Zootaxa 3483: 29–38 (2012)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Article

urn:lsid:zoobank.org:pub:FAB90656-A0E0-484B-968E-C793732F4EAE

A new species of *Allecula* (Coleoptera: Tenebrionidae: Alleculinae) from cork oak stands of Italy

VLADIMÍR NOVÁK[1], NICKLAS JANSSON[2], STEFANO CHIARI[3], AGNESE ZAULI[3], PAOLO AUDISIO[4] & GIUSEPPE M. CARPANETO[3]

[1]*Nepasické náměstí 796, CZ-190 14, Prague 9 – Klánovice, Czech Republic. E-mail: alleculinae.vn@centrum.cz*
[2]*Linköping University, IFM/Biology, 581 83 Linköping, Sweden. E-mail: nicja@ifm.liu.se*
[3]*Department of Environmental Biology, Roma Tre University, Rome, Italy.*
E-mail: schiari@uniroma3.it, azauli@uniroma3.it, carpanet@uniroma3.it
[4]*Department of Biology and Biotechnologies 'Charles Darwin', Sapienza University of Rome, Rome, Italy.*
E-mail: paolo.audisio@uniroma1.it

Abstract

A new species of comb-clawed beetle, *Allecula suberina* Novák **sp. nov.**, is described, illustrated and compared with all western Palaearctic species. The new species is probably saproxylic, as are other species in the genus, because all specimens were collected by traps set within or near tree cavities on old hollow cork oaks (*Quercus suber*).

Key words: Comb-clawed beetles, taxonomy, key to species, saproxylic beetles, hollow trees, *Quercus suber*, Italy

Introduction

Old oaks have a very rich insect fauna in Europe, but the habitat has declined substantially in most countries. Saproxylic insects associated with old trees and dead wood are one of the most endangered invertebrate groups in Europe, as their habitat has severely decreased (McLean & Speight 1993). These insects live in fungal fruiting bodies, dead wood outside the tree (in branches, twigs or parts of the trunk) or inside the tree in hollows (Palm 1959; Speight 1989; Dajoz 2000). Many species dependent on old and hollow trees have survived in small remnant woodlands of ancient trees, often in an agricultural landscape (Speight 1989; Warren & Key 1989). Most *Allecula* species are saproxylic beetles and undergo their larval development in the rotten wood of old hollow trees (Palm, 1959).

The genus *Allecula* was introduced by Fabricius (1801) for *Allecula morio* (Fabricius 1787), originally described in the suppressed *Cistela* Geoffroy, 1762. The species of this genus have a worldwide distribution: Novák & Pettersson (2008) listed 65 species from the Palaearctic region. From the western part of the Palaearctic region only seven species have been described: *Allecula morio* (Fabricius, 1787) and *Allecula rhenana* Bach, 1856 (both in many European countries); *Allecula divisa* Reitter, 1883 (Armenia, Caucasus, Turkmenistan and Uzbekistan); *Allecula oronthea* Baudi di Selve, 1881 (Lebanon and Turkey); *Allecula estriata* Seidlitz, 1896, *Allecula janssoni* Novák, 2011 and *Allecula turcica* Novák, 2011 (all from Turkey). The last two species were recently described and captured by means of traps for saproxylic beetles (Novák *et al.* 2011), the same type used for our samples.

In the present paper, *Allecula suberina* Novák **sp. nov.** is described from Italy, illustrated and compared with other European *Allecula* species.

Accepted by A.D. Smith: 13 Aug. 2012; published: 14 Sept. 2012

Material and methods

Specimen collection. All specimens were collected during an ecological project on saproxylic beetle communities of old cork oaks in central Italy, carried out jointly by Linköping University (Sweden) and Roma Tre University (Italy). Beetles were sampled by traps positioned within or near hollows of cork trees (*Quercus suber*). Ten trees were selected in two different areas (Polverino and Pomezia), both situated in the subcoastal region of central Italy (Latium region) (Fig. 1). Each tree was investigated using one window trap and one pitfall trap, during two years (from 28.IV to 13.VIII in 2009 and from 29.IV to 1.IX in 2010). Methods are the same as those used in previous studies carried out in Sweden (Jansson & Lundberg 2000; Ranius & Jansson 2002). The window traps consisted of a 30x60 cm transparent plastic sheet with a tray underneath, placed near the trunk (< 1 m), beside or in front of a cavity entrance. The pitfall traps were plastic cups with a top diameter of 6.5 cm. They were placed in the wood mould at the bottom of the cavity, with the opening at the level of the wood mould surface. Both trap types were about half filled with ethylene glycol and water (50:50 v/v), with the addition of some detergent to reduce surface tension. The traps were emptied every third week.

FIGURE 1. Location of the two areas in central Italy where *Allecula suberina* Novák **sp. nov.** was found. The black square indicates the type locality (Pomezia).

The first study area, "Bosco Polverino", is a small fragment (about 107 ha) of mixed evergreen/deciduous forest, surrounded by cultivated areas. This area is located in the Latina province, near Priverno, at an altitude of 20–70 m a.s.l.. According to the European Union Habitat Directive, this site is classified as a pSCI (IT6040004). The tree layer is mostly formed by evergreen oaks (*Quercus suber* and *Q. ilex*) and deciduous oaks (*Quercus cerris, Q. frainetto, Q. pubescens*). For a long time, the cork oak (*Q. suber*) was the only tree species occurring in the site, favored by man for the traditional exploitation of the bark, but now this species is showing signs of decline due to the abandonment of this activity and the consequent increased competition with deciduous trees. For this reason, the site is currently managed towards a recovery of cork oaks for conservation purposes. Our sampling activity was focused on cork oaks, and traps were set on old-growth (some hundreds of years) trees of *Q. suber* (Fig. 2).

The second study area, "Sughereta di Pomezia", is a small fragment (about 50 ha) of pasture woodland characterized by cork oaks, extensively grazed by sheep and surrounded by cultivated areas and grasslands. Many of the trees are old and with trunk cavities (Fig. 3). This area is located near Pomezia, a small town 24 km south of Rome, at an altitude of 50–80 m a.s.l. It is still unprotected by law, despite the advice of environmental agencies, and is strongly threatened by urban expansion. In fact, cork exploitation was almost abandoned in recent decades and the area is threatened by a project for a children's recreational park.

FIGURE 2. A Window trap on one of the studied cork oaks in “Bosco Polverino”.

FIGURE 3. One of the studied cork oaks in “Sughereta di Pomezia”.

Morphometric characteristics, measurements and acronyms. Two important morphometric characteristics are used to describe the species of the subfamily Alleculinae: the 'ocular index' (Campbell & Marshall 1964) and the 'pronotal index' (Campbell 1965) both in dorsal view. The 'ocular index' is calculated by measuring the minimum distance between the eyes and dividing this value by the maximum dorsal width across the eyes. The 'pronotal index' expresses the ratio between the pronotum length along the midline and the width at the basal angles. The quotients resulting from both divisions are converted into an index by multiplying by 100 for computational convenience.

Measurements were made by an Olympus SZ 40 stereoscopic microscope, with continuous magnification and soft imaging system analySIS. Measurements of body parts and corresponding abbreviations used in the text are as follows:

AED	total aedeagus length
AL	total antennae length
BL	maximum body length
EL	maximum elytral length
EW	maximum elytral width
HL	maximum length of head (visible part)
HW	maximum width of head
OI	ocular index dorsally
PI	pronotal index dorsally
PL	maximum pronotal length
PW	pronotal width at base
RLA	ratios of relative lengths of antennomeres 1–11 from base to apex (3=1.00)
RL/WA	ratios of length / maximum width of antennomeres 1–11 from base to apex
RLT	ratios of relative lengths of tarsomeres 1–5 respectively 1–4 from base to apex (1=1.00)
RLP	ratios of relative lengths of palpomeres 2–4 from base to apex (3=1.00)
RL/WP	ratios of length / maximum width of palpomeres 2–4 from base to apex

A slash (/) separates data in different rows on locality labels.
Acronyms refer to the following depositories:

MZAC	Museum of Zoology and Comparative Anatomy, Roma Tre University (headed by Giuseppe Carpaneto) Rome, Italy;
NJLS	Collection of Nicklas Jansson, Linköping, Sweden;
VNPC	Collection of Vladimír Novák, Prague, Czech Republic.

***Allecula suberina* Novák, sp. nov.**
(Figs 4–5)

Type locality. Italy, Pomezia (province of Rome), 30 km south of Rome, in association with old trees of *Quercus suber.*

Types. Holotype (♂): first label [printed black]: ITALY, Lazio (Rome), Pomezia / 33T 292672 4614488, 72m a.s.l. / 22.VII–10.VIII.2009 / G. Carpaneto, S. Chiari, A. Zauli; second label [printed black]: Old cork oak / (*Quercus suber*) / Window trap No. 11, (MZAC).

Paratypes labeled: (1 ♀): same data as holotype but 33T 292788 4614521, 74m a.s.l., Pitfall trap No.16, (VNPC); (2 ♂): same data as holotype, but 33T 292604 4614458, 68m a.s.l., Window trap No. 6, (NJLS, VNPC); (1 ♂): same data as holotype, but 33T 292604 4614458, 68m a.s.l., 10.VI–1.VII. 2009, Window trap No. 6, (VNPC); (1 ♀): same data as holotype, but 33T 292788 4614521, 74m a.s.l., 1.VII–22.VII.2009, Window trap No. 16, (NJLS); (1 ♀): same data as holotype, but 33T 292604 4614458, 68m a.s.l., 22.VII–12.VIII.2010, Window trap No. 6, (MZAC); (1 ♀): ITALY, Lazio (LT), Bosco Polverino / 33T 348761 4588673, 39m a.s.l. / 2.VII–23.VII.2009 / G. Carpaneto, S. Chiari, A. Zauli / Old cork oak / (*Quercus suber*) / Pitfall trap No. 4, (NJLS); (1 ♂ 1 ♀): same data as the latter, but 33T 348618 4588614, 49m a.s.l., 21.VII–11.VIII.2010, Window trap No. 5, (MZAC); (1 ♀):

same data as the latter, but 23.VII–13.VIII.2009, (NJLS); (1 ♀): same data as the latte r but 33T 348830 4588741, 28m a.s.l., 11.VI –2.VII.2009, Window trap No. 3, (VNPC); (1 ♀): same data as the latter but 33T 348896 4588787, 28m a.s.l., 2.VII–23.VII.2009, Window trap No. 3, (MZAC).

The types are provided with a printed red label: *Allecula suberina* **sp. nov.** HOLOTYPUS [resp. PARATYPUS] V. Novák det. 2011.

Other material examined: remains of three specimens found in Bosco-Polverino during the sampling period.

Description of holotype. Habitus as in Fig. 4, body elongate, from yellow ochre to brown, slightly shiny, with dense pale brown pilosity, BL 7.64 mm. Widest near middle of elytra length; BL/EW 3.00.

Head (Fig. 5a). Dark brown, with dense pale brown pilosity, microgranulation and dense punctuation. Punctures medium-sized, interspaces between punctures narrow. Space between antennae with large, transverse, near sides oblique impression. HW 1.34 mm; HW/PW 0.72. HL (visible part) 0.96 mm. Eyes dark, large, transverse, deeply excised, space between eyes distinctly broader than length of antennomere 3; OI equal to 33.33.

Antennae (Fig. 5b). Antennomeres unicoloured dark brown with microgranulation, short, pale brown pilosity and punctuation. AL 6.07 mm, AL/BL 0.80. Antennomere 2 shortest, antennomere 3 twice longer than antennomere 2. Antennomere 4 longer than each of antennomeres 5–10. RLA (1–11): 0.86: 0.43: 1.00: 1.75: 1.60: 1.74: 1.74: 1.71: 1.65: 1.62: 1.77. RL/WA (1–11): 1.94: 1.18: 2.03: 2.60: 2.41: 2.63: 2.85: 2.93: 2.89: 2.98: 3.40.

Maxillary palpus. Brown with pale brown pilosity and microgranulation. Palpomeres 2–3 narrowest at base, broadest at apex, penultimate palpomere shortest. Ultimate palpomeres broadly triangular, slightly shiny. RLP (2–4): 1.67: 1.00: 2.17. RL/WP (2–4): 1.92: 1.04: 0.66.

Pronotum (Fig. 5a). Brown, transverse, with dense long pale brown pilosity, microgranulation and punctuation, punctures medium-sized. PL 1.12 mm; PW 1.85 mm. PI equal to 60.54. Marginal lines complete, only in the middle of anterior margin indistinct. Base bisinuate, in ante-scutellar area straight. Posterior angles rounded, slightly obtuse, anterior angles rounded, indistinct. Sides near posterior angles finely excised.

Ventral side of body. Dark blackish-brown, with pale brown pilosity. Punctuation of prothorax indistinct. Abdomen dark blackish-brown with dense, pale brown pilosity and dense punctuation, punctures small, last abdominal sternite pale brown.

Elytron. Long, unicoloured ochre yellow, with short, pale brown pilosity, microgranulation and punctuation, shiny. EL 5.56 mm. Broadest near elytral two thirds from base, EW 2.55 mm. EL/EW 2.18. Elytral striae with distinct rows of medium-sized punctures, interspaces between punctures in rows very narrow, less than diameter of punctures. Punctures on elytral intervals approximately as large as punctures in elytral striae.

Scutellum. Ochre yellow, pentagonal with sides narrowly darker, shiny, with microgranulation and pale brown setae.

Elytral epipleura. Well-developed, ochre yellow as elytron itself with row of large punctures and pale brown setae, shiny, broadest near base, regularly narrowed to metasternum, then parallel.

Legs. Dark brown, with short pale brown pilosity. Tibiae and tarsi narrow, tibiae dilated anteriorly. Penultimate tarsomere of each tarsus slightly broadened and lobed. RLT: protarsus: 1.00: 0.51: 0.49: 0.59: 0.91; mesotarsus: 1.00: 0.29: 0.31: 0.39: 0.68; metatarsus: 1.00: 0.33: 0.23: 0.44.

Both anterior tarsal claws with 6 visible teeth.

Aedeagus (Fig. 5c). Relatively short, pale brown, slightly shiny. Basal half of basal piece rounded laterally, then almost straight, dorsally regularly narrowing. Apical piece short, narrowly triangular dorsally and laterally. Ratio between length of apical piece and length of basal piece 1: 2.74.

Female. Space between eyes broad, distinctly broader than diameter of eye and broader than in male. Antennae distinctly shorter than in male, reaching only 0.49 of body length. Antennomere 4 only approximately 1.3 times longer than antennomere 3. Both anterior tarsal claws with 3 or 4 visible teeth. RLA (1–11): 0.78: 0.37: 1.00: 1.30: 1.44: 1.52: 1.41: 1.41: 1.30: 1.24: 1.44. RLA/W (1–11): 1.80: 0.85: 2.19: 2.31: 2.75: 2.92: 2.41: 2.24: 2.22: 2.38: 3.57. RLT: protarsus: 1.00: 0.55: 0.45: 0.60: 1.16; mesotarsus: 1.00: 0.45: 0.40: 0.34: 0.59; metatarsus: 1.00: 0.41: 0.32: 0.52. BL 8.54 mm; HL 1.08 mm; HW 1.41 mm; OI 43.12; PL 1.23 mm; PW 2.14 mm; PI 57.29; EL 6.23 mm; EW 2.92 mm; HW/PW 0.66; BL/EW 2.93; EL/EW 2.13; AL 4.19 mm; AL/BL 0.49.

Variation. Measurements: mean (minimum–maximum). Males (n=5): BL 7.44 mm (6.98–7.79 mm); HL 0.87 mm (0.73–1.00 mm); HW 1.28 mm (1.21–1.34 mm); OI 32.67 (31.40–33.43), PL 1.17 mm (1.12–1.28 mm); PW 1.77 mm (1.66–1.85 mm); PI 66.14 (60.54–70.49); EL 5.40 mm (5.01–5.76 mm); EW 2.49 mm (2.13–2.81 mm). Females (n=8): BL 8.56 mm (7.75–9.40 mm); HL 1.00 mm (0.90–1.18 mm); HW 1.39 mm (1.31–1.46 mm); OI 40.61 (36.48–43.35), PL 1.28 mm (1.09–1.46 mm); PW 2.12 mm (1.92–2.25 mm); PI 60.15 (52.62–65.63); EL 6.27 mm (5.69–6.76 mm); EW 3.09 mm (2.79–3.36 mm).

FIGURE 4. Habitus of holotype (male, BL 7.64 mm) for the new species *Allecula suberina* Novák.

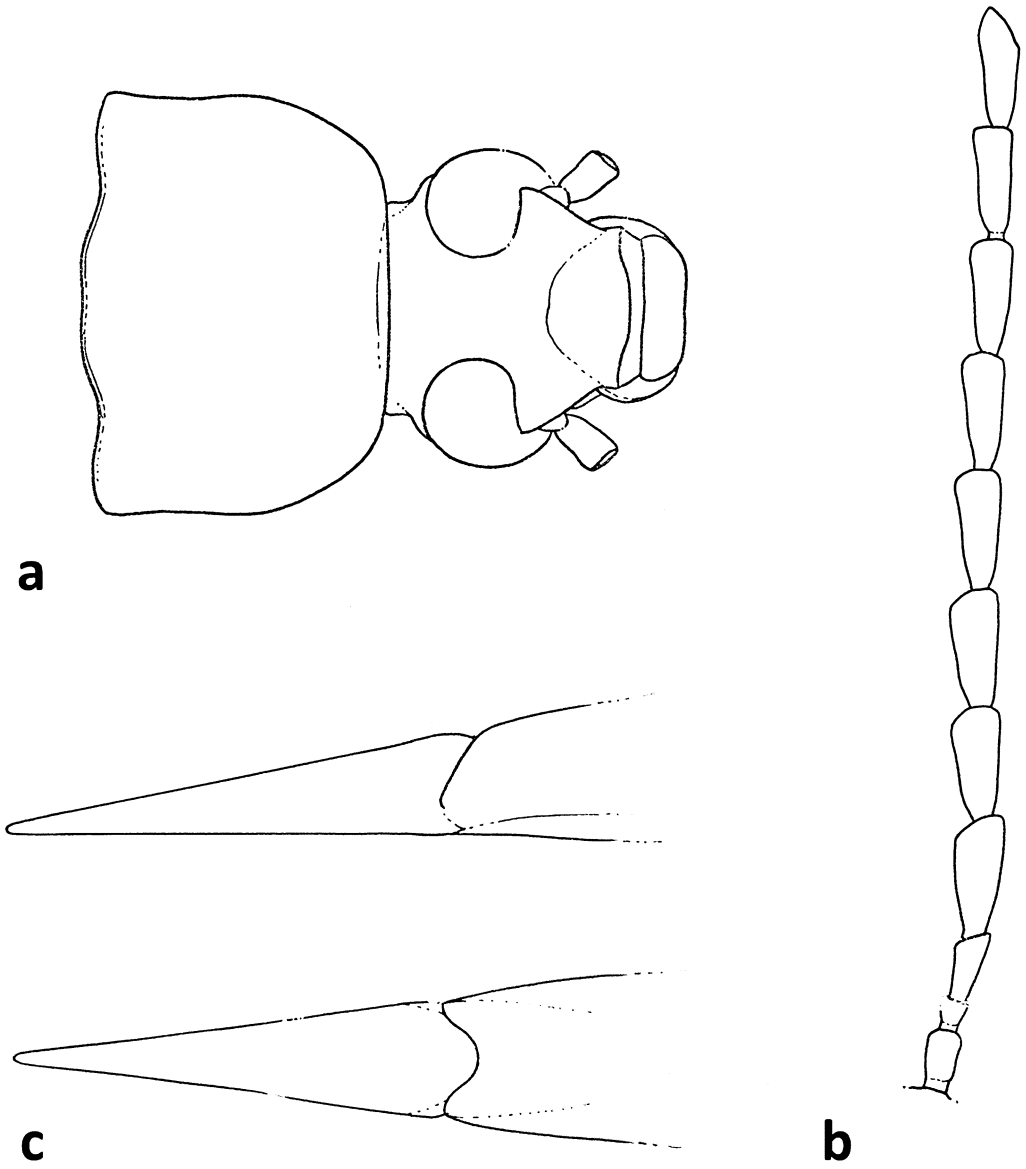

FIGURE 5. *Allecula suberina* Novák **sp. nov.**: a) head and pronotum of holotype (HL 0.96 mm, PL 1.12 mm); b) antenna of holotype (AL 6.07 mm); c) aedeagus of holotype (dorsal and lateral views, AED 1.13 mm).

Differential diagnosis. *Allecula suberina* Novák **sp. nov.** is clearly different from the similar species *A. divisa*, *A. estriata* and *A. oronthea*, mainly by antennomere 3 being distinctly shorter than antennomere 4 (in the latter three species antennomere 3 is approximately as long as antennomere 4). *Allecula suberina* clearly differs from the similar species *A. morio* mainly by the ochre yellow elytra and a broader pronotum (*A. morio* has a dark brown body and a narrower pronotum). Allecula suberina is clearly different from the similar species *A. janssoni*, *A. rhenana* and *A. turcica* mainly by antennomeres 4–11 being only 1.6–1.8 times longer than antennomere 3 (*A. janssoni*, *A. rhenana* and *A. turcica* have antennomeres 4–11 more than twice as long as antennomere 3).

Distribution. Only known from two localities, both situated in the subcoastal region of central Italy, in the Latium region (provinces of Latina and Rome).

Etymology. The name of the new species is derived from the Latin term suber, meaning cork, because all specimens were collected in association with old cork oaks (*Quercus suber*).

Ecological remarks. The new species is probably associated with hollow trees, as are other species of the same genus. All 13 adult specimens were found in traps positioned within or adjacent to cork oak tree cavities. Eleven specimens were collected by window traps, showing that these beetles are active fliers; only two females

were found in pitfall traps. Most of specimens (61.5%) were collected from 22 July to 10 August; three specimens (23.1%) were collected in the first three weeks of July; only two specimens (15.4%) were found from 10 June to 2 July. Therefore, we can deduce that the majority of specimens were active in July.

Key to males of European species of *Allecula* Fabricius, 1801

1	Antennomere 4 1.6–2.6 times as long as antennomere 3	2
-	Antennomere 4 only 0.8–1.2 times as long as antennomere 3	6
2	Antennomere 4 less than twice as long as antennomere 3	3
-	Antennomere 4 more than twice as long as antennomere 3	4
3	Elytra dark brown, pronotum narrow (PI about 75). Europe	*A. morio* (Fabricius, 1787)
-	Elytra ochre yellow, pronotum broad (PI about 60). Italy	*A. suberina* **sp. nov.**
4	Antennomere 4 distinctly longer than twice as long as antennomere 3, space between eyes narrower (OI about 30).	5
-	Antennomere 4 slightly longer than twice as long as antennomere 3, space between eyes broader (OI about 35). Europe	*A. rhenana* Bach, 1856
5	Elytra brown, antennae, tibiae, tarsi reddish-brown, elytral interspaces distinctly convex, pronotum broader (PI about 60) with fine microgranulation, rather dull. Turkey	*A. turcica* Novák, 2011
-	Elytra ochre yellow, antennae, tibiae, tarsi black, elytral interspaces flatter, pronotum narrower (PI about 70), microgranulation indistinct, shiny. Turkey	*A. janssoni* Novák, 2011
6	Antennomere 3 slightly shorter than antennomere 4	*A. divisa* Reitter, 1883
-	Antennomere 3 as long as or distinctly longer than antennomere 4	7
7	Antennomere 3 distinctly longer than antennomere 4, antennomeres 5–10 narrower and shorter than antennomere 4, ultimate palpomere strongly dilated	*A. oronthea* Baudi di Selve, 1881
-	Antennomere 3 as long as antennomere 4, antennomeres 5–10 distinctly longer than antennomere 4, ultimate palpomere only slightly dilated	*A. estriata* Seidlitz, 1896

Acknowledgements

Special thanks are due to Zuzana Čadová (Liberec, Czech Republic) for the excellent drawings. We are grateful to F. Bellotti, F.M. Bianchi, C. Cocciufa, C. Jajo, E. Maurizi, A. Mazziotta, C. Totta, V. Viglioglia, G.M. Zirpoli for fieldwork and material sorting in laboratory. This study was partially supported by the project “Censusing and monitoring xylophagous and saproxylic insect fauna in protected areas of the Latium Region” financed by the Regional Parks Agency (ARP). We thank Alessio De Biase, Iacopo Sinibaldi and Dario Capizzi who participated in the planning of the project.

Literature cited

Bach, M. (1856) *Käferfauna für Nord- und Mitteldeutschland mit besonderer Rücksicht auf die preussischen Rheinlande. Dritter Band*. J. Bölscher, Coblenz, 292 pp.

Baudi di Selve, F. (1881) Heteromerum species ex Aegypto, Syria et Arabia. *Deutsche Entomologische Zeitschrift*, 25, 273–296.

Campbell, J.M. (1965) A revision of the genus *Charisius* (Coleoptera: Alleculidae). *The Coleopterists‘ Bulletin*, 19, 41–56.

Campbell, J.M. & Marshall, J.D. (1964) The ocular index and its applications to the taxonomy of the Alleculidae (Coleoptera). *The Coleopterists‘ Bulletin*, 18, 42.

Dajoz, R. (2000) *Insects and forest. The role and diversity of insects in the forest environment*. Intercept Ltd./Edition Technique et Documentation/Lavoisier Publishing, Paris, 668 pp.

Fabricius, J.C. (1787) *Mantissa insectorum sistens eorum species nuper detectas adiectis characteribus generis differentiis specificis, emendationibus observationibus. Vol.2*. Christian Gottlieb Proft, Hafniae, 382 pp.

Fabricius, J.C. (1801) *Systema eleutheratorum secundum, ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus. Tomus II*. Binliopolii Academici Novi, Kiliae, 687 pp.

Geoffroy, E.L. (1762) *Histoire abrégée des insectes qui se trouvent aux environs de Paris; dans laquelle ces animaux sout rangés suivant un ordre méthodique. [1762/1763] Vol.1*. Durand, Paris, xxviii + 523 pp. + 22 pls.

Jansson, N. & Lundberg, S. (2000) Beetles in hollow broadleaved deciduous trees - two species new to Sweden and the staphylinid beetles (Coleoptera: Staphylinidae) *Hypnogyra glabra* and *Meliceria tragardhi* found again in Sweden. *Entomologisk Tidskrift*, 121, 93–97.

McLean, I.F.G. & Speight, M.C.D. (1993) Saproxylic invertebrates - the European context. *In*: Kirby, K.J. & Drake, K.J. (Eds.),

Dead wood matters: the ecology and conservation of saproxylic invertebrates in Britain. English Nature Science, No. 7, pp. 21–32.

Novák, V. & Pettersson, R. (2008) Alleculinae. *In*: Löbl, I. & Smetana, A. (Eds.), *Catalogue of Palaearctic Coleoptera, Vol. 5. Tenebrionoidea*. Apollo Books, Stenstrup, pp. 319–339.

Novák, V., Jansson, N., Avci, M., Sarikaya, O., Coskun, M., Atay, E. & Gűrkan, T. (2011) New *Allecula* species (Coleoptera: Tenebrionidae: Alleculinae) from Turkey. *Studies and Reports, Taxonomical Series*, 7(1–2), 335–346.

Palm, T. (1959) Die Holz- und Rindkäfer der Süd- und Mittelschwedischen Laubbäume. *Opuscula Entomologica Supplements*, 16, 1–374.

Ranius, T. & Jansson, N. (2002) A comparison of three methods to survey saproxylic beetles in hollow oaks. *Biodiversity and Conservation*, 11, 1759–1771.

Reitter, E. (1883) Neue Coleopteren aus Russland und Bemerkungen über bekannte Arten. *Revue Mensuelle d´Entomologie Pure et Appliquée*, 1, 111–118.

Seidlitz, G.C.M. von (1896) *Alleculidae*. *In*: Erichson, W.F. *et al.* (Eds.), *Naturgeschichte der Insecten Deutschlands. I. Abt., Bd. 5, 2. Hälfte*. Nicolaische Verlags-Buchhandlung R. Stricker, Berlin, pp. 1–305.

Speight, M.C.D. (1989) Saproxylic invertebrates and their conservation. *Council of Europe Nature and Environment Series*, 42, 1–79.

Warren, M.S. & Key, R.S. (1989) Woodlands: past, present and potential for insects. *In*: Collins, N.M. & Thomson, J.A. (Eds.), *The conservation of insects and their habitats*. Academic Press, London, pp. 155–211.