profemur with a variously developed hook (figs 69, 74, 79); female protibia externally tridentate, sometimes (*T. (Neptunides)*) with internal basal hook as in male.
8. Meso- and metatibia externally unarmed in males, both unidentate in females.
  9. Mesometasternal process with mesosternal section short, rounded to truncate, mesosternal declivity setose (figs 66, 71, 76).
  10. Male abdominal sternites moderately depressed along middle.
  11. Aedeagal parameres shorter than pars basalis, with a median lobe on each paramere in dorsal view (figs 70, 75, 80).

The genus is not as homogeneous as *Dicronorbina* or *Cheirolasia*, and fair arguments could be brought forward to either synonymize *Neptunides* with *Taurhina* (with *Rhamphorrhina* perhaps as subgenus) or go to the other extreme and consider *Neptunides* and *Taurhina* as subgenera and *Rhamphorrhina* as a separate genus. There is an essential unity within the group (fig. 91), combined with non-concordant distribution of characters between the three former genera (*Neptunides* and *Taurhina* share colouration, clypeal and profemoral armature of males, mesometasternal process and deplanate aedeagal parameres, while *Taurhina* and *Rhamphorrhina* share basofrontal horns and elongated frons in males). This makes it difficult to treat them in any other way than three subgenera of one genus, which can be distinguished as follows :

### Key to the subgenera of *Taurhina* Burmeister

1. – Dorsum with white tomentose areas; mesometasternal process truncate; male with setal brush on distal pro-

tarsomere and with profemoral projection rounded (fig. 79); aedeagal parameres apically enlarged (fig. 80) ..... *T. (Rhamphorrhina)* Klug

- Dorsum without white tomentose areas; mesometasternal process rounded; male without or with contiguous basofrontal horns (figs 67,72); male without setal brush on distal protarsomere and with profemoral projection acute (figs 69, 74); aedeagal parameres apically flat (figs 70,75) ..... 2

2. - Female with inner basal hook on protibia as in male; male with contiguous basofrontal horns (fig. 72) ..... *T. (Taurbina)* Burmeister

- Female without inner basal hook on protibia; male without basofrontal horns (fig. 67) ..... *T. (Neptunides)* Thomson

### Subgenus *Taurbina* Burmeister s. str.

*Taurbina* Burmeister, 1842 : 190; Westwood, (1842 : 179; Lacordaire, 1856 : 481; Gerstaecker, 1882 : 4; Schoch, 1894 : 196; 1895 : 8; Schenkling, 1921 : 29; Krikken, 1984 : 55; Allard, 1985 : 62.-TYPE SPECIES : *Dicranorrhina nireus* Schaum (by original monotypy).

Two species are known in the nominal subgenus : *T. (T.) nireus* (Schaum, 1841 : 40) and *T. (T.) longiceps* Kolbe, 1892 : 126. The first species has the male cephalic armature much like in *T. (Neptunides)* and *T. (R.) bertolonii*, while *T. (T.) longiceps* leads over to the much transformed head of *T. (R.) splendens*.

### Subgenus *Taurbina (Neptunides)* Thomson stat. nov.

*Neptunides* Thomson, 1879 : 106; (Gerstaecker, 1882 : 4; Péringuey, 1907 : 393; Schenkling, 1921 : 25; Krikken, 1984 : 54; Allard, 1985 : 60).  
TYPE SPECIES : *Neptunides polychrous* Thomson (by original monotypy).

*Neptunistes* Kraatz, 1880 : 18; Schenkling, 1921 : 25 (= *Neptunides*); Allard, 1985 : 60 (= *Neptunides*).

*Neptunoides* Schoch, 1894 : 195; 1895 : 9; Schenkling, 1921 : 25 (= *Neptunides*); Allard, 1985 : 9 (= *Neptunides*).

*Pseudoneptunides* Csiki, 1909 : 18; Moser, 1910 : 293 (= *Neptunides*); Schenkling, 1921 : 26 (=

*Neptunides*); Allard, 1985 : 60 (= *Neptunides*).  
TYPE SPECIES : *Pseudoneptunides szalayi* Csiki (= *T. (N.) stanleyi*) (by original monotypy).

There are two species recognized in this subgenus, of which the one (*T. (N.) stanleyi* Janson, 1889 : 40) seems to be a hypertrophic derivative of the other (*T. (N.) polychrous* Thomson, 1879 : 16). Twenty-one synonyms and infraspecific names were described for these two species, mostly by Allard (1985 : 1991).

### Subgenus *Taurbina (Rhamphorrhina)* Klug stat. nov.

*Rhamphorrhina* Klug, 1855:659; 1862 : 261; Schenkling, 1921 : 72 (= *Ranzania*); Krikken, 1984 : 54 (nom. nov. *Ranzania* Bertoloni nec Nando); Allard, 1985 : 63 (= *Ranzania*).-TYPE SPECIES : *R. petersiana* Klug (= *splendens* Bertoloni) (by monotypy).

*Ranzania* Bertoloni, 1855 : 420; Gerstaecker, 1882 : 6; Schoch, 1894 : 195; 1895 : 9; Péringuey, 1907 : 384; Schenkling, 1921 : 27; Krikken, 1984 : 54 (= *Rhamphorrhina* Klug).-TYPE SPECIES : *R. splendens* Bertoloni (by original monotypy).

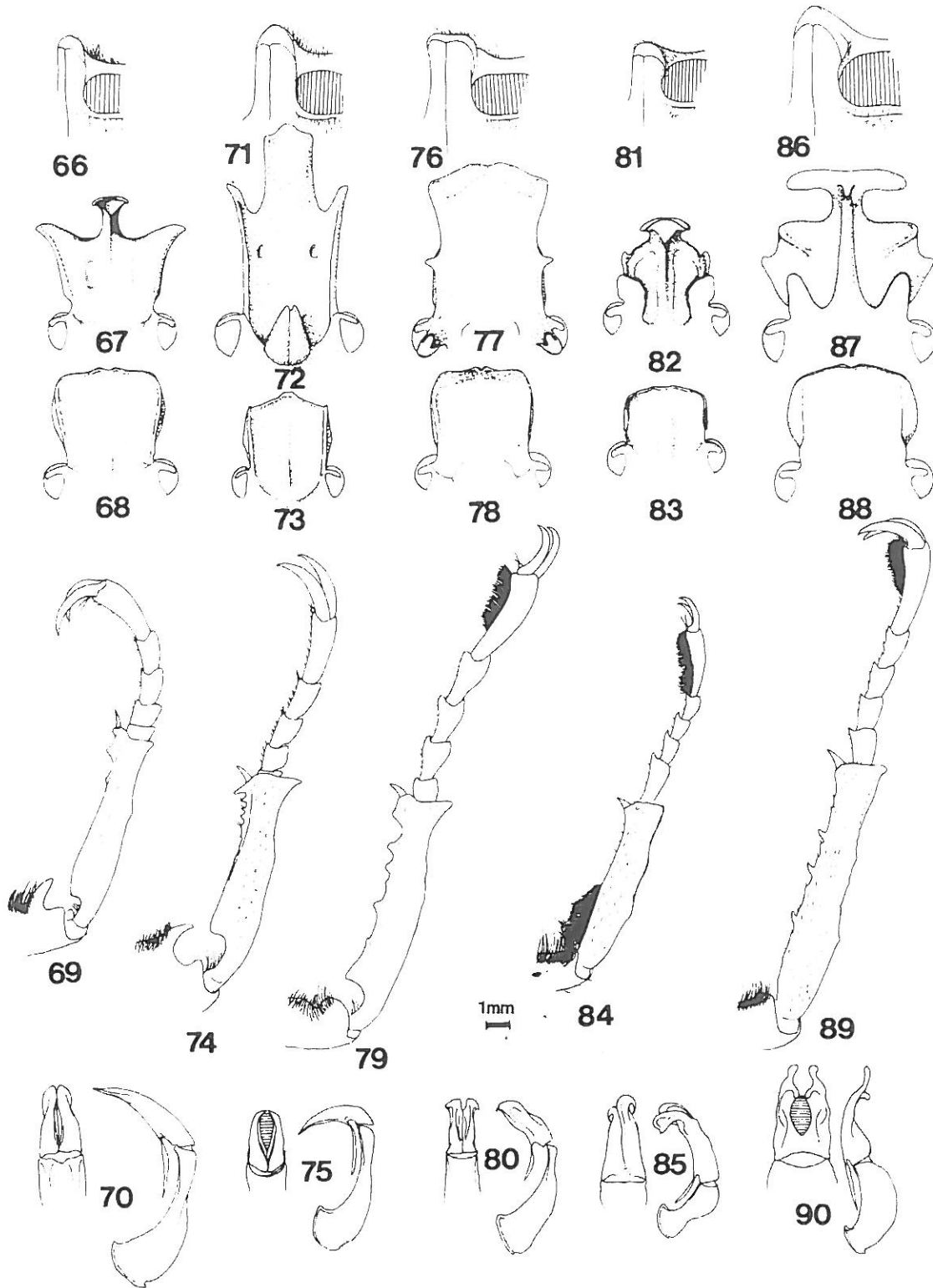
*Mephista* Thomson, 1879 : 113; Kolbe, 1897 : 181. (subg. *Ranzania*); Schenkling, 1921 : 27; (= *Ranzania*); Allard 1985 : 63 (= *Ranzania*).-TYPE SPECIES : *R. bertolonii* Lucas (by monotypy)

*Neoranzania* Distant, 1911 : 256 (nom. nov. *Ranzania* Bertoloni, nec Nando); Krikken, 1984 : 54 (= *Rhamphorrhina* Klug).

The subgenus is represented by two species that are easily distinguished by the clypeal shape of males. *R. splendens* (Bertoloni, 1855 : 420) is illustrated in figs. 76-80. *R. bertolonii* (Lucas, 1880 : 81) has a male clypeus much like *T. (Neptunides)*. Little synonymy and infraspecific ballast has been added to this subgenus.

## RELATIONSHIPS OF THE GENERA NEAR *EUDICELLA* WHITE

Amongst the African Goliathini the most likely sister group of *Eudicella* is *Mecynorrhina* with which it shares the cephalic and tibial armature of males, general shape and setation of mesometasternal process, and shape of pronotum and scutellum. The velutinous



Figs 66-90. - Morphological details of *Taurhina*, *Cheirilasia* and *Dicronorhina* spp. From top to bottom: mesometasternal process, 45° left lateral aspect, male head, dorsal aspect, female head, dorsal aspect; left protibia of male, frontal aspect; aedeagus, left (parameres only) dorsal aspect, right left lateral aspect. (66-70) *T. (Neptunides) polychrous* (Thomson); (71-75) *T. (T.) longiceps* Kolbe; (76-80) *T. (Rhamphorrhina) splendens* (Bertoloni); (81-85) *C. burkei* (Westwood); (86-90) *D. derbyana* Westwood.

covering of *Mecynorrhina* is difficult to interpret : in general this is found in conservative genera (e.g. *Ichnestoma*, *Heteroclyta*, *Mazoe* etc.) but also occurs in highly derived groups (*Pseudinca*, *Daedicorrhina* etc.). In the present context it is considered primitive. The fused aedeagal parameres of the *Mecynorrhina* group, on the other hand, are decidedly derived relative to *Eudicella* although fused aedeagal parameres seem to have developed independently in other genera. Several other generic groups are closely related to the *Mecynorrhina*-*Eudicella* group (e.g. *Dicronorrhina*, *Taurhina*, *Cheiolasia*), but the only other genus with an aedeagus similar to *Eudicella* is *Stephanorrhina* (fig. 20), which, however, has a different pronotal rear margin (fig. 17) and male protibia and profemur (fig. 19), while the mesometasternal process is constricted (fig. 18). This genus must therefore be considered to be a parallel development to *Eudicella*.

In fig. 91 the relationships of the nearest relatives of *Eudicella* are expressed in cladistic terms. While the

cladogram shows several independent repetitions (e.g. 1b, 3b, 6a, 6d), these are all reductions which are likely to occur repeatedly. It is certainly possible to assess the importance of characters differently, but very unlikely that this will affect the generic classification proposed in this paper significantly unless the position is taken that the genera are still too finely split. The general rule which I applied to ranking is that the male genitalia in one genus must belong to one recognisable type, and in a subgenus should form recognisable transformation series. The resulting classification matches well with external characters, and the scarcity of convincing apomorphies separating subgenera (fig. 91) further corroborates the ranking proposed here.

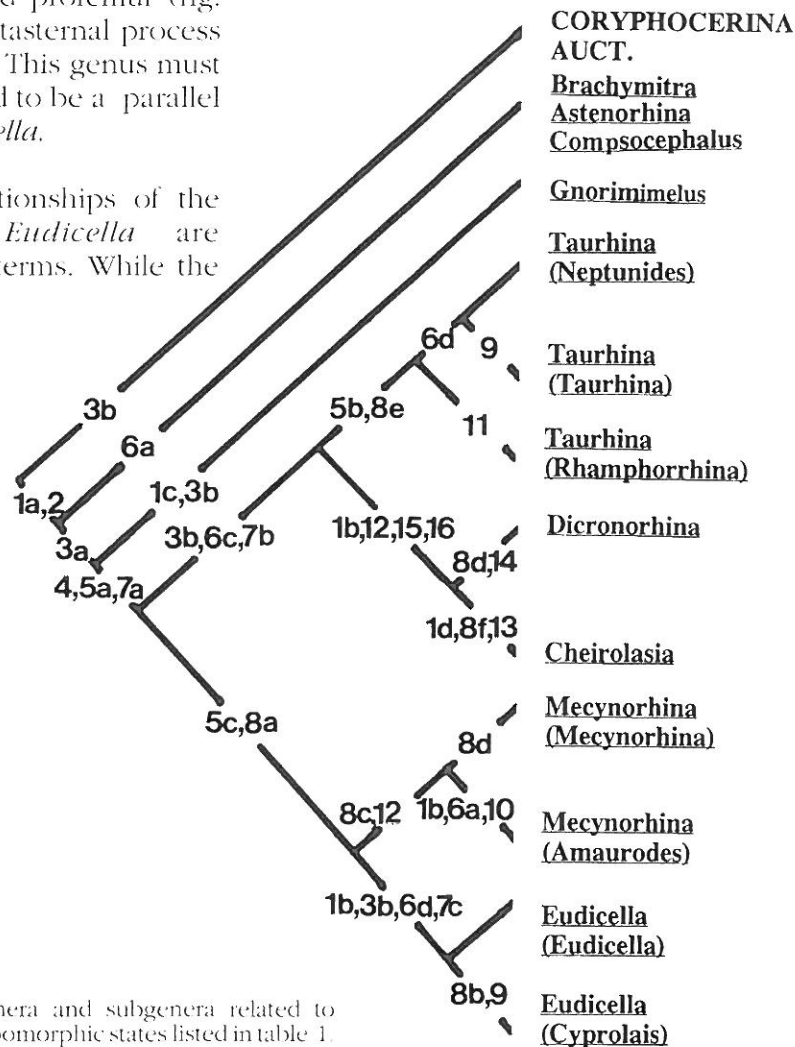


Fig. 91. - Cladogram of genera and subgenera related to *Eudicella*. Numbers refer to apomorphic states listed in table 1.



**Table 1. - List of characters used for the cladogram of genera and subgenera related to *Eudicella*. Numbers refer to apomorphic states, while the presumed plesiomorphic states are unnumbered. Presumed synplesiomorphs for the whole group are: dorsum and venter velutinous with white tomentose areas; mesometasternal process broad, with mesosternum bluntly rounded; females with two outer spines each on mesotibia and metatibia.**

- 
- Male protibia with internal distal margin straight or rounded; male profemur without apical process.
  - 1a Male protibia with internal distal margin curved in angularly; profemur with internal process to form a clasper with prominent inner basal angle of protibia (figs 58, 63, 68, 73, 78).
  - 1b Male protibia as in 1a but without basal clasper on tibia and femur, tibia armed along inside (figs 4, 9, 14, 19, 24, 29, 34, 43, 48, 53, 88).
  - 1c Male protibia as in 1b but unarmed along inside (fig. 39).
  - 1d Male protibia as in 1c but with a setal brush on inside (fig. 84).
  
  - Dimorphic sexual armature (if present) limited to tibiae (exceptions: *Melinesthes*, *Anisorrhina*, *Chordodera*).
  - 2 Sexual dimorphism in both cephalic armature (except *E. (C.) mutica*) and tibial armature well developed, males always with a simple or forked median horn on clypeus (except *E. (C.) mutica*).
  
  - Female with two outer spines on both mesotibia and metatibia.
  - 3a Female with two outer spines on mesotibia, one on metatibia.
  - 3b Female with one outer spine on both mesotibia and metatibia.
  
  - Male profemur with setae more or less diffuse.
  - 4 Male profemur with a frontoventral setal brush which angles downward at distal end (figs 34, 29, 34, 39 etc.).
  
  - Mesometasternal process with mesosternum rounded, diffusely setose.
  - 5a Mesometasternal process with metasternum flattened ventrally, angularly rounded around ventral edge (figs 81, 86).
  - 5b As in 5a, but with metasternum transverse and truncate anteriorly (figs 66, 71, 76).
  - 5c As in 5a, but with metasternum triangularly produced, with a very dense setal brush above (figs 3, 8, 13, 18, 23, 28, 38, 41, 46, 51, 56, 61).
  
  - Dorsum velutinous with white tomentose areas.
  - 6a Dorsum velutinous without white areas (except *Astenorrhina* females).
  - 6b Dorsum velutinous, ornamented with differently coloured velutinous spots and bands.
  - 6c Dorsum glabrous with white tomentose areas.
  - 6d Dorsum glabrous without white tomentose areas.
  
  - Female clypeus bilobate.
  - 7a Female clypeus bi-angulate (figs 42, 47, 52, 57, 62).
  - 7b Female clypeus bi-angulate, but medially produced and finely bilobate (figs 67, 72, 77, 82, 87).
  - 7c Female clypeus truncate with rounded outer margins.
  
  - Aedeagal parameres simple tapering lobes.
  - 8a Aedeagal parameres very short, apically hooked (figs 5, 10, 15, 20, 40).
  - 8b As in 8a, but with ventral tubercle (figs 25, 30, 35, 40).
  - 8c Aedeagal parameres tubularly fused (figs 45, 50, 55).
  - 8d As 8c, but with apices elongated and diversely modified (figs 60, 65).
  - 8e Aedeagal parameres with a separated median lobe in dorsal view (figs 69, 74, 79).
  - 8f Aedeagal parameres asymmetrical (fig. 84).
  
  - Basofrontal tubercles of male undeveloped.
  - 9 Basofrontal tubercles of male prominent (figs 21, 26, 31, 36, 42, 72, 77).
  
  - Metatarsomeres more or less concolourous.
  - 10 Metatarsomeres often with orange and black bands.
  
  - Male with distal protarsomere simple.
  - 11 (Major) males with a ventral setal brush on distal protarsomere (figs 79, 84, 89).
  
  - Males without supraocular horns.
  - 12 Males with prominent supraocular horns (figs 82, 87).
  
  - Dorsum asetose.
  - 13 Dorsum with sparse but long setae.
  
  - Dorsal sculpture not dimorphic.
  - 14 Dorsal sculpture much coarser in females.
  
  - Frons of male flat or concave.
  - 15 Frons of male with a prominent median crest which continues onto clypeal horn (figs 82, 87).
  
  - Aedeagus with pars basalis as long or longer than parameres.
  - 16 Pars basalis shortened, shorter than parameres (figs 85, 90).
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