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Taxonomic remarks, phylogeny and evolutionary notes on the leaf beetle species belonging to the *Cryptocephalus sericeus* complex (Coleoptera: Chrysomelidae: Cryptocephalinae)

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Abstract

A cladistic analysis was carried out for a complex of 33 species of the genus *Cryptocephalus* that has been recognized for some time as monophyletic. 55 morphological adult characters have been used, with 119 character states. Analyses were performed using parsimony procedures as well as Bayesian inference. Further information about phylogenetic scenarios were obtained by combining the morphological dataset with a sequence of 507 bp of the central portion of the 18S ribosomal RNA. Illustrations are provided for most morphological characters used in the analyses. Besides, the following taxonomic changes are proposed here: subg. *Cerodens* has to be considered a **new synonym** of subg. *Cryptocephalus*; *C. zambanellus* is **raised again to species level**; *C. sericeus intrusus* has to be considered a **new synonym** of *C. zambanellus*; *C. telueticus* has to be considered **a new synonym** of *C. azurescens*; all the populations of *C. violaceus* ranging from Iberian Peninsula to central Alps are attributed to the subspecies *scaffaiolus* Burlini, formerly described from the Northern Apennines. Biogeographic remarks are given and some evolutionary hypotheses about the radiation of the monophylum are proposed on the basis of the acquired knowledge. An identification key for the species is also provided.

Key words: Species complex, taxonomy, new synonymy, new status, morphological characters, parsimony, bayesian analysis, total evidence approach, Cryptocephalini, Palaearctic

Introduction

The *Cryptocephalus sericeus* (Linné) species complex sensu Leonardi & Sassi (2001) has been the subject of several studies, including morphological (Leonardi & Sassi, 2001, Steinhausen, 2007), molecular (Gómez-Zurita *et al.*, 2011), behavioural (O'Luanaigh *et al.*, 2006) and evolutionary and faunistic (Baselga & Novoa, 2000, 2004; Burkejs, 2009; Bukejs & Barševskis, 2008; Petitpierre, 1998, 2005; Ouda, 2011; Vig, 2005). The attention paid to this species complex has led, among other things, to the description of three new species (Leonardi & Sassi, 2001; Sassi, 2001) and some taxonomic novelties as the restoration of species previously placed in synonymy (de la Rosa, 2008) or changing rank of some taxa (Sassi, 2011a). Some older works had originally provided interesting perspectives for the development of the more recent studies taking into account morphological characters not previously used (Barabas, 1976; 1978, De Monte, 1948; Iablokoff-Khnzorian, 1966). As a result of all these contributions, the composition and the taxonomy of the *Cryptocephalus sericeu*s species complex (Tab. 1) seem now clear enough. Besides, a thorough study of the molecular evolution of the group (Gómez-Zurita *et al.*, 2011) has laid the foundations for a correct assessment of phylogenetic relationships. However, the molecular markers used in the study have pointed out a trend of some species to hybridization leading to the generation of species DNA paraphyly. This tends to muddle the true taxa relationships. However, until now a phylogenetic analysis of this group of species that would take into account the information obtained from morphological characters, was lacking. In this respect, the present work aims to achieve the following objectives: 1) to clarify the evolutionary relationships within the *Cryptocephalus sericeus* species complex, 2) to test the validity of some morphological characters in providing useful information in the reconstruction of evolutionary pathways within Cryptocephalini, 3) to test the effectiveness of using cladistic procedures based on the morphology of closely related species

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29 Aedeagal tube more elongated, usually more than 1.2 times as long as wide, apex of aedeagus smaller, nearly rectangular, hairy plates not visible on tube in ventral view (fig. 116). 4.0–5.5 mm. Apennines from Liguria to Lucania . . . . . ***samniticus***

- Aedeagal tube shorter, less than 1.2 times as long as wide, apex of aedeagus larger, often subtriangular, hairy plates always partly visible on tube in ventral view (fig. 117). 4.0–5.5 mm. Albania, Austria, Bosnia Herzegovina, Croatia, Czech Republich, France, Germany, Hungary, Italy, Romania, Slovakia, Slovenia, Switzerland, Serbia and Montenegro . . . . . ***transiens***

30 Aedeagal apex in shape of isosceles triangle (figs 118–119) 31

- Aedeagal apex in shape of equilateral triangle (figs 120–121). 32

31 Aedeagal tube parallelsided, with anterior angles more prominent. Generally a longitudinal median impression is clearly detectable (fig. 118). 4.0–5.5 mm. Albania, Austria, Belgium, Bosnia Herzegovina, Croatia, Czech Republich, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Italy, Latvia, Macedonia, Netherlands, Norway, European Russia (Carelia), Poland, Slovakia, Slovenia, Sweden, Switzerland, Serbia and Montenegro . . . . . ***hypochaeridis***

- Aedeagal tube fairly tapered towards apex, with anterior angles less prominent. Longitudinal median impression missing or hardly visible (fig. 119). 4.0–5.5 mm. Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Russia (from European territories to Far East), Estonia, Greece, Hungary, Kazakhstan, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, Turkey, Uzbekistan, Serbia and Montenegro. . . . . ***solivagus***

32 Aedeagal apex usually smooth, slightly convex and devoid of longitudinal impression, hairy plates hardly visible on apex in ventral view; basal part of aedeagal ventral surface slightly impressed (fig. 120). Pit on male anal sclerite more impressed (fig. 12). 4.0–5.5 mm. Aedeagus as in fig. 120. Souteast France . . . . . ***therondi***

- Aedeagal apex often weakly impressed, hairy plates more clearly visible on apex in ventral view; basal part of aedeagal ventral surface not impressed (fig. 121). Pit on male anal sclerite less impressed. 4.0–5.5 mm. France (Pyrenees), Spain (Pyrenees, Cordillera Cantabrica) . . . . . ***cristula***

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