

IDENTIFICATION OF CENTRAL EUROPEAN SPECIES  
OF *BOTANOPHILA* LIOY, 1864, BASED ON  
THE FEMALE TERMINALIA (DIPTERA: ANTHOMYIIDAE)

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Of 39 Central European species of *Botanophila* the postabdominal structures of 33 females are examined in detail and evaluated. Figures drawn from microscope slide preparations of the female terminalia, including the last four abdominal segments, document some relationships among examined species which enable a compilation of the first identification key to females of the Central European species.

Key words: *Botanophila*, Anthomyiidae, females, oviscapt, species identification.

## INTRODUCTION

The family Anthomyiidae is considered to be, taxonomically, an extremely difficult group of Diptera and reliable keys to the female identification even at the generic level, including *Botanophila* LIOY, 1864, are still lacking. The only basic source of information about European *Botanophila* is represented by a fairly old monograph of Palaearctic anthomyiids by HENNIG (1966–1976). The checklists of Anthomyiidae of many European countries are thus relatively poor (or even lacking) due to a very limited number of specialists in this family although anthomyiids include many species of economic importance. Larvae of many species are phytophagous, including serious pests of cereals, vegetables and seeds of coniferous trees. Some species may be found in fungi, others in decaying organic matter, some larvae are parasitoids of Orthoptera, and some are cleptoparasites of some Hymenoptera.

*Botanophila*, as a very diverse group of species, is among the difficult genera lacking significant common external characters that are typical for some other genera of the family, e.g., *Eustalomyia* KOWARZ, 1873, *Hydrophoria* ROBINEAU-DESVOIDY, 1830, *Hylemya* ROBINEAU-DESVOIDY, 1830 or *Pegomya* ROBINEAU-DESVOIDY, 1830. The species identification is chiefly based on examination of the male terminalia because the external characters (shape of the head, chaetotaxy, coloration, etc.) usually do not provide reliably distinguishing characters. In HENNIG's monograph (l.c.) only limited descriptions of females are included and no identifi-

cation key is proposed. Some additional information on the taxonomy of European *Botanophila* was published by ACKLAND (1969, 1972, 1989), BLAND and ACKLAND (2000) and MICHELSEN (1983, 2009). No modern revision of this genus was published after HENNIG's time and a comparative study of the females of *Botanophila* is still lacking.

The present *Botanophila* species were classified in two separate genera *Botanophila* and *Pegohylemyia* SCHNABL, 1911 (in SCHNABL & DZIEDZICKI 1911) by HENNIG (l.c.), although he pointed out their close relationship. As common characters for the males of present *Botanophila* he mentioned extensive reduction of the pregonites that never have a triangular shape, and reduction of the distiphallus, which is membranous and almost without structure. Such reduction also occurs, for example, in the related genera *Chiastocheta* POKORNY, 1889 and *Fucellia* ROBINEAU-DESVOIDY, 1842. As for the shape of the head, the majority of species show an plesiomorphic type of sexual dimorphism with the males having a holoptic head in most species. The crossed interfrontal setae are in males developed as a pair of short setulae at the tip of the ocellar triangle and the orbital setae are only rarely developed. The proboscis is short in some species but elongated in others due to an apparent gradual adaptation to sucking the nectar of blossoms. There is a number of setulae on the upper occiput, which often serves as a distinguishing character from otherwise very similar species of *Delia* ROBINEAU-DESVOIDY, 1830. The thorax and wings apparently have no significant generic characters, the costa is mostly bare on the lower side and the abdomen is flat, never tubular. The only character that may help to identify females as members of the above mentioned group of genera (*Botanophila*, *Chiastocheta* and *Fucellia*) are the strikingly long and slender spermathecal ducts (V. MICHELSEN, pers. comm.). This character also enables distinguishing the females of *Botanophila* from the females of some *Delia* whose terminalia may be similar. While *Delia* spermathecae are situated in the postabdomen, *Botanophila* spermathecae are usually situated in posterior preabdomen because of the very long spermathecal ducts.

As first demonstrated by HUCKETT (1921), the female terminalia within many genera of Anthomyiidae represent a useful tool for identification of the otherwise barely separable females. That is why our attempt to study and compare the females of Central European species of *Botanophila* was made. In Europe 67 species are known to occur (MICHELSEN 2004, 2009). For the purpose of this study, Central Europe is considered to include Germany, Poland, Czech Republic, Slovakia, Switzerland, Austria and Hungary. Of 39 species ascertained in Central Europe (cf. Table 1), specific characters of the female terminalia are defined for 33 *Botanophila* species; females of six species are not available because they are unknown or are rare and/or montane species. We found that structures of the exam-

**Table 1.** Occurrence and distribution of Central European *Botanophila* species. HOL – Holarctic, E – European, EA – Eurasian, W PAL – West Palaeartic

Species	Country							Distribution
	D	PL	CZ	SK	CH	A	H	
<i>B. biciliaris</i> (PANDELLÉ, 1900)	+	+	+	+		+		HOL
<i>B. bompadrei</i> (BEZZI, 1918)					+	+		HOL
<i>B. brunneilinea</i> (ZETTERSTEDT, 1845)	+		+	+	+	+	+	E
<i>B. centaureae</i> (HENNIG, 1970)			+		+			EA
<i>B. cordifrons</i> (ZETTERSTEDT, 1845)						+		EA
<i>B. depressa</i> (STEIN, 1907)	+							EA
<i>B. discreta</i> (MEIGEN, 1826)	+		+	+	+	+		W PAL
<i>B. dissecta</i> (MEIGEN, 1826)	+	+	+	+				EA
<i>B. estonica</i> (ELBERG, 1970)			+			+		E
<i>B. fugax</i> (MEIGEN, 1826)	+	+	+	+	+	+	+	HOL
<i>B. gentianae</i> (PANDELLÉ, 1900)			+	+	+	+		E
<i>B. gnava</i> (MEIGEN, 1826)	+		+	+			+	E
<i>B. helviana</i> MICHELSEN, 1983			+	+				E
<i>B. hucketti</i> (RINGDAHL, 1935)			+			+		E
<i>B. intermedia</i> (ZETTERSTEDT, 1860)						+		E
<i>B. lactucaeformis</i> (VILLENEUVE, 1923)	+					+		HOL
<i>B. laterella</i> (COLLIN, 1967)			+					E
<i>B. latifrons</i> (ZETTERSTEDT, 1845)	+		+	+	+			EA
<i>B. lobata</i> (COLLIN, 1967)			+	+	+			EA
<i>B. maculipes</i> (ZETTERSTEDT, 1845)					+	+		EA
<i>B. monacensis</i> (HENNIG, 1970)						+		E
<i>B. monticola</i> (KARL, 1932)			+			+		EA
<i>B. phrenione</i> (SÉGUY, 1937)	+		+	+				W PAL
<i>B. profuga</i> (STEIN, 1916)			+	+	+	+		HOL
<i>B. retusa</i> (RINGDAHL, 1952)			+					E
<i>B. rubrifrons</i> (RINGDAHL, 1933)				+		+		HOL
<i>B. rubrigena</i> (SCHNABL, 1915)	+			+	+	+		HOL
<i>B. rupicapra</i> (MIK, 1887)	+	+	+	+	+	+		EA
<i>B. sanctimarci</i> (CZERNY, 1906)			+	+	+	+		EA
<i>B. seneciella</i> (MEADE, 1892)	+	+	+	+	+			HOL + Australian region
<i>B. sericea</i> (MALLOCH, 1920)			+	+		+		HOL
<i>B. silvatica</i> (ROBINEAU-DESVOIDY, 1830)	+	+	+	+		+		E
<i>B. sonchi</i> (HARDY, 1872)	+	+				+		EA

Table 1 (continued)

Species	Country							Distribution
	D	PL	CZ	SK	CH	A	H	
<i>B. spinosa</i> (RONDANI, 1866)			+		+		+	EA
<i>B. striolata</i> (FALLÉN, 1824)	+	+	+	+	+	+	+	EA
<i>B. trapezina</i> (ZETTERSTEDT, 1845)					+	+	+	E
<i>B. tuxeni</i> (RINGDAHL, 1953)					+	+		HOL
<i>B. varicolor</i> (MEIGEN, 1826)	+		+	+	+	+	+	EA
<i>B. verticella</i> (ZETTERSTEDT, 1838)	+	+	+		+			E

ined terminalia indicate some relationships among certain species and we could thus propose an original key to the identification of Central European *Botanophila* females.

## MATERIAL AND METHODS

The female terminalia of individual species were examined and described on the basis of microscopic slide preparations that were mostly provided by the courtesy of Dr. V. MICHELSEN of the Zoological Museum, Copenhagen. Some additional microscopic slides and all photographs were prepared by the first author using the Olympus SZX 12 microscope with magnification 8.4 times and the Olympus Camedia 5050 camera. Owing to the shape of the abdomen, in which tergites are mostly markedly arched, occupying not only the dorsal surface but continuing laterally and even partly reaching the ventral side, the figures of female abdomens beginning from segment 6 presented here are based on sclerites in the flat position which enables to compare their actual size. The figures do thus not document the abdomens in dorsal and lateral view in a real position and the interrupted lines bordering the sclerites show actually only the presumed boundary between the tergal and sternal part of the examined abdominal segments. The female abdomens were boiled in 10% KOH for several minutes, then washed, dissected in glycerine-water and cut longitudinally between tergites and sternites and between epiproct and hypoproct. Microscissors with 3.0 mm long blades were used for dissection. The dissected terminalia were rinsed in alcohol and mounted on slides in Canada balsam. The terminology of the female terminalia follows KOTRBA (2000).

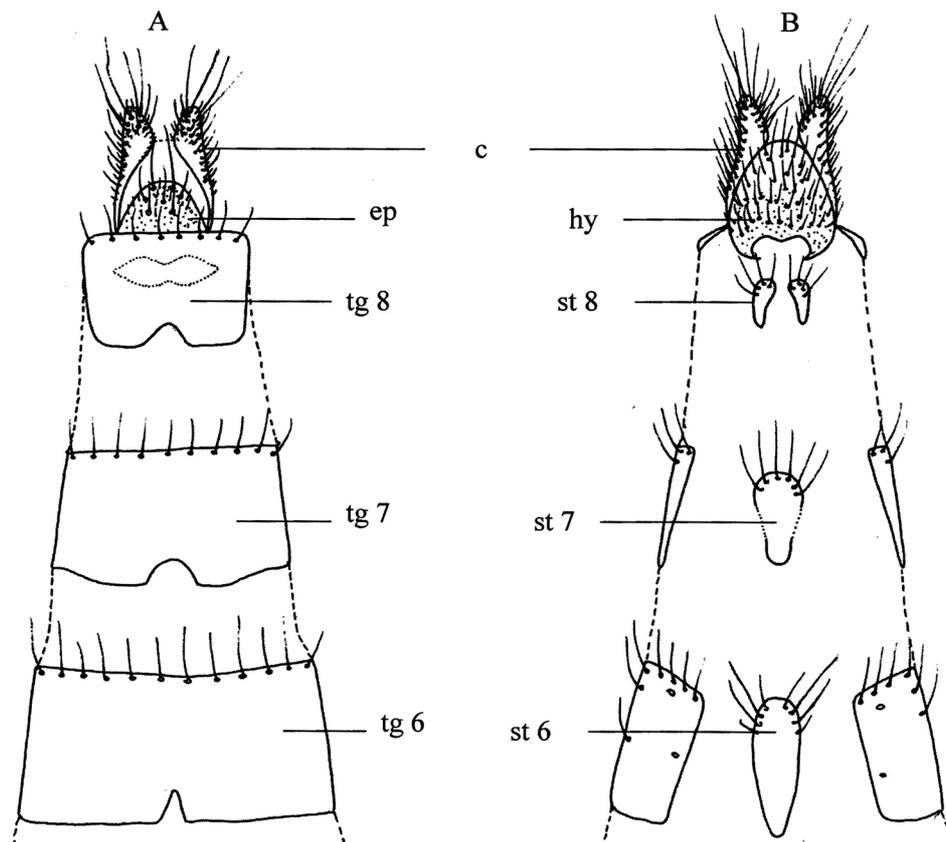
## RESULTS

### *Species-specific characters of oviscapts*

The oviscapt (the female postabdomen = retracted 6th and following postabdominal segments, Fig. 1) is usually tubular, with long intersegmental membranes. Tergites and sternites 6–8 may often be reduced or longitudinally subdivided. Sternite 8 is always small and longitudinally divided. The female postabdomen

contains three spermathecae and it can be situated inside the abdomen in a resting position due to its telescopic character. Seven pairs of spiracles are present on the surface of abdomen, as in the males. The female spiracles 6 and 7 are often closely adjacent on tergite 6, which forms a part of the oviscapt along with tergites 7 and 8 (HUCKETT 1987). The terminal part consists of 2 small and papillate cerci with the epiproct (= supra-anal plate) situated between them and the hypoproct (= subanal plate) on the ventral side. The examined oviscapt of Central European *Botanophila* species may be characterised as follows:

*B. biciliaris* (PANDELLÉ, 1900) (Fig. 13): Oviscapt of medium width, not markedly slender and long; tergites transverse and mostly well sclerotized, tergite 8 subquadrate, poorly sclerotized in central area; sternites 6 and 7 elongate-oval, sternite 8 consisting of two oval sclerites, epiproct transversely semicircular;

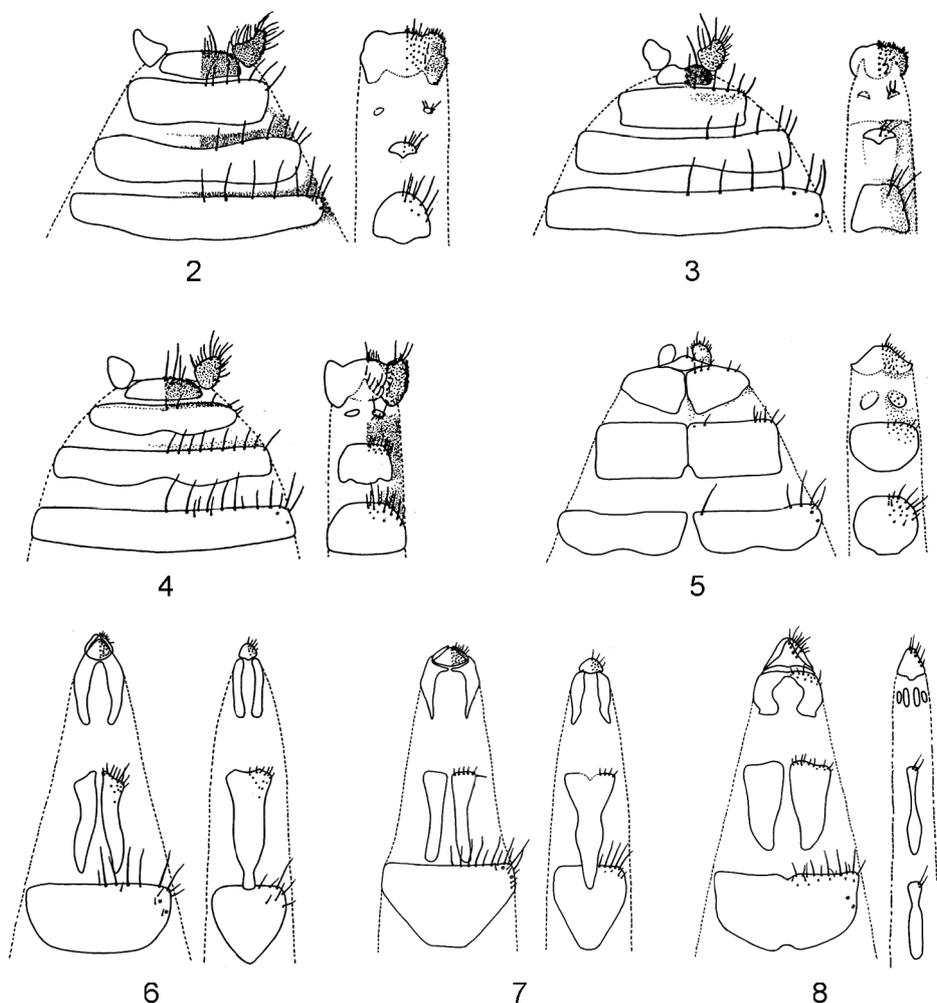


**Fig. 1.** Oviscapt of *Botanophila* sp.: A = dorsal view; B = ventral view. Abbreviations: c – cerci, ep – epiproct, hy – hypoproct, st – sternite, tg – tergite

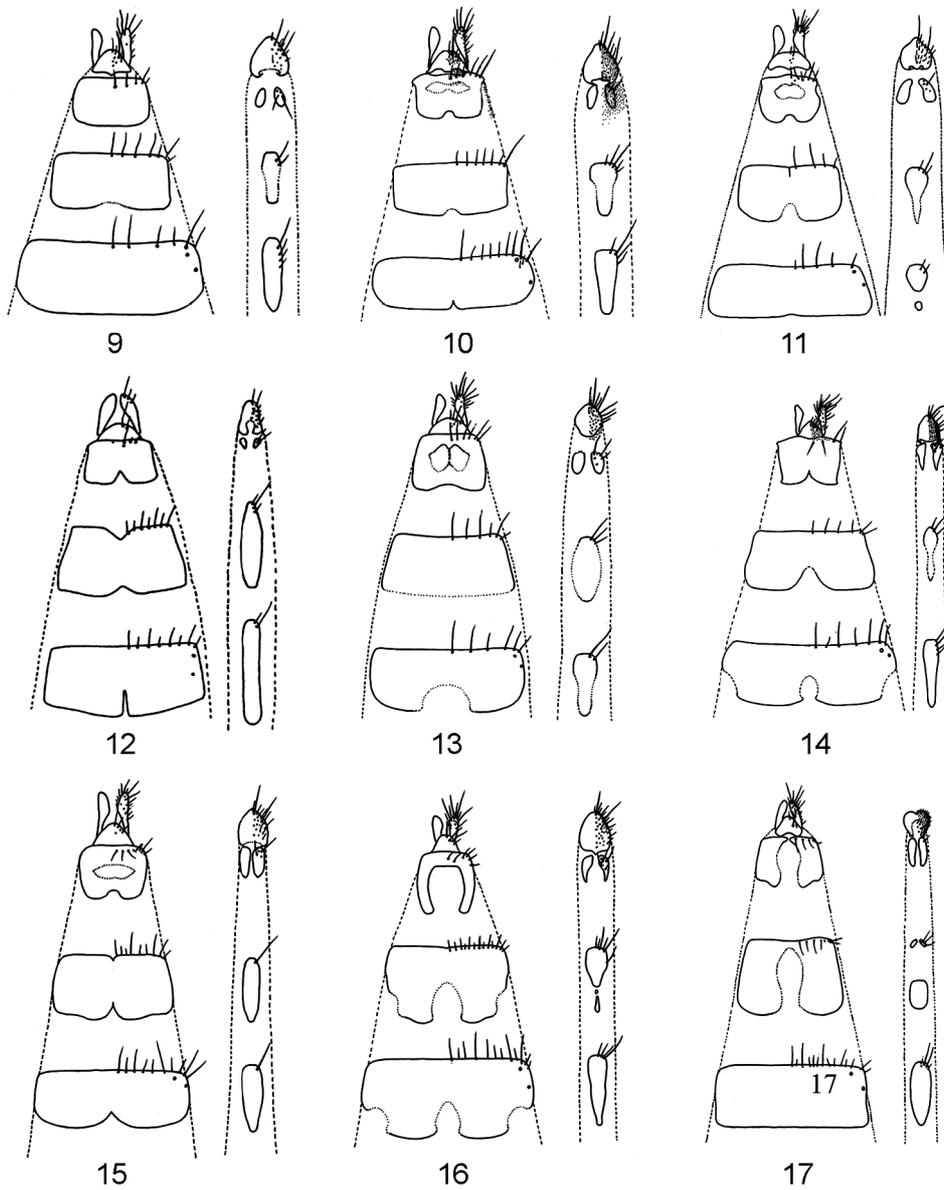
hypoproct suboval, tapered distally; cerci slightly concave on outer margin, with long setae.

*B. bompadrei* (BEZZI, 1918): Female unknown.

*B. brunneilinea* (ZETTERSTEDT, 1845) (Fig. 18): Oviscapt slender; all tergites horseshoe-shaped; sternite 7 slender, about 3 times as long as broad, proximally tapered; sternite 8 consisting of two elongated, proximally tapered sclerites being almost 4 times as long as broad; hypoproct elongated and cut transversally at



**Figs 2–8.** Oviscapt of *Botanophila* spp. (tergites and sternites): 2 = *B. dissecta*, 3 = *B. phreonine*, 4 = *B. lobata*, 5 = *B. sanctimarci*, 6 = *B. monticola*, 7 = *B. seneciella*, 8 = *B. verticella*



**Figs 9–17.** Oviscapt of *Botanophila* spp. (tergites and sternites): 9 = *B. hucketti*, 10 = *B. fugax*, 11 = *B. rubrigena*, 12 = *B. lactucaeformis*, 13 = *B. biciliaris*, 14 = *B. profuga*, 15 = *B. sericea*, 16 = *B. silvatica*, 17 = *B. laterella*

base, twice as long as broad; cerci slender, about 4 times as long as broad; cerci and hypoproct with many long and strong setae.

*B. centaureae* (HENNIG, 1970): Oviscapt same as in *B. brunneilinea* (Fig. 18).

*B. cordifrons* (ZETTERSTEDT, 1845) (Fig. 28): Oviscapt slender, tergites and sternites (or their halves) noticeably longer than broad; all tergites divided into 2 symmetrical parts, sternites 6–7 compact, sternite 8 consisting of 2 long sclerites; rhomboid epiproct and triangular hypoproct longer than broad, with short hairs only; cerci very slender, tightly appressed to epiproct and markedly extending beyond it, with short hairs.

*B. depressa* (STEIN, 1907): Female unavailable.

*B. discreta* (MEIGEN, 1826) (Figs 19, 19a): Oviscapt markedly slender; all tergites slightly dilated toward distal margin with a fairly deep emargination in middle; sternites 6 and 7 sticklike, sternite 7 partly reduced in basal half; both remnants of sternite 8 elongate-oval, tapered toward both ends; epiproct semicircular; cerci long, dilated in distal half; hypoproct oval; cerci convex on outer margin.

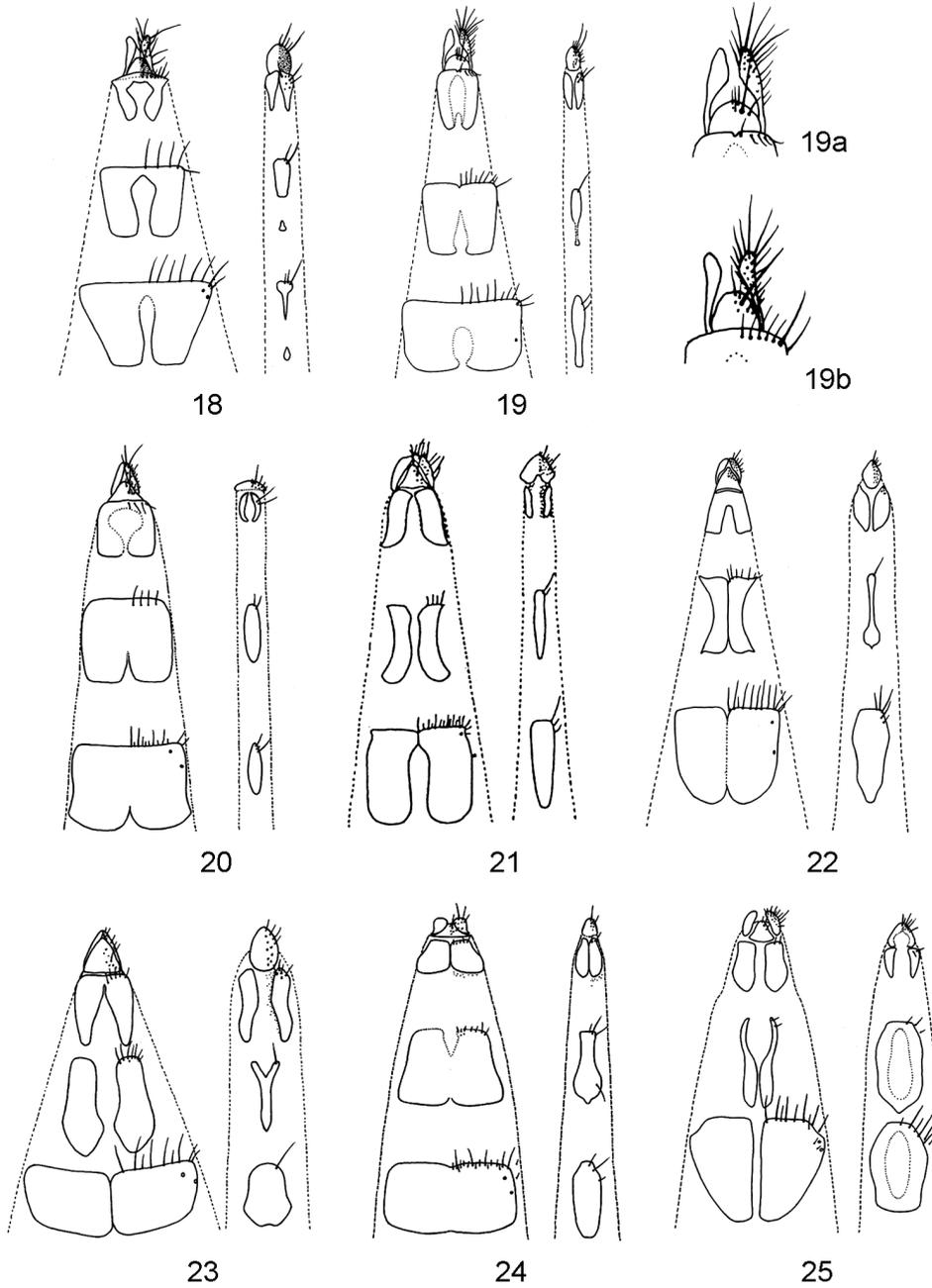
*B. dissecta* (MEIGEN, 1826) (Fig. 2): Oviscapt shortened, very broad; tergites strongly sclerotized and all unusually broad; sternite 7 large, rounded distally; sternite 7 considerably reduced, small; sternite 8 consisting of two inconspicuous sclerites with several setae; epiproct very transverse with rounded posterior margin; hypoproct unusually large and broad, with posterolateral lobes and strong setae in middle; cerci short and subtriangular.

*B. estonica* (ELBERG, 1970): Oviscapt same as in *B. varicolor* (Fig. 20).

*B. fugax* (MEIGEN, 1826) (Fig. 10): Oviscapt of medium width, not markedly slender and long; tergites of basic type, broad on segments 6 and 7 and only slightly broader than long on segment 8, each with shallow proximal midincision; sternites 6 and 7 fairly narrow, almost as long as tergites 6 and 7; remnants of sternite 8 elongate-oval; epiproct subtriangular, broader than long; hypoproct subconical, longer than broad; cerci dilated distally, with long setae.

*B. gentianae* (PANDELLÉ, 1900) (Fig. 26): Oviscapt slender; tergite 6 bipartite; tergite 7 subquadrate and tergite 8 more rounded, both with distinct emargination in middle of proximal margin; sternites 6 and 7 as long as tergites 6 and 7, 3–4 times longer than broad; remnants of sternite 8 elongate-oval, slightly convergent proximally; epiproct subtriangular; hypoproct subconical; cerci slender, tapered basally.

*B. gnava* (MEIGEN, 1826) (Fig. 21): Oviscapt slender; sternites and tergites mostly longer than broad; tergite 6 subquadrate, very deeply emarginate in middle of proximal margin; tergites 7 and 8 bipartite; sternites 6 and 7 elongate, about as long as tergites 6 and 7; sternite 8 consisting of two well separated slender rem-



**Figs 18–25.** Oviscapt of *Botanophila* spp. (tergites and sternites): 18 = *B. brunneilinea*, 19 = *B. discreta*, 19a = cerci of *B. discreta*, 19b = cerci of *B. striolata*, 20 = *B. varicolor*, 21 = *B. gnava*, 22 = *B. rupicapra*, 23 = *B. retusa*, 24 = *B. rubrifrons*, 25 = *B. helviana*

nants; epiproct triangular; hypoproct subtriangular, with midincision at proximal margin; cerci tightly appressed to epiproct.

*B. helviana* MICHELSEN, 1983 (Fig. 25): Oviscapt rather broad and lightly sclerotized; all tergites bipartite, both parts approximated and tapered basally on segment 6, slender, conspicuously tapered in distal half on segment 7; platelike, slightly dilated in proximal half of segment 8; sternites 6 and 7 large, elongate sub-oval; remnants of sternite 8 elongated, tapered proximally; epiproct and hypoproct subtriangular; cerci short and relatively thick.

*B. hucketti* (ZETTERSTEDT, 1860) (Fig. 9): Oviscapt of medium width, resembling that of *B. fugax*; tergites transverse, virtually without medial incision on proximal margins; sternites 6 and 7 more slender; remnants of sternite 8 short oval; hypoproct shorter and cerci only slightly tapered basally.

*B. intermedia* (ZETTERSTEDT, 1860): Female unavailable.

*B. lactucaeformis* (VILLENEUVE, 1923) (Fig. 12): All tergites broader than long, with proximal midincision; sternites 6 and 7 simple, elongate; sternite 8 virtually indistinct, consisting of two small sclerites; epiproct broadly semicircular; hypoproct slender, rounded distally; cerci slightly convex on outer margin, with long and thin setae.

*B. laterella* (COLLIN, 1967) (Fig. 17): Oviscapt relatively slender; tergite 6 much wider than long, without incision; tergites 7 and 8 horseshoe-shaped with very deep median emargination on proximal margin, narrow distal frame nearly interrupted in middle of tergite 8; sternite 6 elongate-oval, sternite 7 reduced to 3 remnants, a larger sclerite situated basally and a pair of very small sclerites at distal margin of original sternite; sternite 8 consisting of two slender and slightly convex sclerites; epiproct subtriangular with rounded proximal corners; epiproct reversely heart-shaped; cerci 3.5 times as long as broad, virtually not tapered basally.

*B. latifrons* (ZETTERSTEDT, 1845) (Fig. 29): Oviscapt very distinctive. In lateral view cerci lanceolate, compressed bilaterally; epiproct and hypoproct swollen, almost circular. Remnants of sternite 7 arranged as in *B. laterella*.

*B. lobata* (COLLIN, 1967) (Fig. 4): Very similar to *B. dissecta* but sternites 6 and 7 much larger, remnants of sternite 8 more distinct; posterolateral corners of hypoproct more prominent; cerci also subtriangular, although more rounded.

*B. maculipes* (ZETTERSTEDT, 1845): Female unavailable.

*B. monacensis* (HENNIG, 1970): Female unknown.

*B. monticola* (KARL, 1932) (Fig. 6): Oviscapt slender, only slightly different from *B. seneciella*; tergite 6 more transversely oval; both parts of tergite 7 slightly sinuate; both parts of tergite 8 almost touching distally; remnants of sternite 8 more sticklike and hypoproct narrower, more rounded; cerci short and tightly appressed to epiproct.

*B. phrenione* (SÉGUY, 1937) (Fig. 3): Oviscapt shortened, very broad, similar to *B. dissecta*, however sternite 6 not rounded distally, both traces of sternite 8 visible only as tufts of setae; epiproct bilobate posteriorly, hypoproct more rounded laterally; cerci short and broad.

*B. profuga* (STEIN, 1916) (Fig. 14): Oviscapt of medium width, resembling *B. fugax*; tergites transverse, with deeper emargination in middle of proximal margin; tergite 8 subquadrate, with all corners prominent; sternites 6 and 7 more slender; remnants of sternite 8 elongate-oval; epiproct triangular; hypoproct almost parallel sided in basal half; cerci slender.

*B. retusa* (RINGDAHL, 1952) (Fig. 23): Tergite 6 divided by a longitudinal median suture, tergite 7 consisting of 2 symmetrical parts; tergite 8 with a very deep proximal midincision; sternite 6 elongate-suboval; Y-shaped slender sternite 7 unique within entire genus; sternite 8 consisting of 2 parts; epiproct subtriangular; hypoproct egg-shaped; cerci tightly appressed to epiproct.

*B. rubrifrons* (RINGDAHL, 1933) (Fig. 24): Oviscapt not markedly slender; tergite 6 broader than long; tergite 7 subquadrate, with midincisions on proximal as well as distal margins; transverse tergite 8 with distinct longitudinal median suture; sternites 6 and 7 fairly large, elongate, the latter broadened in proximal half; sternite 8 consisting of 2 tightly appressed sclerites; epiproct unusually low; hypoproct subconical; cerci short.

*B. rubrigena* (SCHNABL, 1915) (Fig. 11): Oviscapt of medium width, not markedly elongate; tergite 6 about 3 times as broad as long; tergite 7 twice as broad as long; tergite 8 subquadrate; all sternites somewhat reduced, sternite 8 consisting of 2 suboval remnants; epiproct broadly semicircular; hypoproct reversibly heart-shaped; cerci straight on outer margin, with long setae.

*B. rupicapra* (MIK, 1887) (Fig. 22). Oviscapt similar to *B. gnava* but with longitudinal median suture on tergites 6 and 7; tergite 8 compact, with deep emargination in middle of proximal margin; sternite 6 distinctly broader; sternite 7 clublike, extended basally; both remnants of sternite 8 approximated, elongate-oval, subpointed on both end; hypoproct almost oval; cerci short, appressed to epiproct.

*B. sanctimarci* (CZERNY, 1906) (Fig. 5): Oviscapt shortened, strongly sclerotized, all tergites very broad, divided into 2 transverse plates on segment 6, with a distinct longitudinal median suture on segment 7 and consisting of two large, subtriangular and approximated plates in segment 8; sternites 6 and 7 large, rounded, broad; remnants of tergite 8 obliquely oval; epiproct subtriangular, very short; hypoproct relatively large, subtriangular, with prominent and acute basal corners; cerci unusually short, rounded.

*B. seneciella* (MEADE, 1892) (Fig. 7): Oviscapt slender, very unusual; tergite 6 large, tapered proximally; tergite 7 bipartite consisting of approximated narrow and slightly distally dilated plates; tergite 8 bipartite, its short posteromedian projections approximated in middle; sternite 6 large, subtriangular, narrower than tergite 6; sternite 7 longer than tergite 7, dilated distally; sternite 8 bipartite, both parts elongated and tapered anteriorly and posteriorly; epiproct subtriangular, very short; hypoproct small, with rounded lateral corners; narrow cerci tightly appressed to epiproct.

*B. sericea* (MALLOCH, 1920) (Fig. 15): Oviscapt of medium width, not very slender; tergite 7 about twice as broad as long; sternite 7 slender, about 3 times as long as wide; tergite 8 rectangular, poorly sclerotized in central area, slightly broader than long; sternite 8 consisting of two oval sclerites; epiproct subtriangular; hypoproct pentagonal, parallel-sided at least in basal half; cerci straight along outer margin, with long setae.

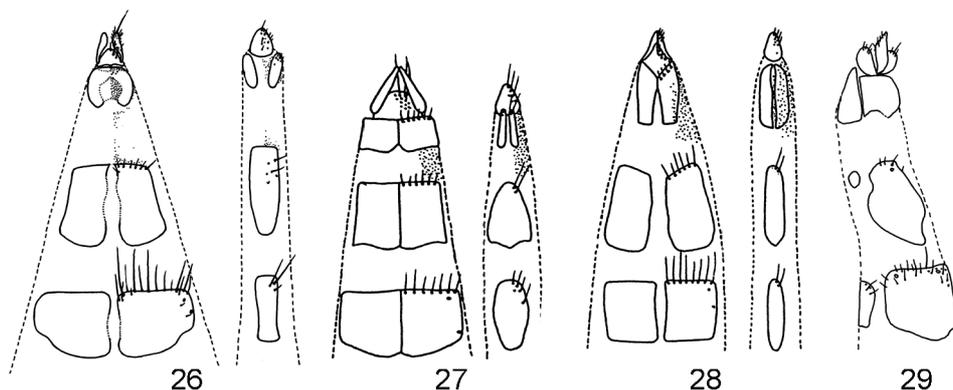
*B. silvatica* (ROBINEAU-DESVOIDY, 1830) (Fig. 16): Oviscapt similar to *B. brunneilinea* but tergites 6 and 7 nearly twice as wide as long and not as deeply emarginated proximally; proximal part of sternite 7 reduced; horseshoe-like remnant of tergite 8 also narrow but distal corners not as prominent; sternite 8 consisting of 2 short sclerites; cerci shorter and not as tapered basally.

*B. sonchi* (HARDY, 1872): Female not reliably described.

*B. spinosa* (RONDANI, 1866): Oviscapt same as in *B. brunneilinea* (Fig. 18).

*B. striolata* (FALLÉN, 1824) (Fig. 19b): Oviscapt very similar to *B. discreta* (Fig. 19) but with cerci concave on outer margin (in distal part).

*B. trapezina* (ZETTERSTEDT, 1845): Oviscapt same as in *B. varicolor* (Fig. 20).



**Figs 26–29.** Oviscapt of *Botanophila* spp. (tergites and sternites): 26 = *B. gentianae*, 27 = *B. tuxeni*, 28 = *B. cordifrons*, 29 = *B. latifrons* (lateral view)

*B. tuxeni* (RINGDAHL, 1953) (Fig. 27): Tergites broader than long, all with longitudinal median suture; sternites 6 and 7 fairly large; sternite 8 bipartite, consisting of narrow plates provided with several long, apical hairs; epiproct semicircular; hypoproct subconical, with several long setae; cerci tapered distally, slightly appressed to epiproct.

*B. varicolor* (MEIGEN, 1826) (Fig. 20): Oviscapt slender and long; all tergites almost rectangular but tergite 6 with acute proximal corners and tergites 6 and 7 with distinct midincision at proximal margin; sternites 6 and 7 elongate-oval, shorter than tergites 6 and 7; both remnants of sternite 8 narrow, convex externally; epiproct subtriangular; hypoproct very typical, unusually short and transverse; cerci slender and rather sticklike, not markedly tapered basally.

*B. verticella* (ZETTERSTEDT, 1838) (Fig. 8): Oviscapt with unusual combination of characters; tergite 6 transverse, with rounded proximal margin; tergite 7 consisting of two elongate, distally broadened sclerites; tergite 8 horseshoe-shaped with only narrow distal portion; sternites 6 and 7 developed as elongated and very narrow sclerites, both somewhat narrowed beyond middle; sternite 8 consisting of two pairs of four small sclerites in transverse row; epiproct triangular with broad base; hypoproct subconical, longer than broad; very slender cerci appressed to epiproct, setae on cerci thin and not very long.

#### KEY TO CENTRAL EUROPEAN *BOTANOPHILA* SPECIES BASED ON THE FEMALE TERMINALIA

- |   |   |                     |
|---|---|---------------------|
| 1 | Oviscapt in lateral view with lanceolate cerci; epiproct and hypoproct swollen, almost circular (Fig. 29)   | <i>B. latifrons</i> |
| – | Oviscapt of another shape   | 2                   |
| 2 | Tergites 6–8 more than twice as broad as long, strongly sclerotized and undivided (Figs 2–4); hypoproct transversely extended, more or less lobate posterolaterally | 3                   |
| – | Tergites 6–8 not as broad; if rarely broad, then tergite 6 bipartite (Fig. 5); hypoproct of another shape   | 5                   |
| 3 | Sternite 7 large, almost subquadrate; hypoproct with slightly acute posterolateral lobes (Fig. 4)   | <i>B. lobata</i>    |
| – | Sternite 7 small, nearly semicircular; posterolateral lobes of hypoproct rounded (Figs 2–3)   | 4                   |

4	Sternite 6 with rounded distal margin (Fig. 2)	<i>B. dissecta</i>
–	Sternite 6 with angulate distal margin (Fig. 3)	<i>B. phrenione</i>
5	Hypoproct very narrow, transverse (Fig. 20)	<i>B. estonica</i> / <i>B. trapezina</i> / <i>B. varicolor</i>
–	Hypoproct longer than broad	6
6	Tergite 7 entire or more or less notched by reduced sclerotization in middle of proximal margin. Sometimes reduction of sclerotization nearly reaching distal part of tergite and then horse-shaped (Fig. 17)	7
–	Tergite 7 consisting of two sclerites (Figs 6–8) or longitudinally divided by a median suture (Figs 5, 22), never horse-shoe shaped	19
7	Tergite 8 consisting of two sclerites or with a distinct longitudinal median suture (Figs 17, 24)	8
–	Tergite 8 consisting of one sclerite and without longitudinal median suture although sometimes deeply emarginated	11
8	Tergite 8 consisting of two sclerites; sternite 7 consisting of 3 remnants (Fig. 17)	<i>B. laterella</i>
–	Tergite 8 with a distinct longitudinal median suture; sternite 7 undivided (Fig. 24)	<i>B. rubrifrons</i>
9	Tergite 7 subquadrate (Figs 18, 19)	10
–	Tergite 7 always broader than long	12
10	Tergite 7 horseshoe-shaped, with deep and rounded proximal emargination (Fig. 18)	<i>B. brunneilinea</i> / <i>B. centaurea</i> / <i>B. spinosa</i>
–	Tergite 7 not horseshoe-shaped, not with rounded proximal emargination (Fig. 19)	11
11	Cerci convex on outer margin (Fig. 19a)	<i>B. discreta</i>
–	Cerci concave on outer margin (Fig. 19b)	<i>B. striolata</i>
12	Tergite 8 horseshoe-shaped (Fig. 16)	<i>B. silvatica</i>
–	Tergite 8 not horseshoe-shaped	13
13	Sternite 6 short-oval, much shorter than tergite 6 (Fig. 11)	<i>B. rubrigena</i>
–	Sternite 6 elongate, as long or longer than tergite 6	14

- 14 Tergite 6 without incision in middle of proximal margin (Fig. 9)  
*B. hucketti*
- Tergite 6 with distinct incision in middle of proximal margin 15
- 15 Proximal corners of tergite 8 prominent and pointed (Fig. 14) *B. profuga*
- Proximal corners of tergite 8 not prominent, more or less rounded 16
- 16 Distal margin of tergite 7 without mid incision (Figs 10, 13) 17
- Distal margin of tergite 7 with mid incision (Figs 12, 15) 18
- 17 Distal corners of tergite 8 not markedly prominent (Fig. 13) *B. biciliaris*
- Distal corners of tergite 8 markedly prominent (Fig. 10) *B. fugax*
- 18 Remnants of sternite 8 short, barely longer than broad (Fig. 12)  
*B. lactucaeformis*
- Remnants of sternite 8 more than twice as long as broad (Fig. 15)  
*B. sericea*
- 19 Tergite 7 with a longitudinal median suture (Figs 5, 22, 27) 20
- Tergite 7 consisting of 2 separate sclerites (Figs 6–8) 22
- 20 Tergite 7 with concave lateral margins; sternite 7 very narrow (Fig. 22)  
*B. rupicapra*
- Tergite 7 with straight lateral margins; sternite 7 broad (Figs 5, 27) 21
- 21 Tergite 6 consisting of two sclerites; cerci short and oval (Fig. 5)  
*B. sanctimarci*
- Tergite 6 compact, with distinct median suture, cerci long and slender (Fig. 27)  
*B. tuxeni*
- 22 Tergite 6 compact, at most with very short proximal emargination in middle (Figs 6–8) 23
- Tergite 6 consisting of 2 separate sclerites (Fig. 26) or divided by a longitudinal median suture (Fig. 27) or deeply notched in middle of proximal margin (Fig. 21) 25
- 23 Sternites 6 and 7 broadened distally and narrowed toward proximal part; sternite 8 consisting of two narrow sclerites (Figs 6, 7) 24

–	Sternites 6 and 7 very narrow; sternite 8 consisting of 4 small sclerites (Fig. 8)	
		<i>B. verticella</i>
24	Tergite 6 transverse suboval, rounded proximally (Fig. 6)	<i>B. monticola</i>
–	Tergite 6 subtriangular, tapered proximally (Fig. 7)	<i>B. seneciella</i>
25	Two-partite sternite 8 about as long as tergite 8 (Figs 23, 26, 28)	26
–	Two-partite sternite 8 shorter than tergite 8 (Figs 21, 25)	28
26	Cerci narrow, appressed to epiproct	27
–	Cerci oval, connected with epiproct only in its basal parts (Fig. 26)	
		<i>B. gentiana</i>
27	Sternite 7 elongate-oval (Fig. 28)	<i>B. cordifrons</i>
–	Sternite 7 Y-shaped (Fig. 23)	<i>B. retusa</i>
28	Sternite 7 about six times longer than broad (Fig. 21)	<i>B. gnava</i>
–	Sternite 7 two times longer than broad (Fig. 25)	<i>B. helviana</i>

## DISCUSSION

Structures of female postabdomens, especially the shape and arrangement of tergites and sternites (or their remnants) provide a suitable base for distinguishing females of most of the Central European *Botanophila* species. In some cases, also, distinct relationships of the examined females might be suggested (e.g. *dissecta* group, *seneciella* group, *varicolor* group, *gnava* group) and a subdivision of the genus into the species groups of Palaearctic forms as they were proposed by D. M. ACKLAND in XUE and SONG (2007) might be thus supported. Nevertheless, we conclude that the determination of the relationships of the European species needs a much broader approach based on evaluation of the morphological structures of both sexes, including the male as well as the female terminalia, genetic evaluation, and a delimitation of biological requirements.

\*

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## REFERENCES

- ACKLAND, D. M. (1969) A redescription of *Pegohylemyia retusa* Ringdahl, including the 3rd instar larva (Dipt., Anthomyiidae). *Entomologiske Meddelelser* **37**: 274–279.
- ACKLAND, D. M. (1972) A further note on anthomyiid flies associated with *Epichloë* fungus. *The Entomologist* **105**: 231–232.
- ACKLAND, D. M. (1989) Anthomyiidae new to Britain, with a description of a new species of *Botanophila*. *Entomologist's Monthly Magazine* **125**: 211–230.
- BLAND, K. P. & ACKLAND, D. M. (2000) The Gentian-feeding anthomyiid *Botanophila tuxeni* (Ringdahl, 1953) (Diptera, Anthomyiidae), new to Britain. *Dipterists Digest* **7**: 27–29.
- HENNIG, W. (1966–1976) Anthomyiidae. In: LIDNER, E. (ed.): *Die Fliegen der palaearktischen Region*. Vol. 7(1). Schweizerbart, Stuttgart, 1xxviii + 974 pp.
- HUCKETT, H. C. (1921) On the morphology of the ovipositor of certain anthomyian genera. *Annals of the Entomological Society of America* **14**: 290–320, pls 20–26.
- HUCKETT, H. C. (1987) Anthomyiidae. Pp. 1099–1114. In: MCALPINE, J. F. (ed.): *Manual of Nearctic Diptera*, Volume 2. Agriculture Canada, Ottawa.
- KOMZÁKOVÁ, O. (2006) Anthomyiidae. In: JEDLIČKA, L., STLOUKALOVÁ, V. & KÚDELA, M. (eds): *Checklist of Diptera of the Czech Republic and Slovakia*. Electronic version 1. <http://zoology.fns.uniba.sk/diptera> (last access June 20, 2009)
- KOTRBA, M. (2000) Morphology and terminology of the female postabdomen. Pp. 75–84. In: PAPP, L. & DARVAS, B. (eds): *Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance)*, Vol. 1. Science Herald, Budapest.
- MICHELSSEN, V. (1983) A new species of *Botanophila* Lioy from Denmark (Diptera: Anthomyiidae). *Entomologica Scandinavica* **14**: 293–296.
- MICHELSSEN, V. (2004) Anthomyiidae. Diptera: Brachycera. In: PAPE, T. (ed.): *Fauna Europaea*, version 1.3, <http://www.faunaeur.org> (last access September 9, 2009)
- MICHELSSEN, V. (2009) Revision of the *Botanophila helviana* species group (Diptera: Anthomyiidae) in Europe. *Zootaxa* **2108**: 45–61.
- XUE, W. & SONG, W. (2007) A review of the genus *Botanophila* Lioy (Diptera: Anthomyiidae) from China, with descriptions of three new species. *Zootaxa* **1633**: 1–38.

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