

Genus	Vol. 16(3): 313-323	Wroclaw, 15 IX 2005
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*Norialsus berkheyae* n. sp. from South Africa – a planthopper FROM  
*Berkheya coddii* (Asteraceae), a nickel hyperaccumulating plant  
(Hemiptera: Fulgoromorpha: Cixiidae)

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**ABSTRACT.** A new species of the genus *Norialsus* VAN STALLE, 1986, endemic in southern Africa is described. *Norialsus berkheyae* sp. n. was found on the *Berkheya coddii*, an Asteraceae plant recognized as a hyperaccumulator of nickel. The new species is related to the *Norialsus capeneri* group regarding external characters and male genital structures.

**Key words:** entomology, taxonomy, new species, Fulgoromorpha, Cixiidae, Pentastirini, *Norialsus*, nickel hyperaccumulating host-plant, South Africa

#### INTRODUCTION

The genus *Norialsus* was erected by VAN STALLE in 1986 and comprise 37 species endemic in the Cape region and the Drakensberg mountains. It is placed in the tribe Pentastirini EMELJANOV, 1971 of the subfamily Cixiinae SPINOLA, 1839. It can be differentiated from the other Cixiidae by the following combination of characters (VAN STALLE 1986). Postclypeus large, reaching to level of lateral ocelli; subapical transverse carina of vertex connected to apical border by only one median carina. Mesonotum usually with five longitudinal carinae, but three-carinated species occurs. Tegmina often reduced, costal margin provided with protruding granules. Hind tarsi with a double row of 7 to 12 teeth on basal and mid tarsomeres, or only mid tarsomere with a double row of teeth. The most important character at generic level is the presence of a semicircular process at the base of

flagellum of the aedeagus, not observed in any other Pentastirini genera. Within the genus the various species differ considerably in their external morphology, due to important differences in coloration, from pale ochreous to black, and a different degree of reduction of tegmina and wings. While in many species tegmina are well developed, *N. micropterus* VAN STALLE, 1986 has small coriaceous tegmina which are weakly convex and nearly reach the tip of abdomen. In this species the wings are rudimentary, another undescribed species is apterous, the wings being totally reduced; in most species they are fairly developed. Nothing is known about their ability to fly. Finally the number and morphology of hind tarsal teeth varies considerably within the genus; in some species variation might be greater than presently assumed in the view of the small number of specimens examined (VAN STALLE 1986).

#### SYSTEMATIC PART

#### *Norialsus* VAN STALLE, 1986

TYPE SPECIES: *Oliarus capeneri* SYNAVE, 1953: SYNAVE 1953: 1; by original designation by VAN STALLE 1986: 198.

#### *Norialsus berkheyae* n. sp.

(Figs 1–20)

#### DIAGNOSIS

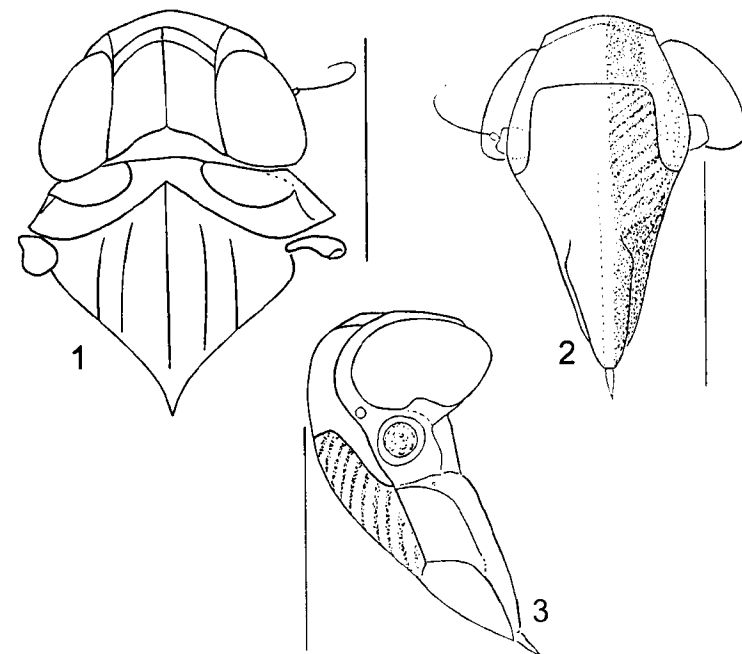
Related to the *capeneri* – *somerseti* – *ficksburgi* group of species, but differs in external characters as well as in genital structures of the male. Genital styles with triangular apices (different in the *capeneri* – *somerseti* – *ficksburgi* group). Left pair of endosomal apical processes fused at base and directed posterodextrad (processes not fused at base and directed in other directions). Long basal process of endosoma directed dorsad and dextrad, slightly widened in median portion with crenate margin at this point (this process, if present differs in other species of the genus). Tibio-metatarsal formula 1+2+3 : 2+[7–8] : 2+[7–10] (formula 1+2+3 : 2+[7–8] : 2+[7–9] in the other members of this species-group).

#### DESCRIPTION

Total length 5.1 – 5.4 mm, in males pygofer exceeding length of tegmina, in females pygofer not exceeding length of tegmina. General coloration similar in both sexes, dark brownish-blackish. Vertex brownish with lateral margins lighter and median lighter yellowish-brownish streak; frons blackish with lighter lateral carinae and median streak; postclypeus blackish with lighter median streak and brownish oblique streaks, lora brownish with lighter emarginations, anteclypeus brownish with lighter median streak, clypellus yellowish; circumocular area black, compound eyes brown-reddish, circumantennal area light brownish, with antafossa margin blackish anteriorly, antennae brownish; maxillary plate blackish. Pronotum

brownish with lighter, yellowish postocular carinae and median streak, mesonotum brownish with 5 lighter streaks along carinae. Tegulae dark brown, tegmina uniformly dark brown with lighter veins and light setae. Fore and mid trochanters brownish, fore and mid femora yellowish with longitudinal brownish streaks, fore and mid tibia yellowish, tarsi yellowish, with apical portion and tarsal claws brownish; hind coxae and trochanters brownish, hind femur yellowish with brownish longitudinal streaks, hind tibia yellowish with longitudinal brownish streaks, apical portion dark brown to black, hind tarsomeres yellowish with brownish to black apical portions, tarsal claws dark brown. Abdomen brownish, pygofer, anal tube, male genital styles and female ovipositor dark brownish.

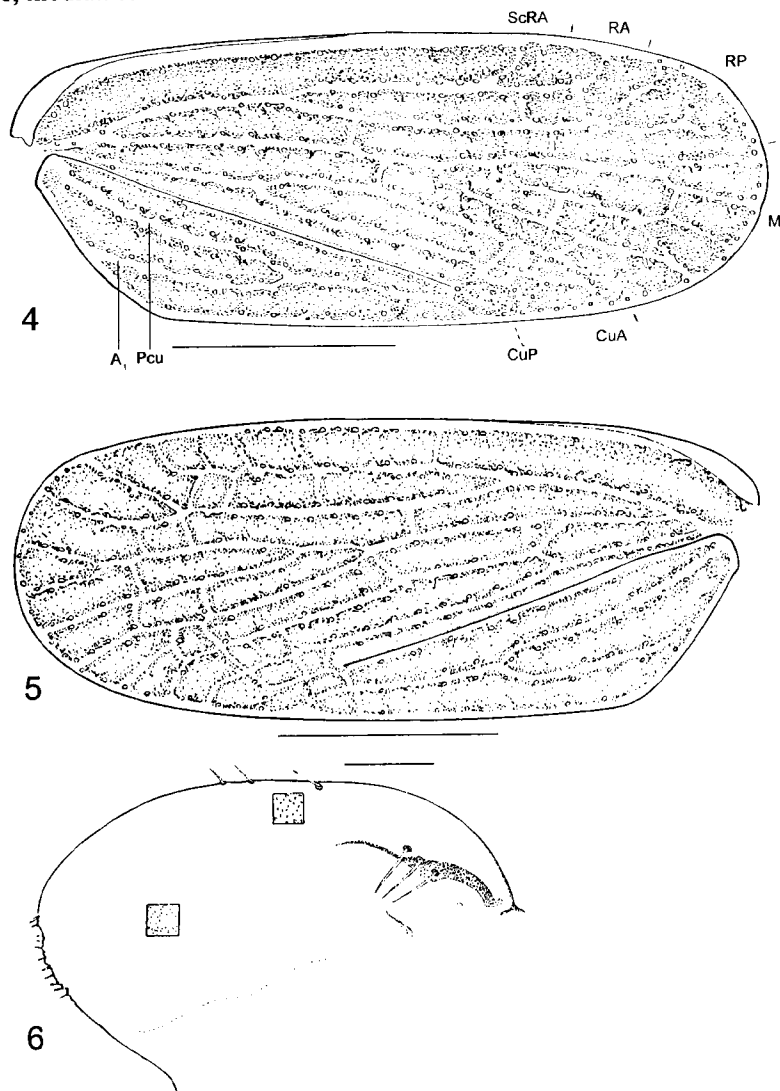
Head with compound eyes slightly narrower than pronotum, compound eyes big, elongate. Vertex wider at base than long in mid line; anterior margin arcuate, posterior margin slightly excavate, lateral margins subparallel, slightly elevated; median carina complete, reaching to the apex of vertex. Apical transverse carina of vertex arcuate, subapical transverse carina of vertex parallel to apical one, connected with it by single short median longitudinal carina. Frons short in mid line, in lateral line about as long as wide, lacking median carina, with wrinkled sculpture. Frontoclypeal suture strongly produced on frons, with two distinct lateral angles reaching level of lateral ocelli. Median ocellus absent. Clypeus about twice as long as wide. Postclypeus without median carina, not distinctly



1–3. *Norialsus berkheyae* n. sp.: 1 – anterior part of body; 2 – face; 3 – head in lateral view (scale bar = 1 mm)

swollen, with distinct traces of internal musculature. Anteclypeus without median carina. Lateral margins of frons elevated, lateral ocellus placed at level of anteroventral angle of compound eye. Antafossa with posterior margin slightly elevated, second antennal joint globose, about as long as wide. Rostrum reaching hind coxae, apical segment 0.75 times as long as subapical one.

Pronotum small, short in mid line (about 0.44 times as long as vertex in mid line), distinctly excavated along posterior margin, postocular carinae distinct, arcuate, median carina absent.



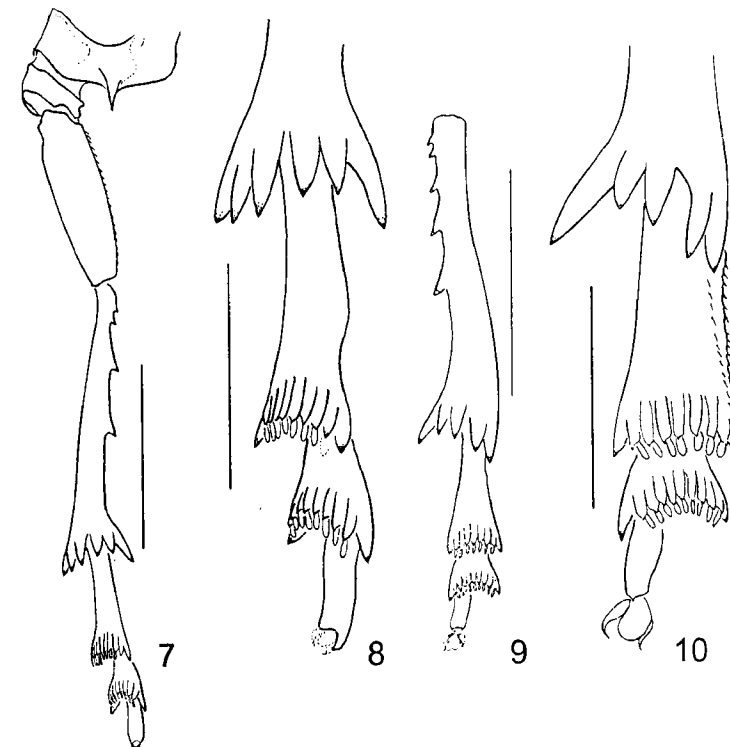
4-6. *Norialsus berkheyae* n. sp.: 4 - right tegmen; 5 - left tegmen; 6 - left hind wing (scale bar = 1mm, for 4 & 5, 0.1 mm for 6)

Mesonotum with scutellum slightly wider than long, with five longitudinal carinae.

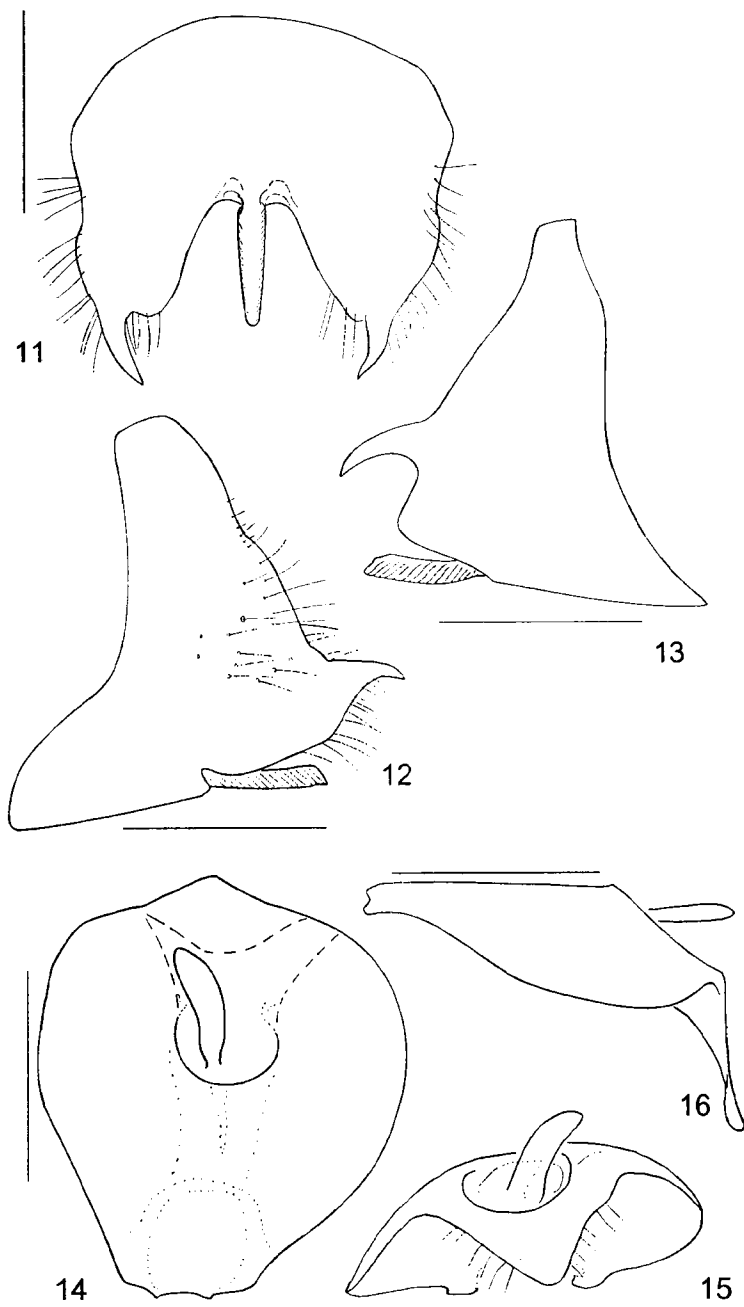
Tegulae twice as wide as long in mid line.

Tegmen coriaceous, with apex of clavus not exceeding  $2/3$  of tegmen length, veins covered by large protruding and concolorous setiferous tubercles, costal margin distinctly curved at base, anterior and posterior margins of tegmen subparallel, apex round, stigma not distinctly developed; costal complex of veins thickened, covered with setiferous tubercles; basal cell about twice as long as wide, vein ScR separated from basal cell basad of arculus, first ScR forking at level of claval veins junction, number of RA terminals varies, even on left and right tegmen, RP with three terminals; first forking of M slightly basad of apex of clavus, posterior of half of tegmen length, with five terminals, vein CuA forked slightly basad of claval veins junction and basad of first ScR forking; claval veins Pcu and  $A_1$  fused at half of clavus length, at level of  $1/3$  of length of tegmen; veinlets not regular. Hind wings reduced, lobe-like, membranous.

Fore femur longer than fore tibia, with rows of short setae on ventral margins, fore femur quadrangular in cross section, emarginate with rows of short setae, basitarsomere slightly shorter than mid tarsomere, their combined length slightly

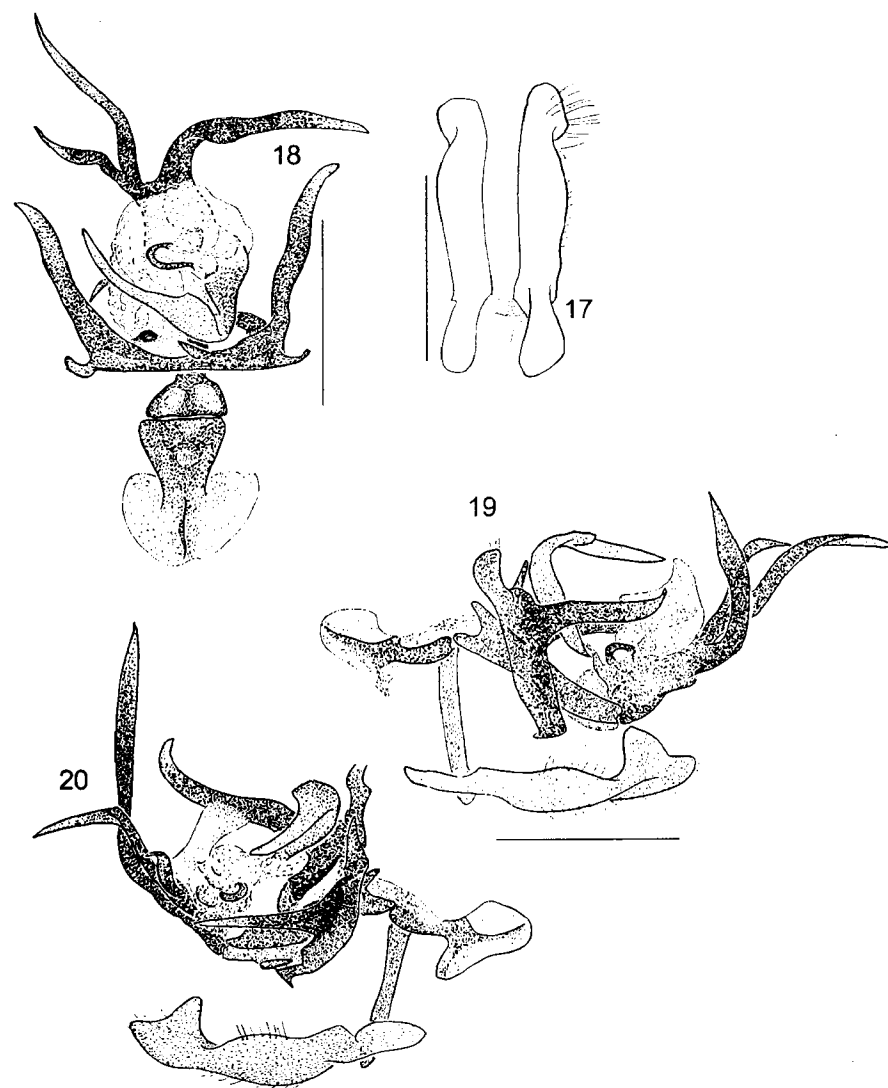


7-10. *Norialsus berkheyae* n. sp.: 7 - left hind leg; 8 - left hind tarsus; 9 - right tibia and tarsus; 10 - right hind tarsus (scale bar = 1 mm for 7 & 9, 0.5 mm for 8 & 10)



11–16. *Norialsus berkheyae* n. sp.: 11 – male pygofer in ventral view; 12 – male pygofer in left lateral view; 13 – male pygofer right lateral view; 14 – male anal tube in dorsal view; 15 – male anal tube in posterior view; 16 – male anal tube in left lateral view (scale bar = 0.5 mm)

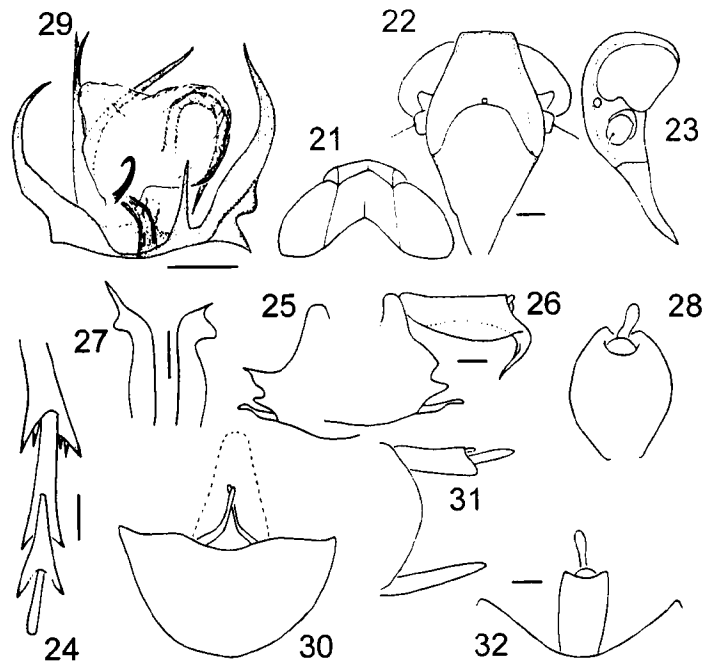
bigger than length of apical tarsomere, basitarsomere and mid tarsomere provided with pair of apical platellae; midleg similar in structure, slightly longer. Hind coxa with meracanthal spine icicle-like, hind femur of similar length as mid femur, hind tibia with 4–5 lateral spines, apical row of six spines distinct; basitarsomere the longest, slightly longer than combined length of mid- and apical tarsomeres, with 9–10 apical spines, provided with platellae except of external ones, mid tarsomere and apical tarsomere subequal in length, mid tarsomere with row of 9–12 apical



17–20. *Norialsus berkheyae* n. sp.: 17 – genital styles in ventral view; 18 – male genitalia in dorsal view; 19 – male genitalia in left lateral view; 20 – male genitalia in right lateral view

spines, provided with platellae except external ones, tarsal claws relatively small. Apex of right tibia of male holotype with five apical spines. Tibio-metatarsal formula  $1+2+3 : 2+[7-8] : 2+[7-10]$ .

Male genitalia symmetrical or nearly so. Pygofer with two spinose processes curved downwards on each side, the right one a bit more slender and curved, ventral margin of pygofer distinctly excavated with long median process, lateral surface of median process sculptured with long oblique notches. Genital styles relatively short, with triangular apices. Connective tubular, long. Phallic complex: phallobase ring-like with with two laterad long processes and shorter sinistral process near middle; sheath tubular, sclerotized; endotheca with three apical processes and long basal process directed dorsad and dextrad, this process slightly widened in median portion with crenate margin at this point, additional short process present at base of endosoma on the right side, fishhook-like process present at base on dorsal side, endosoma membranous, support tube subtriangular, about as long as wide, support bridge triangular, distinctly wider than long in mid line. Anal tube round in dorsal aspect, slightly wider than long with triangular ventrad process at apex, anal style long, widened in apical portion.

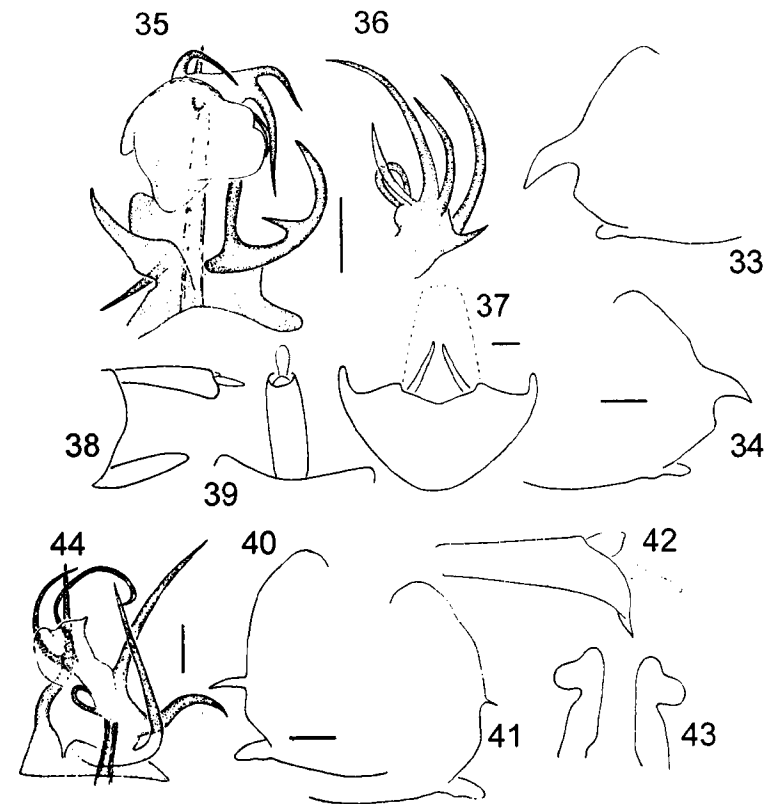


21–32. *Norialsus capeneri* (SYNAVE): 21 – head in dorsal view; 22 – face; 23 – head in lateral view; 24 – hind tarsus and distal part of hind tibia; 25 – male pygofer in right lateral view; 26 – male pygofer and anal tube in left lateral view; 27 – genital styles; 28 – anal tube in dorsal view; 29 – phallic complex in dorsal view; 30 – female genital block in ventral view; 31 – female genital block in left lateral view; 32 – female anal tube in dorsal view (scale bar = 0.2 mm). After VAN STALLE 1986

Female genitalia: posterior margin of pregenital segment slightly concave in middle, anal tube elongate, about 1.7 times as long as wide, slightly widened in apical portion, without additional processae or elongations, anal style long, slightly shorter than anal tube. Ovipositor reduced, about as long as anal tube, gonoplags covered with long setae, gonapophyses VIII very short.

#### MATERIAL EXAMINED

Holotype, male. South Africa: Agnes Mine, 11.XI.2003. On *Berkheya coddii*, leg. E. GLOWACKA. Deposited in Koninlijk Belgisch Instituut voor Natuurwetenschappen / Institut royal des Sciences naturelles, Bruxelles [KBIN/IRScN]. Paratypes – male and female same data and locality, KBIN/IRScN; Paratypes – 2 males, South Africa: Agnes Mine, 23.X.2001. On *Berkheya coddii*, leg.



33–39. *Norialsus ficksburgi* VAN STALLE: 33 – pygofer in left lateral view; 34 – pygofer in right lateral view; 35 – phallic complex in dorsal view; 36 – apical spines of phallic complex in left lateral view; 37 – female genital block in ventral view; 38 – female genital block in left lateral view; 39 – female anal tube in dorsal view (scale bar = 0.2 mm). 40–44. *Norialsus somersetti* VAN STALLE: 40 – male pygofer in right lateral view; 41 – male pygofer in left lateral view; 42 – male anal tube in left lateral view; 43 – genital styles; 44 – phallic complex in dorsal view (scale bar = 0.2 mm). After VAN STALLE 1986

E. GŁOWACKA. KBIN/IRScN; Paratypes – 2 males, South Africa: Agnes Mine, 14.XI.2003. On *Berkheya coddii*. leg. E. GŁOWACKA. National Collection of Insects, Pretoria [NCI]; Paratypes – 2 males, South Africa: Agnes Mine, 14.XI.2003. On *Berkheya coddii*. leg. E. GŁOWACKA. Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw [MZPW]; Paratypes – 2 males, South Africa Agnes Mine, 24.X.2001. Natural History Museum, London [NHM].

#### REMARKS

The species described above belongs to the same group as *Norialsus capeneri* (SYNAVE, 1953) with tibio-metatarsal formula  $1+2+3 : 2+[7-8] : 2+[7-8]$ , *N. somersetti* VAN STALLE, 1986 –  $1+2+3 : 2+[7-9] : 2+[7-9]$  and *N. ficksburgi* VAN STALLE, 1986 –  $1+2+3 : 2+[7] : 2+[7-8]$  regarding the structure of male genitalia and external characters (Figs 21–44). Although male genitalic structure has been one of the most important sources of characters in the formation in Fulgoromorpha systematics, the interpretation of its particular elements is still under debate (BOURGOIN 1987, YANG & CHANG 2000). The phallic complex in Cixiidae is a composed structure, and different opinions have been raised in identification and homologization of its particular parts. In the genus *Norialsus* VAN STALLE the phallic complex is also a composed structure. The phallobase is ring-like with additional processes, sclerotized sheath is tubular, endotheca bears a number of spines, at base on dorsal side of endotheca a semicircular process is present, endosoma is membranous, the support tube is subtriangular, as well as the support bridge. All species of this genus are restricted in distribution and occur in and around the Cape region and the Drakensberg mountains.

The host plant of *Norialsus berkheyae* Szw., a plant of the Asteraceae family *Berkheya coddii* ROESSLER is an endemic herbaceous plant growing on serpentine outcrops of the Mpumalanga Province, South Africa. This plant has the exceptional and rare ability to hyperaccumulate nickel. Any above ground part contains more than 0.1% of this metal per dry weight of material. The highest enrichment of nickel [Ni] in leaves is typical for hyperaccumulators and in *Berkheya coddii* it reaches 3.6%. Five phytophagous beetle species have been recorded on the leaves of *Berkheya coddii* (MESJASZ-PRZYBYŁOWICZ & PRZYBYŁOWICZ 2001): Chrysomelidae: Chrysomelinae – *Chrysolina pardalina* (FABRICIUS, 1781), and Curculionidae – *Listroderes costirostris* SCHÖNHERR, 1826 (Cyclominae: Rhythirrinini), *Brachytrachelus pseudopatrinus* OBERPRIELER, 1988 (Entiminae: Tanyrhynchini) and two species of the genus *Holcolaccus* MARSHALL, 1953 (Entiminae: Oosomini).

It seems that *N. berkheyae* Szw. is another highly endemic and very limited in distribution species. *Norialsus berkheyae* Szw. is the first representative of Hemiptera known from this plant, but not the only representative of Fulgoromorpha. Also a representative of Cixiidae, of the genus *Achaemenes* STÅL, 1866 has been found. However, its identity at species level is not confirmed yet.

#### ACKNOWLEDGEMENTS

I would like to thank Dr. Elżbieta GŁOWACKA, Department of Zoology, University of Silesia, Katowice, Poland for the material and additional information about collecting sites, Dr. Marek WANAT, Zoological Museum, University of Wrocław, Poland and Dr. Michael STILLER, Agricultural Research Council, Plant Protection Research Institute, Pretoria, South Africa for comments on the beetles living on *Berkheya*. The paper results from joint Polish-South African project: “Relations between South-African indigenous plant *Berkheya coddii* and its natural consumers for metal bioremediation purposes”, between University of Silesia, Poland and Ithemba Labs, Materials Research Group, National Research Center, Somerset West, Republic of South Africa.

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