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On the systematics of the subgenus *Donaciella* REITTER, 1920 of the
genus *Donacia* FABRICIUS, 1775, with description of the larva of
Donacia tomentosa AHRENS, 1810
(Coleoptera: Chrysomelidae: Donaciinae)

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ABSTRACT. Examination of the adults of all the species formerly included in *Donaciella* (*Donacia cinerea*, *D. clavipes*, *D. microcephala*, *D. pubicollis*, *D. tomentosa*, and the larvae of *D. cinerea*, *D. clavipes*, *D. tomentosa*) revealed that the subgenus *Donaciella* should include only the type species *D. tomentosa*. *Donacia cinerea*, *D. clavipes*, and *D. pubicollis* are transferred to the subgenus *Donaciomima*. *D. clavipes* and *D. pubicollis* are close to each other. *D. cinerea* is close to *D. simplex* and *D. vulgaris*. Host plant data confirm this point of view. *Donacia microcephala* occupies an isolated position within the genus *Donacia*. The subgeneric status of *Donaciella* is discussed. The larva of *D. tomentosa* is described for the first time.

Key words: entomology, taxonomy, Coleoptera, Chrysomelidae, *Donacia*, *Donaciella*, larva, host plants.

INTRODUCTION

The subgenus *Donaciella* of the genus *Donacia* was established by REITTER (1920) to include the four Palaearctic species with entirely pubescent dorsum, namely *Donacia cinerea* HERBST, 1784, *D. microcephala* DANIEL et DANIEL, 1904, *D. testaceipes* PIC, 1908, and *D. tomentosa* AHRENS, 1810. The type species was not originally designated.

Some time later, KOLOSOV (1931) assumed that *Donaciella* was not a natural group because it included, on the one hand, species related to other species groups and, on the other, species very different from each other.

MONROS (1959) designated *D. tomentosa* as type species of *Donaciella* and reduced this subgenus to a junior subjective synonym of *Donacia*. Several authors (e.g. JOLIVET 1970, SEENO & WILCOX 1982, BOROWIEC 1984) maintained this point of view. Other workers (e.g. LOPATIN & KULENOVA 1986, MEDVEDEV & DUBESHKO 1992, KIPPENBERG & DOEBERL 1994) continued to use *Donaciella* as a subgeneric name.

ASKEVOLD (1990) considered *D. testaceipes* to be a junior synonym of *D. microcephala* and excluded this taxon from *Donaciella*. Also, he raised *Donaciella* to the generic level and included there Palaearctic species *D. clavipes* FABRICIUS, 1798, *D. cinerea*, *D. tomentosa*, and Nearctic species *D. pubicollis* SUFFRIAN, 1872. KIPPENBERG & DOEBERL (1994) placed *D. cinerea*, *D. clavipes*, and *D. tomentosa* in *Donaciella*. However, they believed *Donaciella* to be a subgenus of the genus *Donacia*.

MATERIAL

Adult specimens of *Donacia cinerea*, *D. clavipes*, *D. microcephala*, *D. pubicollis*, and *D. tomentosa*, and mature larvae of *D. cinerea*, *D. clavipes*, and *D. tomentosa* were examined (for material examined see below). Larvae were determined by means of comparison with exuvia from cocoons containing adult insects. Data on host plants of Palaearctic species were obtained during our collections of larvae and field and laboratory observations of adult feeding. Additional adult specimens of most Palaearctic and several Nearctic species of Donaciinae were examined as a comparative material.

Material examined

Donacia cinerea. Adults: 25 specimens from European Russia (Moscow reg. and Saratov reg.); on leaves of *Typha latifolia*. Larvae and exuvia: 24 specimens from Russia (Moscow reg. and Saratov reg.); on roots of *Typha latifolia* and *T. angustifolia*.

Donacia clavipes. Adults: 19 specimens from European Russia (Moscow reg., Tver reg., and Chelyabinsk) and Ukraine (Lugansk reg.); on leaves of *Phragmites australis*. Larvae and exuvia: 622 specimens from Russia (Moscow reg., Novgorod reg., and Penza); on roots of *Phragmites australis*, *Eleocharis acicularis*, and *Glyceria* sp.

Donacia microcephala. Adult: 1 male from Iran: Khuzestan. Shoushtar, 24.4.1973, L. Knutson leg.

Donacia pubicollis. Adult: 1 male from the USA (Kentucky).

Donacia simplex. Adults: 50 specimens from European Russia (Moscow reg., Karelia, and Tver reg.); Ukraine (Crimea); Estonia (Rutja); Poland (Olsztyn reg.); on leaves of *Sparganium erectum*. Larvae and exuvia: g specimens from Ukraine (Crimea); Poland (Olsztyn reg.); Russia (Novgorod reg. and Ryazan reg.); on roots of *Sparganium erectum*.

Donacia tomentosa. Adults: 21 specimens from European Russia (Moscow reg. and Volgograd); Kazakhstan (Uralsk); Ukraine (Zhitomir); Turkmenistan

(Ashkhabad reg.); Germany (Berlin); on leaves of *Butomus umbellatus*. Larvae from European Russia: Moscow reg., 23 km east of Zvenigorod, Nikolina Gora vill., Moskva river, in leaf axils under water and on roots of *Butomus umbellatus*, 16.9.1992, 21.7.1993, 2.10.1993; Canada balsam slides: one larva and two exuvia from cocoons containing adults, many larvae in alcohol; Novgorod reg., Edrovo vill., Edrovskoe lake, 10.10.1993; Canada balsam slide: one larva, many larvae in alcohol.

Donacia vulgaris. Adults: 50 specimens from European Russia (Karelia, Moscow reg., St.-Petersburg) and the Caucasus (Krasnodar Krai, Azerbaijan: Talysh); on leaves of *Typha latifolia*, *Sparganium angustifolium* and *S. sp.* Larvae and exuvia: 30 specimens from Russia (Moscow reg.) and Ukraine (Chernigov reg.); on roots of *Typha latifolia* and *Glyceria sp.*

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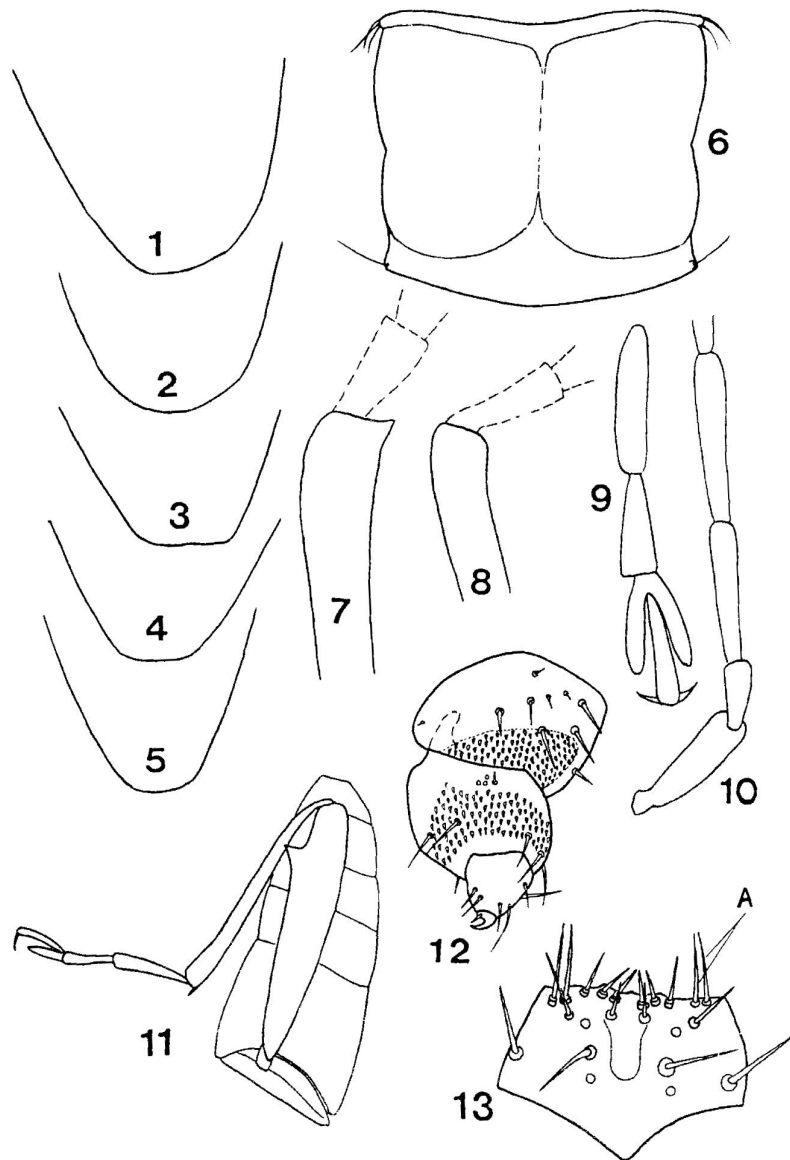
RESULTS AND DISCUSSION

1. Adult morphology

We examined many structural details including all characters which were used by ASKEVOLD (1990) for his diagnosis of *Donaciella*.

Elytral apex is evenly rounded in *D. microcephala* (Fig. 5), *D. tomentosa* (Fig. 4), and *D. pubicollis* (Fig. 2), truncate in *D. cinerea* (Fig. 3), and mostly truncate, rarely slightly rounded in *D. clavipes* (Fig. 1).

ASKEVOLD (1990) noted that subapical setae of ovipositor were absent in members of *Donaciella*, but we found these setae in females of *D. cinerea*, *D. clavipes*, and *D. tomentosa*. The females of *D. microcephala* and *D. pubicollis* were not available during the present study. Females of *D. pubicollis* (after ASKEVOLD 1990) and *D. clavipes* have sclerotized and apically acute ovipositor, which is similar to that in females of *Plateumaris* THOMSON, 1859. In *D. cinerea* and *D. tomentosa* the ovipositor is not more sclerotized than in species of *Donaciomima* L.MEDVEDEV, 1973. Ventral valve of ovipositor is longer than dorsal valve in *D. cinerea* and *D. clavipes*, however the shape of the ventral valve is very different in these two species. *D. tomentosa* has dorsal and ventral valve of equal length. At the same time, the type species of the subgenus *Donaciomima*, namely *D. clavareau* JACOBSON, 1906, has the ventral valve slightly longer than dorsal one.



1-5. Apex of left elytron: 1 - *Donacia clavipes*, 2 - *D. pubicollis*, 3 - *D. cinerea*, 4 - *D. tomentosa*, 5 - *D. microcephala*; 6. Pronotum of *D. microcephala*; 7-8. Apex of fore tibia: 7 - *D. cinerea*, 8 - *D. tomentosa*. 9-11. *D. microcephala* (male): g - hind tarsus, 10 - antennomeres 1-4, 11 - hind leg. 12-13. Larva of *D. tomentosa*: 12 - leg, 13 - labrum (A - angular setae)

Among the examined species the mesosternum is narrower in *D. clavipes*, *D. microcephala*, *D. pubicollis*, and *D. tomentosa*, and broader in *D. cinerea* (Table 1).

Punctures on pronotal disk are fine, equal, and closely spaced in *D. cinerea*, *D. microcephala*, *D. pubicollis*, and *D. tomentosa*. These punctures are large and unequal in *D. clavipes*.

The fore tibia is broadened forming tooth-like projection in *D. clavipes*, *D. pubicollis*, and *D. cinerea* (Fig. 7). It is narrow, without projection in *D. tomentosa* (Fig. 8) and *D. microcephala*. ASKEVOLD (1990) stated the presence of one tibial spur on pro- and mesotibia and absence of it on metatibia of all Donaciinae. However, we found small metatibial spur in all examined specimens of *D. tomentosa* and the single available specimen of *D. microcephala* (Fig. 11).

Table 1 includes the main distinguishing adult characters of the species formerly included in *Donaciella*.

2. Larval morphology

Larvae of *Donacia clavipes* and *D. pubicollis* are well known (BÖVING 1910, HOFFMAN 1940a, OGOBLIN & MEDVEDEV 1971, BIENKOWSKI 2001). Larva of *D. cinerea* was recently redescribed (BIENKOWSKI 1993). GOECKE (1935) noted that the larva of *D. tomentosa* inhabited leaf axils of *Butomus umbellatus* underwater and had an unusual green body colour. However, the morphology was not studied till now. Therefore the larva of *D. tomentosa* is described for the first time. Terminology for the structural details is used after BIENKOWSKI (1993).

Table 1. The main distinguishing characters of the species formerly included in *Donaciella*. Adults.

	Species				
	<i>clavipes</i>	<i>pubicollis</i>	<i>tomentosa</i>	<i>cinerea</i>	<i>microcephala</i>
Number of measured specimens					
male	10	1	10	10	1
female	8	0	10	8	0
Pronotal pubescence	-	+	+	+	+
Elytral pubescence	-	-	+	+	+
Antennomeres length 3/2					
male	1.26-1.80	1.81	2.00-3.64	1.19-1.58	2.29
female	1.31-1.83	-	1.95-2.53	1.25-1.53	2.25
Hind femur reaches sternum IV	+	+	-	-	+
Tooth-like projection of fore tibia	+	+	-	+	-
Elytral impressions	-	-	-	2 sutural, 1 lateral	1 sutural
Convex anterolateral pronotal callus	+	+	-	+	-
Sclerotized ovipositor	+	+	-	-	-
Labrum emargination	+	+	+	-	+
Denticle on hind femur	-	-	-	-	+
Spur on hind tibia	-	-	+	-	+
Mesocoxa/mesosternum width					
male	2.84-3.93	3.81	2.58-4.09	2.00-3.13	4.50
female	2.23-3.50	-	2.50-3.58	1.67-2.22	-

Donacia tomentosa AHRENS, 1810, last instar larva

DESCRIPTION

Body of live specimens is pale green, of fixed and in alcohol-preserved pale yellow. Head, legs, and pronotal shields are yellow. Ocelli, spiracles, setae, claws and abdominal hooks are brown. Body length 9.5-12.0mm, head width 0.6mm.

Frontale pentagonal, with 8 long setae and 2 pores.

Labrum (Fig. 13) with distinct lateral angles, bearing 18 setae. Anterior margin straight or slightly emarginate. Outer marginal seta somewhat separated from central one. Distal seta shorter than median one. Mandibles. Cutting edge with 1-2 denticles. Inner teeth with 2 denticles. Maxillae. Lacinia with long thin needle-like process. Labium. Mental sclerite broadened in middle and angularly projected backward.

Table 2. The main distinguishing characters of the species formerly included in *Donaciella*. Larvae.

Character	Species			
	<i>clavipes</i>	<i>pubicollis</i>	<i>tomentosa</i>	<i>cinerea</i>
Body colour	pale-cream	cream to white	green	green
Setae on labrum	16	16	18	16
Denticles on molar edge of mandible	0	0	1-2	0
Meso- and metathorax: rows of setae in inner posterior tergal path	2	2	1	2-3
Abdominal segments 1-4: rows of setae in inner anterior tergal path	2-3	3-4	2	3-4
Abdominal segments 2-4: rows of setae in posterior tergal path	1-2	2	1	3-4
Integument microstructure	-	?	+	-

Meso- and metathorax. Each lateral and middle anterior tergal patch consists of 2-3 rows of setae, widely separated from each other, with several intermediate setae. Middle posterior tergal patch consists of 1 row with several additional setae, sternal patch -of 1-2 rows of setae, lateral intercalar patch -of 9-20 setae, middle intercalar one absent or consists of 1 seta.

Abdomen. Segments 1-4. Lateral and middle anterior tergal patches each consists of 2 rows of setae, widely separated from each other, with several intermediate setae. Posterior tergal patch narrow, 8-16 times narrower than distance between middle anterior and posterior tergal patches, consists of 1 row of setae with additional setae at its sides.

Setae, covering body, short, more or less equal in length, with several long additional setae on abdominal segments 5 and 6. Integument microsculpture presents on membranous parts of coxae and femora (Fig. 12), and ventral side of body.

DIAGNOSIS

Larva of *D. tomentosa* has several unique features among all known Donaciinae larvae: labrum with 18 setae (because of the duplication of the angular setae) (Fig.

13: A), integument microsculpture is well developed on whole ventral side of body. Pale green colour of body allows to separate *D. tomentosa* from all other known larvae of Palaearctic Donaciinae. Only the larva of Nearctic *Neohaemonia nigricornis* (KIRBY, 1837) is also green coloured (HOFFMAN 1940). In other respects, the larva of *D. tomentosa* resembles other known *Donacia* larvae more than those of *Plateumaris*, *Macrolea* SAMOUELLE, 1819, and *Neohaemonia* SZÉKESY, 1941.

DISCUSSION

Larva of *D. cinerea* is morphologically rather close (BIENKOWSKI 1993, 2001) to *D. vulgaris* ZSCHACH, 1788, and *D. simplex* FABRICIUS, 1775. The latter two share all characters mentioned in Table 2 for *D. cinerea* and differ from this species only in the presence of 1-2 denticles on the molar edge of mandible, and small spines on anterior side of coxae (in *D. vulgaris* only). Larvae of *D. clavipes* and *D. pubicollis* are similar to each other in principal features and differ from both *D. tomentosa* and *D. cinerea*. Table 2 includes the main distinguishing larval characters of the species formerly included in *Donaciella*.

3. Biology

Donacia tomentosa is a monophagous species feeding on *Butomus umbellatus* (Butomaceae) as adult and as larva. Only adults of few unrelated members of Donaciinae, namely *Donacia bactriana*, WEISE, 1887, *D. mistshenkoi* JACOBSON, 1910, and *D. sparganii* AHRENS, 1810 were also recorded from this plant (MEDVEDEV & ROGINSKAJA 1988). However, the host plants of larvae of *D. bactriana* and *D. mistshenkoi* are unknown, and larvae of *D. sparganii* develop on roots of *Sparganium* spp. (BIENKOWSKI 1993). Another interesting peculiarity of *D. tomentosa* is that the larva attaches the cocoon to the interior side of the leaves of the host plant underwater, but not to roots or rhizomes as all other known Donaciinae larvae do.

The main host plants of *Donacia cinerea*, namely *Typha latifolia* and *T. angustifolia* (Typhaceae), are also consumed by adults and larvae of *D. vulgaris*. Larvae of *D. cinerea* also develop on roots of *Carex* sp. (Cyperaceae).

Donacia clavipes and *D. pubicollis* feed principally on *Phragmites australis* (Gramineae) (host plant of the latter is cited after HOFFMAN 1940 b). Larvae of *D. clavipes* were also found by us on roots of *Glyceria maxima* (Gramineae).

Therefore, our host plant data contradict the opinion of ASKEVOLD (1990) that the species of *Donaciella* sensu ASKEVOLD are associated with grasses, principally *Phragmites*.

4. Systematics

Donacia cinerea is well separated from *D. tomentosa*, however rather close to two members of the subgenus *Donaciomima*, namely *D. vulgaris* and *D. simplex*,

on the basis of adult and larval morphology and host specialization. Although the adults of the last two species are devoid of dorsal pubescence and have stronger punctures on pronotum and elytra, they have a similar shape of labrum (without emargination), convex anterolateral tubercles of pronotum, similar ratio of length of antennomeres 2 and 3, femora rufous in basal 1/3-1/4, hind femora without denticle, broad mesosternum (mesocoxa no more than 2.50 times as broad as mesosternum in female and 2.92 -in male) and distinct impressions on elytra. Therefore, we believe that the three above mentioned species represent a species group within the subgenus *Donaciomima*.

SCHAEFFER (1925) noted that *Donacia clavipes* and *D. pubicollis* were similar in certain respects. We think that the morphology of adults and larvae, and host specialization allow to consider these two species as a natural species group within the subgenus *Donaciomima* (Tables 1, 2).

The subgenus *Donaciella* was originally based on a single character, the pubescence of the dorsal body side. However, this feature is also present in some different unrelated species of Donaciinae. *Donacia (Donaciomima) clavareau* JACOBSON, 1906, *D. (Donaciomima) hirticollis* KIRBY, 1837, and several *Plateumaris* species have pubescent pronotum (MARX 1957, ASKEVOLD 1991, and available specimens), and *D. (Donaciomima) pubescens* LECONTE, 1868 is wholly covered with hairs (MARX 1957). Therefore, the dorsal pubescence is not a sufficient feature to distinguish *Donaciella*.

We compared the original descriptions of *D. microcephala* (DANIEL & DANIEL, 1904) and *D. testaceiceps* PIC, 1908) with the available specimens and confirmed the decision by ASKEVOLD's (1990) opinion that these names are synonyms. Adults of *Donacia microcephala* have the following combination of characters: body entirely rufous, dorsum pubescent, fore tibiae narrow, without tooth-like projection on outer side near apex, hind femur bears a strong denticle, metatarsomere 1 very long (Fig. 9), anterior corner of pronotum bears 2-3 setae (Fig. 6), antennomere 3 as long as 2.29 (male, Fig. 10), or 2.25 (female, after DANIEL & DANIEL 1904) antennomere 2, and mandible terminates in one teeth (ASKEVOLD 1990). Biology and immature stages of this rare species living in Turkey, Iran, and Iraq are not known. However, the adult characters show that *D. microcephala* is not close to *D. tomentosa*, *D. cinerea*, *D. clavipes*, and *D. pubicollis* and occupies an isolated position within the genus *Donacia*.

The recent classification of Donaciinae is based on the following principal characters: a) adult (WARCHALOWSKI 1985, MEDVEDEV 1992): presence/absence of a spine or hook at elytral apex, normal/exposed sutural margin before the elytral apex, broad/narrow and elongate tarsomeres; b) larva (BIENKOWSKI 2001): shape of frontale, labrum, process of lacinia, length and shape of setae covering body and labrum. All these characters are similar in *D. tomentosa* and other *Donacia* species. In adult, the shape of fore tibiae is the single character which allows to distinguish *D. tomentosa* from all other Palaearctic Donaciinae except *D. microcephala*. Both these variants, with the apical tooth-like projection on

outer edge of fore tibiae and without it, are present in unrelated Nearctic *Donacia* species (MARX 1957). Therefore, a combination of the adult and larval characters permits us to consider *D. tomentosa* as a member of a monotypic subgenus of the genus *Donacia* rather than a separate genus.

Subgenus *Donaciella* REITTER, 1920: 38

Type species: *Donacia tomentosa* AHRENS, 1810: 42, designated by MONROS (1959).

DIAGNOSIS (adult)

Body coppery, green, or blackish; above covered with dense yellow hairs; femora, antennae, tibiae, and tarsi partly rufous. Anterior margin of labrum slightly emarginate. Antennomere 3 as long as 1.95-3.64 antennomere 2. Anterolateral calli of pronotum weak. Elytra without sutural and lateral impressions. Fore tibiae weakly enlarged apically, without tooth-like projection at outer apical edge. Hind femora devoid of denticles, short, extends abdominal sternum 2. Ovipositor valve not sclerotized.

DIFFERENTIAL DIAGNOSIS (adult)

Donacia (Donaciella) differs from *Donacia* (s.str.) and *Donacia (Donaciomima)* in the yellow hairs on pronotum and elytra, shape of fore tibiae, and ratio of antennomeres 2 and 3.

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