The identity of *Blondelia pinivorae* (Ratzeburg) (Diptera: Tachinidae), a parasitoid of processionary moths (Lepidoptera: Thaumetopoeidae)

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Abstract

Blondelia pinivorae (Ratzeburg, 1844), an apparently exclusive parasitoid of larvae of processionary moths, is removed from synonymy with *B. nigripes* (Fallén, 1810), a common species which belongs to the most polyphagous tachinid flies. A full redescription is given for *B. pinivorae*, and a key to the European species of *Blondelia* is presented. Lectotypes are designated for *Musca pinivorae* and *Tachina nigripes*. *Blondelia piniariae* (Hartig, 1838) is treated as a synonym of *B. nigripes*.

K e y w o r d s : Tachinidae, *Blondelia*, Thaumetopoeidae, lectotypes, key, new synonymy.

Zusammenfassung

Blondelia pinivorae (Ratzeburg, 1844), ein wahrscheinlich spezifischer Parasitoid von Prozessionsspinner-Raupen, der zuvor mit *B. nigripes* (Fallén, 1810) vermengt war, wird als gültige Art nachgewiesen. *B. pinivorae* wird detailliert wiederbeschrieben und ein Schlüssel für die europäischen *Blondelia*-Arten wird erstellt. Für *Musca pinivorae* and *Tachina nigripes* werden Lectotypen designiert. *Blondelia piniariae* (Hartig, 1838) wird als Synonym von *B. nigripes* aufgefasst.

Contents

1 Introduction

The genus *Blondelia* Robineau-Desvoidy, 1830 constitutes a morphologically and biologically homogeneous group within the large and multiform tribe Blondeliini (Herting 1984; Shima 1979, 1984; Wood 1985; Tschorsnig & Herting 1994). This tribe includes small to medium sized flies recorded as parasitoids on a wide range of host species including larvae and adults of beetles, larvae of Lepidoptera, sawflies and crane-flies, and also nymphs and adults of grasshoppers. Most females are known to deposit incubated or unincubated eggs directly onto the integument of their hosts, but females of *Blondelia*, *Vibrissina* and *Compsilura* possess a piercing ovipositor that enables an injection of larvae directly into the host. All *Blondelia* species are, as far as known, parasitoids of larvae of Lepidoptera or Hymenoptera (Symphyta).

At least the Nearctic and Palaearctic *Blondelia* share the following features: Eyes practically bare. Fronto-orbital plate with 2–3 (rarely 4 in male) reclinate inner orbital setae (anteriormost seta smallest); without proclinate outer orbital setae in male. Ocellar setae strong and proclinate. Facial ridge with a few recumbent setulae on lower half or less. First flagellomere in male about as long as or slightly longer than that of the female. Parafacial bare. Prosternum normally with setulae (specimens with bare prosternum extremely rare). Proepisternum bare except for 1–2 seta(e) and some hairs at lower margin. Postpronotum with 4 (rarely 5) setae; 3 basal setae arranged in a straight or slightly curved row. Katepisternum with 3–4 setae (specimens with only 2 setae extremely rare). First postsutural supra-alar seta shorter and weaker than notopleural setae. Scutellum with 3 pairs of strong setae: basal and lateral pair shorter than subapical pair; apical pair undifferentiated, short and hair-like except for *B. inclusa* where the apical scutellar bristles are rather strong, sometimes almost as long as the scutellum. Wing with second costal sector bare ventrally; cell r_{4+5} ending well before wing tip; open or closed, rarely with a very short petiole. Anterodorsal apical seta of the fore tibia longer than the dorsal apical seta. Mid tibia with 2–5 strong anterodorsal setae. Abdomen with mid-dorsal depression on syntergite 1+2 extending back to hind margin; tergite 2 with 1–2 pairs of median marginal setae. ♀♀: Ventral margins of tergite 3 and

4 raised, forming a sharp keel, their posterior edges with small and stout spines. Sternite 7 modified into a hook-like piercer (HERTING 1957, SHIMA 1984, WOOD 1985).

The genus *Blondelia* (sensu WOOD 1985) is mainly represented in the Holarctic region, but occurs in all biogeographic regions except the Australasian one (O'HARA 2008). Up to the present six species of *Blondelia* are recorded from the Palaearctic region, i. e. *B. angusticornis* Herting, 1987, *B. siamensis* (Baranov, 1938) [= *B. breviceps* Shima, 1984] (O'HARA et al. 2009), *B. vexillaria* (Villeneuve, 1922), *B. inclusa* (Hartig, 1838), *B. nigripes* (Fallén, 1810), and *B. piniariae* (Hartig, 1838) (HERTING 1987, HERTING & DELY-DRASKOVITS 1993), of which the latter three are found in Europe (TSCHORSNIG et al. 2004). One eastern Palaearctic species, *B. siamensis* (Baranov, 1938), is also found in the north eastern fringe of the Oriental region (SHIMA 1997), and one species, *B. vexillaria* (Villeneuve, 1922), is restricted to North Africa (Tunisia). Only one species, *B. tibialis* Mesnil, 1962, is known from the Afrotropical region (MESNIL 1962). Six species are distributed in America north of Mexico (O'HARA & WOOD 2004), and ten species are cited from the Neotropical region (GUIMARÃES 1971).

In this paper *Blondelia pinivorae* (Ratzeburg, 1844), earlier placed in synonymy with *B. nigripes* (Fallén, 1810), is shown to represent a valid species while *B. piniariae* is proposed as a new synonym of *B. nigripes*. Detailed information is given on the types of *Musca pinivorae* Ratzeburg, *Tachina nigripes* Fallén and *Tachina piniariae* Hartig.

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2 Material and Methods

This study was based on our examinations of the following material representing three Palaearctic species of *Blondelia*:

B. pinivorae (Ratzeburg, 1844): A syntype (now lectotype) from Germany [ZSM], 133 specimens from Sweden [CB, MZLU, NMSZ], Turkey [MTPPD, CBYS] and Europe [NHMW] (see material listed in chapter 3).

B. nigripes (Fallén, 1810): 386 specimens from Sweden including 3 syntypes [CB, CRE, MZLU, NHRS], Denmark [CB], Finland [MZH], the Netherlands [CTZ] Poland [CBYS], and Russia [MZH]). In addition 169 specimens previously assigned to *B. piniariae* (Hartig, 1838): 8 syntypes probably from Germany [ZSM], 161 specimens from Germany, Poland and the Czech Republic, all reared from *Bupalus piniaria* [SMNS, CBYS]. Among the reared material are numerous specimens from Böhmen [= Bohemia] and Mähren [= Moravia], reared by F. A. WACHTL.

B. inclusa (Hartig, 1838): 14 specimens from Sweden [CRE, MZLU], Poland [CBYS] and Russia [MZH].

The dissection of the male and female terminalia was performed following the method described by O'HARA (2002).

External morphological images (Figs. 1–6) were taken with a Nikon D2X digital camera mounted to a bellow and a macro-optical tube. Images of the terminalia (Figs. 7–18) were taken with a digital camera Nikon Coolpix 8400 mounted on a stereoscopic microscope Nikon SZS 1500. To create a completely focused image, a series of images of each object was taken at different focal planes. Using HeliconFocus, a program that combines the focused areas from the several partially focused images, creates one completely focused image.

Data on the labels of type material are listed using the following symbols: / = end of a line; // = end of a label (from top to bottom on the same pin).

The dissected male and female terminalia are preserved in glycerol in a small plastic tube pinned together with the specimen.

Terminology of external morphology and terminalia as well as measurements and ratios of head follow TSCHORSNIG (1985) and TSCHORSNIG & RICHTER (1998).

Acronyms of depositories

CB	Private collection of C. BERGSTRÖM, Uppsala, Sweden
CBYS	Private collection of C. BYSTROWSKI, Warsaw, Poland
CRE	Private collection of ROGER ENGELMARK, Umeå, Sweden
CTZ	Private collection of THEO ZEEGERS, Soest, the Netherlands
MTPPD	The Museum of Tokat Plant Protection Department, Tokat, Turkey (K. KARA)
MZH	Zoological Museum, Division of Entomology, Helsinki, Finland (P. VILKAMAA)
MZLU	Museum of Zoology, Lund University, Lund, Sweden (R. DANIELSSON)
NHMW	Naturhistorisches Museum, Vienna, Austria (P. SEHNAL)
NHRS	Swedish Museum of Natural History (= Naturhistoriska Riksmuseet), Stockholm, Sweden (B. VIKLUND)
NMSZ	National Museums of Scotland, Edinburgh, U. K. (D. ROBERTSON)
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany (H.-P. TSCHORSNIG)
ZSM	Zoologische Staatssammlung, Munich, Germany (M. KOTRBA)

3 *Blondelia pinivorae* (Ratzeburg, 1844)

Material

Lectotype (♀) of *Musca pinivorae* Ratzeburg, 1844 from Germany (locality unknown). RATZEBURG's collection is supposed to be lost (see below), but a female that most probably emanates from his collection is still available in HARTIG's collection in ZSM. This female was examined by MIK & WACHTL

(1895: 242) who mentioned that it bears an original label of RATZEBURG. MIK and WACHTL undoubtedly regarded the studied female as type, but as they did not state that in their publication, it is no fixation of a lectotype in the sense of Art. 74.6. ICZN. We also assume, in accordance with Art. 72.4.1.1. ICZN that the specimen of *B. pinivorae* from the HARTIG collection in ZSM belongs to the type series of RATZEBURG. The full labelling is as follows: "262 // [printed] aus dem Kasten: / Tachiniden-Typen / von HARTIG und RATZEBURG // [handwritten label of RATZEBURG] *pinivorae* / Rtzbg. // [printed and handwritten red label] Type von RATZEBG: / *Lydella* R.-D. / *pinivorae* Rtzbg. // [handwritten] *Blondelia* / *nigripes* Fall. / B. HERTING det. ♀ // [printed] *Blondelia* ♀ / *pinivorae* (Ratzeburg) / det. C. BERGSTRÖM 2008". The specimen is in fairly good condition except for the head that is devoid of numerous setae. This specimen of RATZEBURG is hereby designated as lectotype.

A d d i t i o n a l s p e c i m e n s : **Europe** (country unknown, probably Central Europe): 1 ♂ "[handwritten] *Masicera*? / (*Chaetotachina*) // *Cn. pinivora* / 20/5 // 86 // *Blondelia* ♂ / *pinivorae* (Ratzeburg) / det. BERGSTRÖM 2007" [NHMW]. – 1 ♀ "[handwritten] *Cn. pinivora* 13/5 // [printed] *machairopsis* / det. B. B. // *Blondelia* ♀ / *pinivorae* (Ratzeburg) / det. BERGSTRÖM 2007" [NHMW]. — **Sweden:** 1 ♂, 1 ♀, Öland, Böda, 20.VIII.1956, em. 21.IX.1956, ex *Thaumetopoea pinivora*, leg. E. THAM [MZLU]. – 2 ♀♀ [one of it misidentified as ♂ in FORD et al. 2000], Öland, Böda, Byerum, 31.VII.1993, em. VI.1994, ex *Thaumetopoea pinivora*, leg. CLAES ELIASSON [NMSZ]. – 2 ♀♀, Öland, Böda, VIII.1993, em. 20.VIII.1995, ex *Thaumetopoea pinivora*, leg. CLAES ELIASSON [NMSZ]. – 1 ♀, ex *Thaumetopoea pinivora*, leg. F. NORDSTRÖM [MZLU]. – 3 ♂♂, 5 ♀♀, Gotland, Sudret, em. V.–VI.2005, from pupae inside cocoons of *Thaumetopoea pinivora*, leg. STIG LARSSON [CB]. – 1 ♂, 1 ♀, Gotland, Vamlingbo parish, host cocoon collected from the ground in spring 2007, em. 28.V.2007, ex *Thaumetopoea pinivora*, leg. STIG LARSSON [CB]. – 15 ♂♂, 7 ♀♀ and 2 puparia, same data as before, but em. 29.V.–1.VI.2007 [CB, 1 ♂ SMNS]. – 2 ♂♂, 2 ♀♀, Gotland, Sundre parish, Hoburg, host cocoon collected from the ground in spring 2007, em. 28.V.2007, ex *Thaumetopoea pinivora*, leg. STIG LARSSON [CB]. – 1 ♀, same data as before, but em. 29.V.–1.VI.2007 [CB]. – 3 ♂♂, 2 ♀♀, Gotland, Sundre parish, Muskmyr, host larvae collected from *Pinus* 28.VII.2006, em. spring 2007, ex *Thaumetopoea pinivora*, leg. MIKAEL JOHANNESSON [CB]. – 28 ♂♂, 28 ♀♀, Gotland, Vamlingbo parish, Nore, collected with simple emergence traps or glue traps in an area infested with *Thaumetopoea pinivora*, VII.2009, leg. STIG LARSSON [CB]. — **Turkey**: 5 ♂♂, 5 ♀♀ [examined out of a total number of 42 ♂♂, 38 ♀♀], Isparta, 25.IV.2000, ex *Thaumetopoea ispartaensis*, leg. M. AVCI [4 ♂♂, 4 ♀♀ MTPPD; 1 ♂, 1 ♀ CB]. – 1 ♂, 14 ♀♀, Alacabel near Sydişehir, 1825 m, on *Euphorbia* plants [= "wilczomlecze"], locality [= "st."] 1, 23.VI.2009, leg. C. BYSTROWSKI [CBYS].

History of the use of the name *Musca pinivorae*

RATZEBURG (1844: 172–174) described eleven new tachinid species, of which today only *Ceromya flaviceps* is considered a valid species. Most of his collection, including the type specimens, is supposed to be destroyed during the Second World War (HERTING 1990, ZIEGLER 1998). However, as mentioned above, one presumable type specimen still exists in HARTIG's collection in ZSM. The original description of *Musca pinivorae* Ratzeburg (1844: 173–174) is – like many old descriptions – very insufficient, reading: "15. *M. Pinivorae* 5–5¼ ´´´ lang, gestreckt. 2. Fühlgl. z. 3 = 1 : 2. Borste etwa ¼ verdickt. Sp. Quernerv fast grade. Gesicht, Stirn und Scheitel fast ganz schwarz; Taster dunkel; Hinterleib lang-kegelförmig, an der Seite des 2. u. 3. Ringes roth. Ausserordentlich borstig. Im Herbste von mir aus Raupen und Puppen der *Bombyx pinivora* gezogen".

The presence of lateral red spots on the abdominal tergites 3 and 4 only fits the male gender. This feature was also noted by the first revisers MIK & WACHTL (1895: 242): "RATZEBURG hat die oben reproducirte Beschreibung offenbar nach einem ♂ entworfen". The original description is, however, extremely scarce and as it is not explicitly stated that it refers to the male gender alone, it can therefore not be ruled out that RATZEBURG's type series also included females.

In fact MIK & WACHTL (l. c.) also found a female specimen of *Musca pinivorae* in HARTIG's collection: "sub Nr. 262 ein ♀ unter dem Namen *Tachina pinivorae* mit Originalzettel von RATZEBURG". They regarded the name as valid in the new combination *Dexodes pinivorae* Ratzeburg. In a comprehensive description they also presented features, e. g. width of parafacial at narrowest point compared to maximal width of face, that made it possible to distinguish *D. pinivorae* from their *D. piniariae*. *Dexodes* was replaced by *Lydella* in the Katalog der Paläarktischen Dipteren (BEZZI & STEIN 1907) where *Lydella nigripes* (= *Blondelia nigripes*) and *Lydella pinivorae* (= *B. pinivorae*) were treated as species propria while *L. piniariae* (= *B. piniariae*) was regarded as a synonym of *L. nigripes*. This opinion was unfortunately not followed by later authors. BAER (1921: 156–157) who also examined the specimens in HARTIG's collection, treated both *Lydella pinivorae* and *L. piniariae* as synonyms of *Lydella nigripes*. STEIN (1924: 96) mentions under *Ceromasia nigripes* (= *Blondelia nigripes*) two large males, with a body length of almost 12 mm and with brownish yellow palps and a single female standing in RATZEBURG's collection, all reared from *Thaumetopoea pinivora* and thus apparently representing syntypes that are lost today (see above). Furthermore he mentions a female of *Ceromasia piniariae* (measuring 8 mm) and a female of *C. pinivorae* (12 mm) standing in HARTIG's collection in Munich, apparently representing the two specimens illustrated in the paper of MIK & WACHTL (l. c.). In accordance with BAER (l. c.) he regarded all these specimens to represent a single species, i. e. *Ceromasia nigripes* (= *Blondelia nigripes*). HERTING & DELY-DRASKOVITS (1993) treated *B. pinivorae* as a synonym of *B. nigripes* while *B. piniariae* was listed as a valid species. *Musca pinivorae* herein revised is removed from synonymy with *Blondelia nigripes* (Fallén, 1810) and established as a valid species in the combination *Blondelia pinivorae* (Ratzeburg, 1844).

Redescription

Male:

Colouration and pruinosity: Head black with dense grey to white pruinosity, sometimes with a yellowish tinge; frontal vitta black. Face at mouth margin, lower anterior portion of parafacial, and genal groove reddish brown or brownish but usually well hidden by pruinosity. Antenna including arista black or brownish black. Palps black or brownish black. Thorax black, dorsally covered with a rather dense greyish white pruinosity; marked with 5 unpruinose dark longitudinal stripes; middle stripe absent in front of the suture; the three median stripes behind the suture mostly confluent in the anterior region. Wing veins as well as microtrichia infuscated (dark with a brownish tinge). Mesothoracic spiracles lined with black hairs; flap of metathoracic spiracle covered with black hairs. Tegula and basicosta black. Calypter yellowish white, the fringe slightly more reddish yellow. Halter slightly infuscate at base, stem brownish yellow, knob at least partly reddish. Legs black. Abdomen (Fig. 5) black with a pair of reddish brown spots laterally on tergites 3 and 4 and narrow spots occasionally visible laterally on tergite 2. Syntergite 1+2 unpruinose except for a very narrow posterior band of greyish white pruinosity. Tergites 3–5 with basal bands of greyish white pruinosity dorsally covering anterior $^{3}/_{4}$–$^{4}/_{5}$, $^{2}/_{3}$–$^{3}/_{4}$ and $^{3}/_{5}$–$^{3}/_{4}$ respectively, towards hind margins replaced by a thin and brownish pruinosity; interrupted in the middle by a more or less continuous black longitudinal stripe.

Head (Figs. 1, 2): Eyes practically bare, but at higher magnification with scattered microscopic pale hairs as long as 1–1.5 eye facets. Frons about as long as face. Frons at its narrowest point 0.24–0.30 times (n = 15) as wide as head in dorsal view. Interfrontal area at midpoint 1.0–1.2 times as wide as the corresponding parafrontal area. Ocellar setae proclinate, usually as strong as strongest frontal setae; postocellar setae well developed. Inner vertical seta 0.6–0.7 of eye-height; outer vertical setae undifferentiated, rarely somewhat exceeding the length of the adjacent postocular setae, weaker and also shorter than postocellar setae. A row of 7–9 crossed frontal setae descending to about apex of pedicel or slightly beneath; 2–4 strong inner reclinate orbital setae. Parafrontal outside the frontal setae with numerous long erect hairs and frequently also with some fairly strong setae that can form a parallel row of small frontal setae. Parafacial in frontal view slightly narrowing below, nearly always bare, i. e. no parafrontal hairs descending below the level of the lowest frontal seta; at its narrowest point (actual width) 0.28–0.31 times (n = 15) as wide as the maximum width of the face (including the facial ridges). Facial ridge with 1–2 strong supravibrissal setae and numerous setulae in lower ⅓–½. 2–4 strong subvibrissal setae. Back of head covered with pale hairs, behind the postocular row with numerous short black setae arranged in one or two somewhat irregular rows. Flagellomere 1 relatively short, in lateral view about 3 times as long as wide and evenly curved at apex, 1.76–2.20 times (n = 14) as long as pedicel. Arista thickened in its basal $^{1}/_{5}$–$^{1}/_{4}$, gradually tapering towards the middle. Sclerotized part of prementum about twice as long as wide. Palpus not or only slightly widened apically, about as long as first flagellomere, its tip densely covered by black hairs.

Thorax: Postpronotum with 4 (rarely 5) setae; 3 basal setae arranged in an almost straight line and 1 slightly weaker seta in front of the middle and inner basal setae. Scutum with 2 inner posthumeral setae, the foremost often weak, 1 outer posthumeral seta, 3 + 3 pairs of acrostical setae, 3 + 3 pairs of dorsocentral setae and 1 + 3 pairs of intra-alar setae. First postsutural supra-alar seta distinctly weaker than notopleural setae. Katepisternum with 3 setae. Katepimeron bare or with 1–2 small setulae at the anterior edge. Anepimeral seta weak, distinctly weaker than the lowest katepisternal seta. Scutellum with 3 pairs of strong setae along margin; basal pair of setae subequal to the lateral pair and about 0.8 times as long as the strong subapical pair; apical pair minute (hair like) not exceeding the size of the ground vestiture; dorsal surface of scutellum with 2(–3) + 4 erect discal setae, the strongest almost as long as the length of the scutellum.

Wing: Costal spine weakly developed, about twice as long as the surrounding costal setulae, normally distinctly shorter than cross-vein r-m; second costal section bare ventrally; combined fourth and fifth costal section 1.4–1.8 times as long as sixth costal section. Vein R_{4+5} dorsally with 2–4 setulae at base. Bend of vein M obtuse and normally without an appendage; apical section of vein M slightly concave, normally distinctly longer than section of M between crossvein dm-cu and bend; section of M between dm-cu and bend 0.9–1.4 times as long as distance between bend of vein M and margin of wing. Last section of vein CuA_1 at least as long as crossvein dm-cu.

Legs: Claws and pulvilli on fore legs about 1.2 times as long as tarsal segment 5, the latter 1.7–1.8 times as long as tarsal segment 4. Fore tibia with 2 posterior setae and a row of 6–8 short anterodorsal setae; preapical anterodorsal seta well developed, longer and stronger than the preapical dorsal seta. Mid tibia with 3–5 strong anterodorsal setae, accompanied by 1–4 sometimes very weak setulae, 2 posterior and 1 strong and 1–2 small ventral setae. Hind tibia with an irregular row of 12–14 anterodorsal setae including a stronger seta inserted at middle of row, 5–6 posterodorsal setae including a strong seta at level of strong anterodorsal seta, 3–4 anteroventral setae, and 2 preapical dorsal setae; preapical posteroventral seta undifferentiated.

Abdomen (Fig. 5): Ground vestiture partly recumbent dorsally on tergite 3, more erect in the dorsomedial region

(along the black longitudinal mid-stripe) and laterally, erect or semi-erect on tergites 4 and 5. Tergite 2 with 2–4 median and 1–(2) lateral marginal seta(e) on each side. Tergite 3 dorsally with 2–4 median and 2 lateral marginal setae on each side, with 2 (rarely 3) median discal and 0–1 lateral discal setae on each side. Tergite 4 with a complete row of 8–12 marginal setae, dorsomedially normally with 2–4 strong discal setae often mixed with some additional setulae, rarely with as many as 6 strong setae, but medial discal setae always well separated from 1–3 lateral discal setae. Tergite 5 with numerous discal setae, sometimes arranged in 2–3 more or less irregular rows, and with marginal setae at the tip.

Male terminalia (Figs. 7–9): Sternite 5 about as wide as long; basal plate long and strongly arched; anterior margin evenly rounded except for a small indentation at midpoint; posterior margin with a U-shaped incision, basally with a narrowing, reaching to about middle of that segment; maximal width of incision as wide as or slightly wider than the width of the posterior lobe at that point; posterior lobe on surface with numerous setulae of varying size, medioapical margin densely short-haired. Sternite 6 well developed, strongly asymmetrical. Tergite 6 rather weakly sclerotized, widely constricted at the middle or separated into two hemitergites, rarely with some weak hairs along inner posterior margin; spiracle 6 situated in membrane close to lower margin of segment 7 + 8. Segment 7 + 8 narrow, with numerous setulae; spiracle 7 above, in an almost dorsolateral position, close to the anterior margin of that segment. Epandrium in dorsal view approximately twice (1.8–2.0 times) as wide as long. Cerci robust, in lateral view widest at about middle with ventral margin almost straight in apical half, in dorsal view wide for a long distance and tapering shortly before apex, 3.7–4.0 times as long as wide at level of beginning of apical cleft; cleft about 0.25–0.30 times as long as basal suture. Surstylus distinctly shorter than cerci, in lateral view subrectangular, its tip evenly rounded with setulae in the dorsodistal portion, some of them noticeably long. Pregonite with 4–5 hairs in apical portion. Postgonite narrow, hook-like, with 2–3 sensorial hairs, membranous apically. Intermedium long and narrow. Basiphallus without basal projection; epiphallus distinctly sclerotized, inserted basally. Ventral plate of distiphallus densely covered with spinules; lateroventral lobes insignificantly developed.

Body length: 8.4–11.2 mm [10.9] (n = 17).

Female (differences to male):

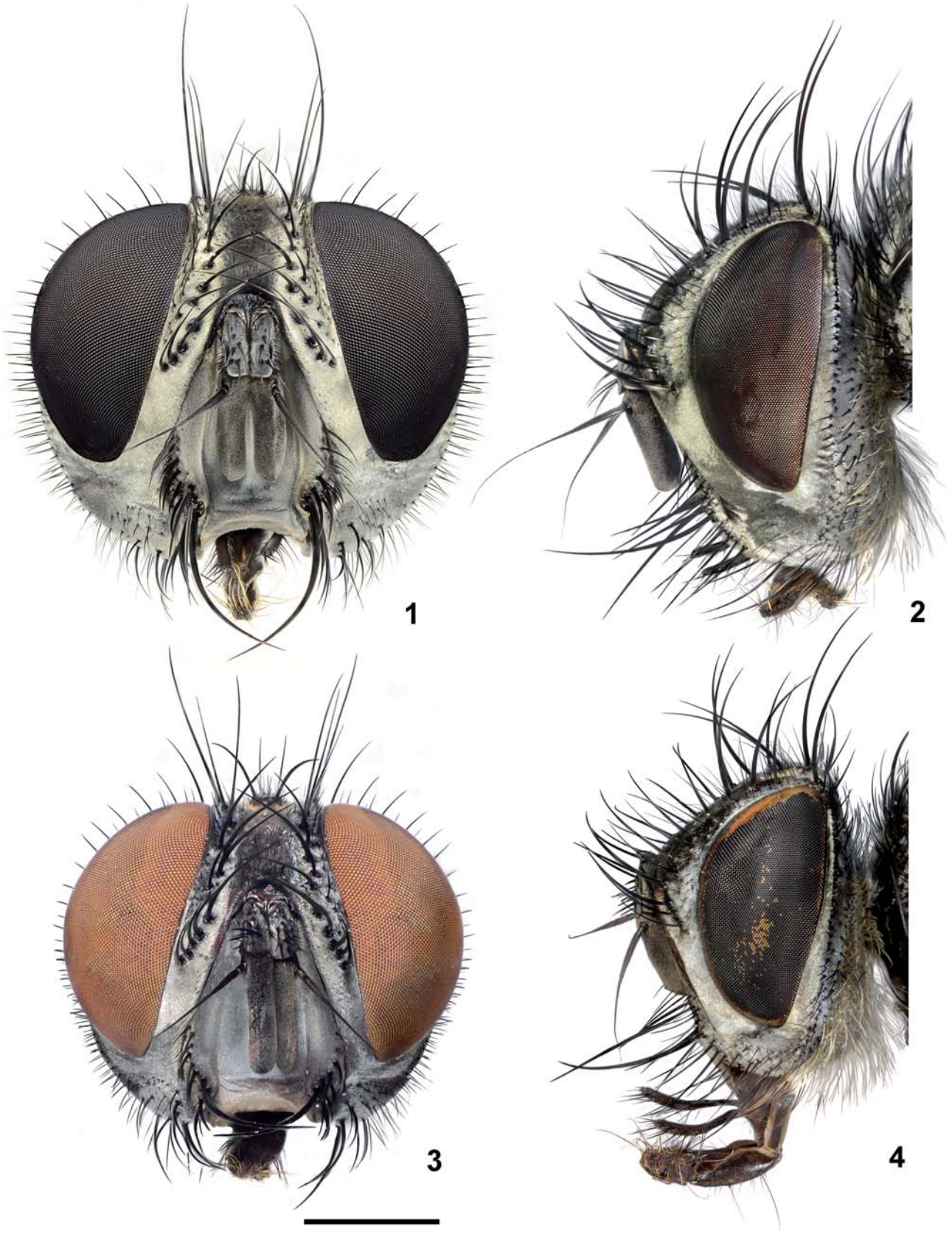
Frons at narrowest point 0.32–0.37 [0.36] times (n = 17) as wide as head in dorsal view. Interfrontal area at midpoint 0.6–0.7 times as wide as the corresponding parafrontal area. Parafrontal area with a row of [4]5–7 frontal setae; 2 outer proclinate orbital setae and 2 inner reclinate orbital setae (the posteriormost seta smaller and often slightly lateroclinate). Inner vertical seta about 0.8 of eye-height; outer vertical setae well developed, about half as long as inner vertical seta and also longer and stronger than postocellar setae. Parafacial at its narrowest point (actual width) 0.31–0.38 [0.34] times (n = 17) as wide as the maximum width of the face (including the facial ridges). First flagellomere 1.62–1.97 [1.72] times (n = 14) as long as pedicel. Legs: Claws and pulvilli on fore legs about as long as tarsal segment 5, the latter 1.5–1.6 times as long as tarsal segment 4. Abdomen: Ventral margins of tergites 3 and 4 raised, forming a sharp ventral keel with 5–8 rather long but still stout spines at the posterior edges of tergites 3 and 4.

Ground vestiture dorsally on tergites 3 and 4 recumbent also in the dorsomedial region, partly erect on tergite 5. Tergite 2 with 2 median and 1 lateral marginal seta(e); tergite 3 with 2 median and 0–1 lateral marginal setae, 2(rarely 3) median discal setae and 0–1 [0] lateral discal setae; tergite 4 with a complete row of 8–10 [10] marginal setae, dorsomedially normally with 2 strong medial discal setae (rarely without) and 0–1 [0] lateral discal setae. Tergite 5 with fewer discal setae compared to male, arranged in two rows in the posterior ⅔ of that segment.

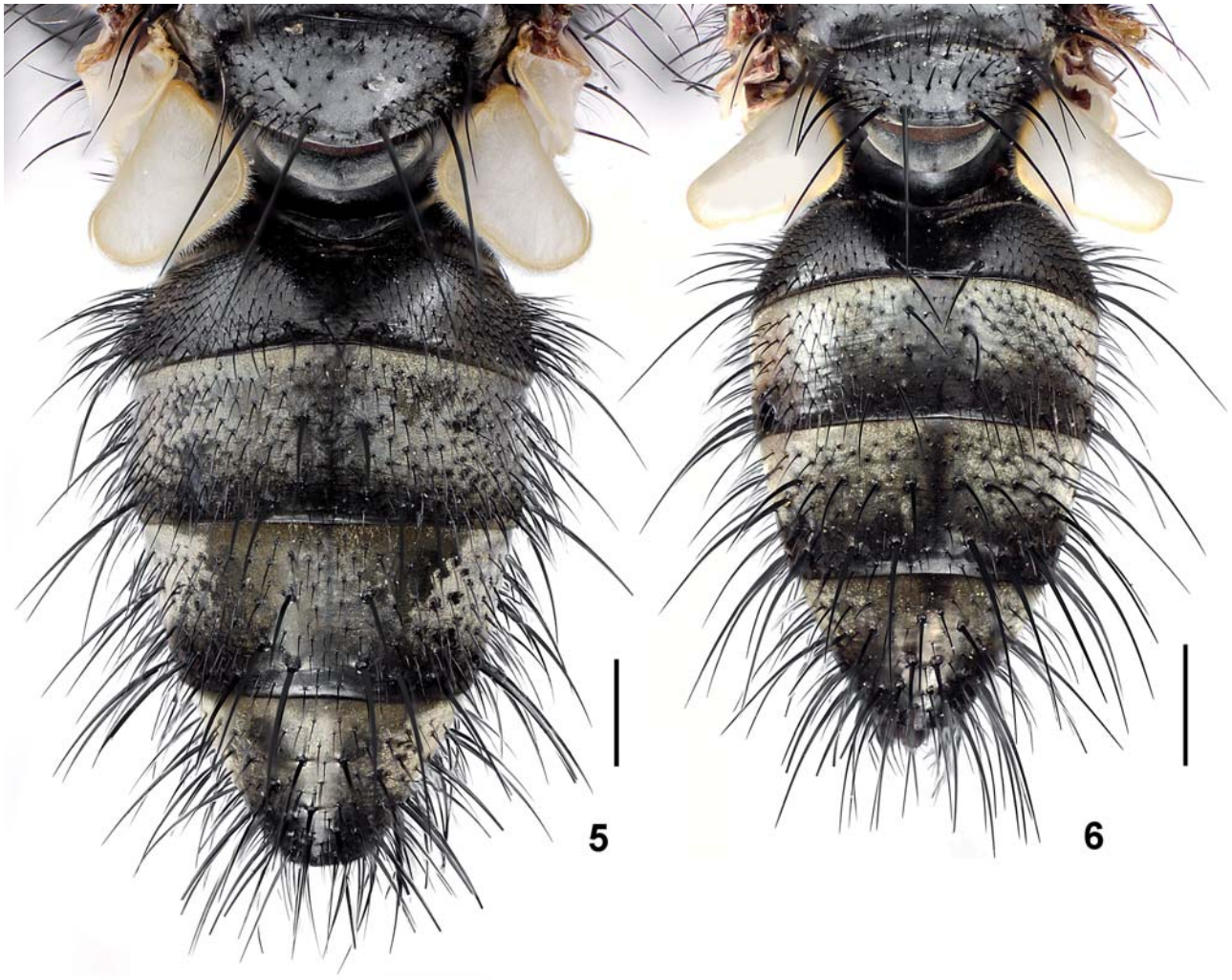
Female terminalia (Figs. 13, 17): Sternite 5 with posterior half triangular in caudal view, somewhat membranous along mid line, anterior half with a long and narrow invagination concealed below sternite 4. Tergite 6 short, entire, slightly constricted at middle, with numerous hairs along posterior margin. Sternite 6 in lateral view modified into a distinct downcurved hook, apex in caudal view about twice as long as wide at middle, anterior invagination fairly membranous with two sensorial pits (sensilla trichodea) at base. 6th and 7th spiracles in the membrane between tergite 6 and sternite 6. Tergite 7 divided into two hemitergites. Sternite 7 with posterior part modified into a downcurved hook-like piercer, basal lateral part differentiated into a wide and mostly stoutly sclerotized bridge fused to tergite 7, a minute anterior invagination with two sensorial pits. Tergite 8 divided into two small hemitergites, subtriangular in basal half and narrowly extended posteriorly. Sternite 8 long and narrow (sometimes apparently short due to the membranous apical part). Epiproct present. Hypoproct densely covered by microtrichia, lingulae long and wide in dorsal view, extending parallel to the narrow extension of tergite 8 and approaching its subtriangular area. Cerci short.

Distribution

B. pinivorae is mainly recorded from Sweden (Öland and Gotland), but as the species is also known from Germany (type material) and Turkey, it is most probably widespread in Europe.



Figs. 1–4. *Blondelia* spp., ♂, head, frontal (1, 3) and lateral (2, 4) view. – **1**, **2**. *B. pinivorae*. **3**, **4**. *B. nigripes*. – Scale: 1 mm.



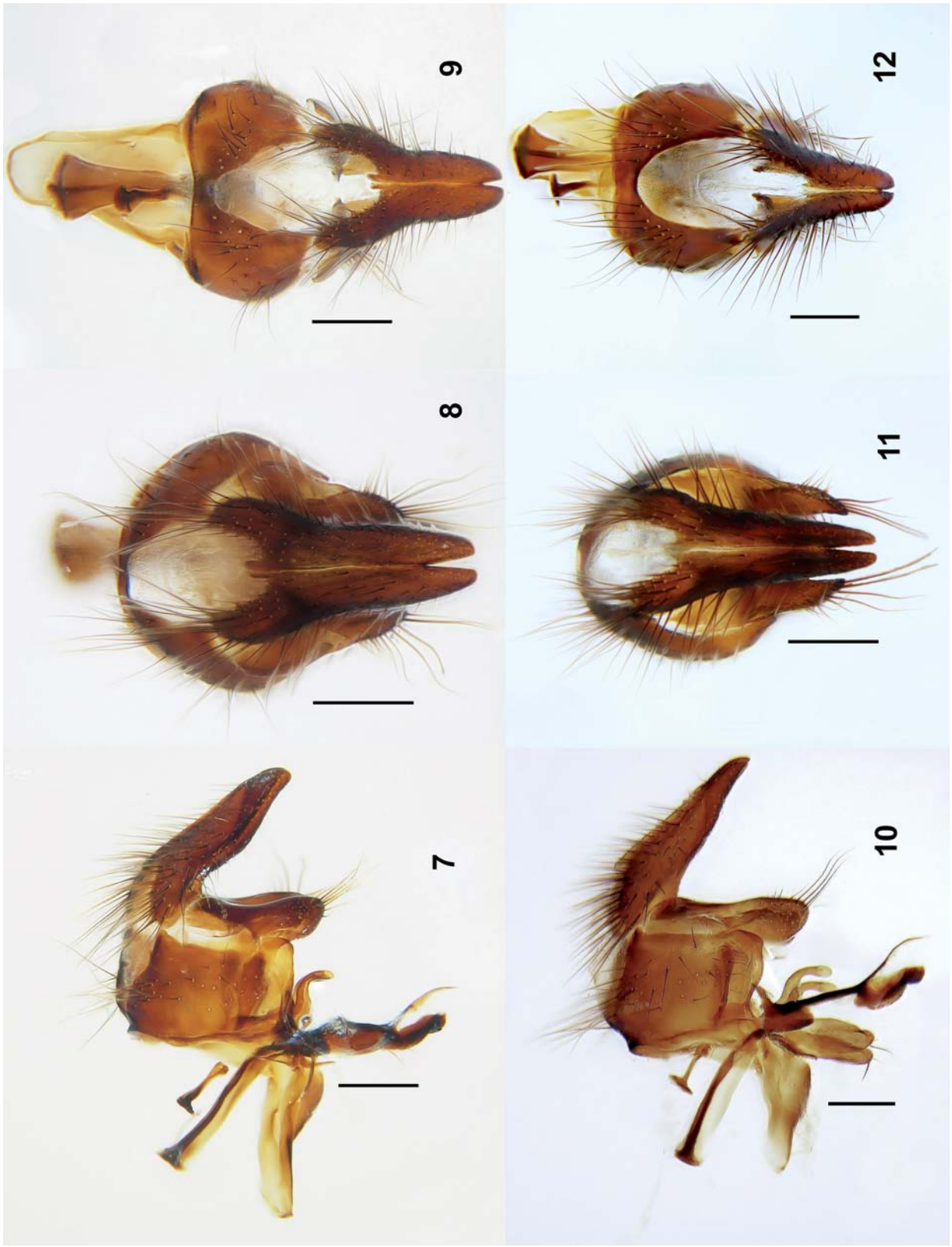
Figs. 5–6. *Blondelia* spp., ♂, abdomen, dorsal view. **5**. *B. pinivorae*. **6**. *B. nigripes*. – Scales: 1 mm.

Biology

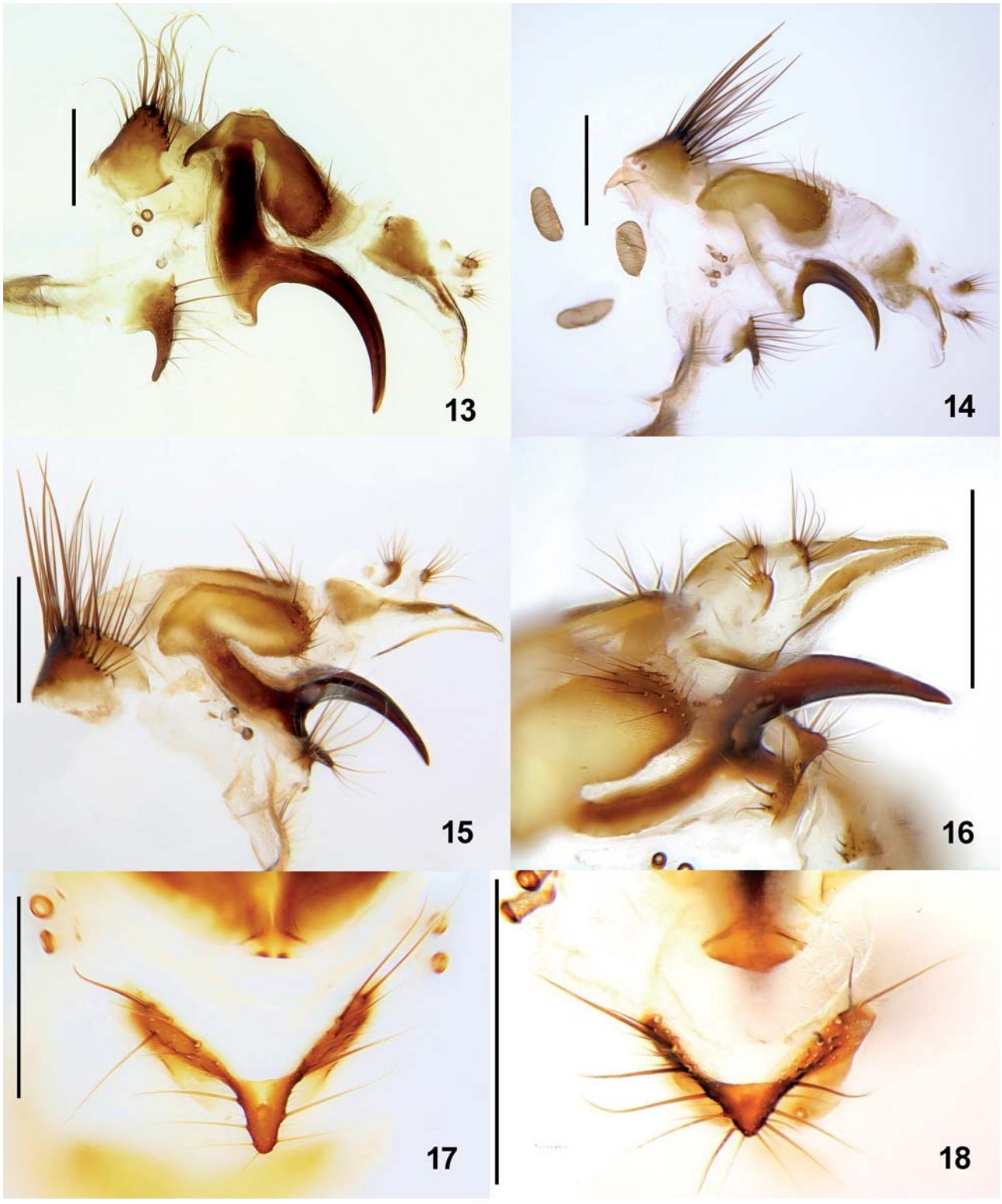
Blondelia pinivorae is probably, based on the available information, a principally univoltine and almost monophagous parasitoid of larvae of processionary moths (Lepidoptera: Thaumetopoeidae). However, it cannot be ruled out that it at least occasionally needs an alternate host to fulfil its life cycle. Flight period in Sweden normally from late May to end of July, but specimens reared from cocoons occasionally emerge from late August to late September.

A total of 99 Swedish specimens of *B. pinivorae* have been examined in this study: 43 specimens were reared from the northern pine processionary moth *Thaumetopoea pinivora* (Treitschke, 1834) and 56 specimens were collected with simple emergence traps or glue traps from localities infested by this host (56). Most specimens originate from a rearing experiment in Gotland (Larsson 2006), but a few are also from Öland (Ford et al. 2000, as *B. nigripes*). The Gotland population of *T. pinivora* has a two-year development with parallel cohorts (year classes). The host larvae feed from April to end of July, which indicates that flies emerging from one cohort will parasitize larvae of the parallel cohort. Cohorts with high larval densities only occur in even years and are followed by a relatively large population of *B. pinivorae* in uneven years (Larsson 2006).

One or two (rarely three) full-grown tachinid larvae come out from each host (5th instar larva, prepupa or pupa). The pupariation takes place inside the host cocoon, or in its close vicinity. The most probable scenario is that the tachinid hibernates in its puparial state inside the cocoon close together with the dead host pupa (in the ground), but this has not been shown in Larsson's study. The adult flies emerge under natural conditions from end of May to mid



Figs. 7–12. *Blondelia* spp., ♂, hypopygium in lateral (7, 10), caudal (8, 11) and dorsal (9, 12) view. – **7–9**. *B. pinivorae*. **10–12**. *B. nigripes*. – Scales: 0.25 mm.



Figs. 13–18. *Blondelia* spp., ♀, terminalia in lateral (13–15) and oblique dorsal view (16), sternite 6 in caudal view (17, 18). – **13**, **17**. *B. pinivorae*. **14–16, 18**. *B. nigripes*. – Scales: 0.5 mm.

July the following year. However, if the Swedish population of *B. pinivorae* is monophagous (restricted to *T. pinivora*), it is not easy to explain the occurrence of newly emerged flies in autumn (August – September). One possibility is that they originate from perpetual host larvae whose development has been influenced by an abnormal rearing temperature.

We have also examined ten Turkish specimens reared from the cedar processionary moth *Thaumetopoea* [= *Traumatocampa*] *ispartaensis* Doğanlar & Avcı, 2001, published as *Blondelia nigripes* by Avci & Kara (2002). This material turned out to be *B. pinivorae*, as well as the two specimens in NHMW reared from *T. pinivora* (published by Herting 1960 as *B. nigripes*). Baer's (1921) record of *B. nigripes* from *T. pinivora* refers to the original material of *B. pinivorae* of Ratzeburg (1844). So it is obvious, that *B. pinivorae* represents the only species of *Blondelia* from those two processionary moths.

The winter pine processionary moth *Thaumetopoea pityocampa* (Denis & Schiffermüller, 1775) is a commonly reared host which is primarily attacked by *Phryxe caudata*, but frequently also by *Compsilura concinnata*, and more rarely by *Exorista segregata* and *E. larvarum* (e. g. Biliotti 1956, 1958; Démolin 1970; Kara & Tschorsnig 2002; López-Sebastián et al. 2007; Cerretti & Tschorsnig 2010). The first author has also examined an extensive material reared from *T. pityocampa* kindly sent to him from Andrea Battisti (University of Padova). This material, apart from numerous specimens of *P. caudata*, also included many specimens of *C. concinnata* and also a single specimen of *E. larvarum* (from Sardinia). There is only a single literature record of *Blondelia nigripes* from *T. pityocampa* (Herting 1960). Without a study of the specimen(s), it cannot be decided if it really refers to *B. nigripes* or to *B. pinivorae*, but *Blondelia* is surely of negligible importance as parasitoid of *T. pityocampa*.

The oak processionary moth *Thaumetopoea processionea* (Linnaeus, 1758) is rarely recorded as a host for *Blondelia nigripes* (Dowden 1933, Zeegers 1997). The first author has dissected the single male specimen from the Zeegers material and it is actually representing *B. nigripes*, although the genitalia are slightly aberrant. However, other tachinid species which are often reared in large numbers from *T. processionea*, especially *Carcelia iliaca* and *Pales processioneae* (Tschorsnig 1996, Cerretti & Tschorsnig 2010), indicate that *Blondelia* is an uncommon parasitoid for this host.

4 Key to the European species of *Blondelia*

Blondelia pinivorae is very similar to *B. nigripes* in outer morphology and was therefore not recognized as a separate species in the available keys. However, it is – although the body size is widely overlapping – normally a distinctly larger species. Overlapping are also the extent of the abdominal pruinosity, the width of the frons in dorsal view, and the width of the first flagellomere in lateral view, but these features may nevertheless be useful in certain cases and are therefore included in the following key, which is modified from Tschorsnig & Herting (1994):

1 Palpus yellow. Scutellum with long and crossed apical setae. First flagellomere in ♂ 2.8–3.8, in ♀ 1.9–2.8 times as long as pedicel. Tergites 3 and 4 with bands of pruinosity in anterior 1/5–2/5. ..... ***B. inclusa***

– Palpus black to brownish yellow. Scutellum without or with only hair-like apical setae. First flagellomere in ♂1.76–2.50, in ♀ 1.43–1.97 times as long as pedicel. Tergites 3 and 4 with bands of pruinosity in anterior 3/5–5/6. ..... **2**

2 Body size 8.4–11.2 mm. Parafacial in frontal view slightly narrowing below; actual width at narrowest point in male 0.28–0.31, in female 0.31–0.38 times as wide as maximal width of face (including the facial ridge) (Fig. 1). First flagellomere in lateral view narrower than actual width of parafacial at middle (Fig. 2). Wing veins and microtrichia strongly infuscated (not visible in sun bleached specimens). Frons in ♂ at its narrowest point 0.24–0.30 times as wide as head in dorsal view, in ♀ 0.32–0.37 times. Abdominal pruinosity covering the anterior 3/4–5/6 of tergite 3, 2/3–3/4 of tergite 4, and 3/5–2/3 of tergite 5 (Fig. 5). – ♂: Tergite 3 with 2–4 median and 2 lateral marginal setae on each side, 2 (rarely 3) median discal setae; tergite 4 normally with 2–4 strong medial discal setae mixed with some additional setulae but always well separated from 1–3 lateral discal setae (Fig. 5). Terminalia: Epandrium in dorsal view 1.8–2.0 times as wide as long (Fig. 9); cerci robust, in lateral view with ventral margin almost straight in apical half (Fig. 7), in dorsal view wide over a long distance (tapering shortly before apex), 3.7–4.0 times as long as wide at level of beginning of apical cleft (Fig. 8); lateroventral lobes of distiphallus vaguely expanded in the medioventral region (Fig. 7). – ♀: Tergite 3 with 2 median and 0–1 lateral marginal setae, 2 median and 0–1 [0] lateral discal setae; tergite 4 dorsomedially with 0–2 strong medial and 0–1 [0] lateral discal setae; tergite 5 dorsally with 2 medial setae separated from 1–2 seta on each side. Terminalia: Sternite 6 in lateral view with a long hook-like ventral projection, in caudal view with apex about twice as long as wide at middle; sternite 7 long and strong, anteriorly with a shallow ventral incurvature (Figs. 13, 17)..... ***B. pinivorae***

– Body size 5.3–9.6 mm. Parafacial in frontal view distinctly narrowing below; actual width at narrowest point in male 0.18–0.26, in female 0.22–0.28 times as wide as maximal width of face (Fig. 3). First flagellomere normally as wide as or wider than actual width of parafacial at middle (Fig. 4). Wing veins and microtrichia yellowish or light brown. Frons slightly narrower, in male at its narrowest point 0.21–0.28 times as wide as head in dorsal view, in female 0.29–0.34 times. Abdominal pruinosity slightly less developed, covering the anterior 3/5–3/4 of tergites 3 and 4, and 1/2–3/5 of tergite 5 (Fig. 6). – ♂: Tergite 3 with at least 4 median and 2 lateral marginal setae on each side (sometimes forming a complete row), 2–4 (rarely 6) median discal setae; tergite 4 usually with a complete row of strong discal setae, sometimes with a second row (Fig. 6). Terminalia: Epandrium in dorsal view 1.4–1.6 times as wide as long (Fig. 12); cerci more slender, in lateral view with ventral margin somewhat incurved in apical half (Fig. 10), in dorsal view wide over a shorter distance (tapering well before apex), 5.0–5.5 times as long as wide at level of beginning of apical cleft (Fig. 11);

lateroventral lobes of distiphallus markedly expanded in the medioventral region (Fig. 10). – ♀: Tergite 3 with 2 median and 1–2 lateral marginal setae, and 2 median and 1 (sometimes weak) lateral discal setae; tergite 4 occasionally with a complete row of strong discal setae but then the row mostly consisting of 2–4 strong medial setae, some erect mediolateral setulae and 2–3 lateral discal setae of different size; tergite 5 dorsally with 10–12 equally sized discal setae forming a complete row. Terminalia: Sternite 6 in lateral view with a short projection, in caudal view with apex about as long as wide at middle; sternite 7 weaker, anteriorly with a deeper ventral incurvature (Figs. 14–16, 18). .....***B. nigripes***

5 Notes on some types of *Blondelia*

Tachina nigripes Fallen, 1810
[Fallén 1810: 270]

Type material: One syntype (♀) is available in the Fallén collection in NHRS, drawer 13 (1) and two syntypes (♀♀) are available in the Diptera Scandinaviae Collection in MZLU, drawer 20 (10). The original description (partly in Swedish) mentions only the female. The male gender was included later by Fallén (1820: 13). The type locality is apparently Kiviks Esperöd, Mellby parish, Scania, Sweden, as indicated by Zetterstedt (1844: 1059) "Hab. in Scandinavia, 12 Jul.–18 Sept., passim, in copula; scilicet in Scania in graminosis ad Esperöd in paræc. Mellby".

Three specimens, 2 ♀♀ and 1 ♂ were found under the name *Tachina nigripes* in the Fallén collection in NHRS: One female is mounted on an old strong pin and bears the following labels: "[handwritten faded ink label of Fallén] *T. nigri* / *pes* ♀ Fall. // Lectotype ♀ / *Tachina* / *nigripes* Fallén 1810 / des. Bergström 2008". I hereby designate this female from Sweden as lectotype of *Tachina nigripes* Fallén, 1810. It is in fairly good condition except for severe tears in both wings. The second female bears a Fallén label "*Tachina* /*nigripes* /♂ Fallén", i. e. it was originally misidentified as male. The third specimen, a correctly associated male, is unlabelled. The misidentified female and the male are not regarded as belonging to the syntype series.

The paralectotypes in MZLU are both mounted on old strong pins of Fallén type. The first female is labelled as follows: "[light blue tag (= Sweden, Skåne, Mellby, Esperöd near Kivik)] // [handwritten Zetterstedt label] *T. nigripes* / ♀ Mus. Fall. // Paralectotype ♀ / *Tachina nigripes* / Fallén 1810 / des. Bergström 2004". The second, originally unlabelled female is labelled: "Paralectotype ♀ / *Tachina nigripes* / Fallén 1810 / des. Bergström 2004".

According to Dowden (1933), who refers to an unpublished work of Sellers, two cotypes, a male and a female, of *nigripes* Fallén are present in Meigen's collection in NHMW. The male was designated by Sellers as the true *nigripes* while the female was referred to as *B. piniariae* Hartig. The type designation of Sellers (in Dowden l. c.) has not been accepted by recent entomologists, apparently because the original description explicitly refers to the female gender alone. Herting & Dely-Draskovits (1993) also referred to the type as a female from Sweden.

Identity: *Tachina nigripes* (Fallén, 1810) is a valid species of *Blondelia* Robineau-Desvoidy 1830 as currently understood.

Tachina piniariae Hartig, 1838
[Hartig 1838: 283]

Type material: Eight syntypes, which are available in the collection Hartig in ZSM have been examined by the first author. The original description of *Tachina piniariae* was based on an unspecified number of specimens representing both genders, all reared from *Bupalus piniaria* (Linnaeus, 1758) (as *Geometra piniariae*) and *Abraxas grossulariata* (Linnaeus, 1758) (as *Geometra grossulariata*). Type locality: probably Germany.

These syntypes are labelled as follows (measurements made by the first author are given in square brackets at the end of each type); four of the eight specimens were originally labelled as types:

♂, with puparium; 210 // [printed] aus dem Kasten: / Tachiniden-Typen / von Hartig und Ratzeburg // [printed and handwritten red label] Type von Hartig / *Lydella* R.-D. / *piniariae* Htg // [handwritten Hartig label with a black curled/coiled rim] *piniariae* / n. // [handwritten and printed label with a black frame] *Lydella* 210/212 / *nigripes* Fall. / Det. Sellers // [handwritten] *Blondelia* ♂ / *nigripes* Fall. / B. Herting det. '79 / od *piniariae* Htg. / nicht trennbar. [frons/head width = 0.26, actual width of parafacial at narrowest point (pafc w) / maximal width of facial (fc w) = 0.21].

♂, with puparium and remains of host pupa; 211 // [printed] aus dem Kasten: / Tachiniden-Typen / von Hartig und Ratzeburg // [printed and handwritten red label] Type von / Hartig // [handwritten Hartig label with a black curled/coiled rim] *piniariae* / n. // *Lydella* 209/211 / *piniariae* Hrtg. / Det. Sellers // [handwritten] *Blondelia* ♂ / *nigripes* Fall. / od *piniariae* Htg. / det. B. Herting, '79. [frons/head = 0.27, pafc w/fc w = 0.21].

♂, with puparium and host pupa; 212 // [printed] aus dem Kasten: / Tachiniden-Typen / von Hartig und Ratzeburg // [printed and handwritten red label] Type von / Hartig // [handwritten Hartig label with a black curled/coiled rim] *piniariae* / n. // *Lydella* 210/212 / *nigripes* Fall. / Det. Sellers // [handwritten] *Blondelia* ♂ / *nigripes* Fall. / od *piniariae* Htg. / det. B. Herting, '79. [frons/head = 0.27, pafc w/fc w = 0.20].

♀, with puparium; 209 // [printed] aus dem Kasten: / Tachiniden-Typen / von Hartig und Ratzeburg // [printed and handwritten red label] Type von / Hartig // [handwritten Hartig label with a black curled/coiled rim] *piniariae* / n. // *Lydella* 209/211 / *piniariae* Hrtg. / Det. Sellers // [handwritten] *Blondelia* ♀ / *nigripes* Fall. / od *piniariae* Htg. / det. B. Herting, '79. [frons/head = 0.33, pafc w/fc w = 0.23].

♂; (green) 406 // [printed] aus dem Kasten: / Tachiniden-Typen / von Hartig und Ratzeburg // [handwritten Hartig label with a black curled/coiled rim] *piniariae* / n. // [handwritten] *Blondelia* ♂ / *nigripes* Fall. / od *piniariae* Htg. / det. B. Herting, '79. [frons/head = 0.25].

♀; (red) 499 // [printed] aus dem Kasten: / Tachiniden-Typen / von HARTIG und RATZEBURG // [handwritten HARTIG label with a black curled/coiled rim] *piniariae* / n. // [handwritten] *Blondelia* ♀ / *nigripes* Fall. / od *piniariae* Htg. / det. B. HERTING, '79. [frons/head = 0.30].

♀; [printed] aus dem Kasten: / Tachiniden-Typen / von HARTIG und RATZEBURG // [handwritten HARTIG label with a black curled/coiled rim] *piniariae* / n. // [handwritten] *Blondelia* ♀ / *nigripes* Fall. / od *piniariae* Htg. / det. B. HERTING, '79. [frons/head = 0.32].

♂, head missing, with puparium; (blue) 904 // [printed] aus dem Kasten: / Tachiniden-Typen / von HARTIG und RATZEBURG // [handwritten HARTIG label with a black curled/coiled rim] *piniariae* / n. // [handwritten] *Blondelia* ♂ / *nigripes* Fall. / od *piniariae* Htg. / det. B. HERTING, '79.

MIK & WACHTL (1895) treated *Dexodes piniariae* (Hartig) as a valid name although *Tachina nigripes* Fallén was regarded a valid senior synonym. This opinion was however not accepted by BEZZI & STEIN (1907), BAER (1921) and STEIN (1924) who treated *B. piniariae* as a synonym of *B. nigripes*. However, DOWDEN (1933) claimed that *B. nigripes* and *B. piniariae* represented two distinct species. This opinion was supported by rearing experiments showing that specimens reared from *Bupalus piniaria* (Geometridae) apparently have habits and life histories different from those reared from *Lymantria dispar* and *Euproctis chrysorrhoea* (Lymantriidae). For example, it was shown that under natural conditions larvae of *Bupalus piniaria* were parasitized by *B. piniariae* but not by *B. nigripes*. Furthermore, according to DOWDEN (l. c.), the two species could easily be distinguished by the relationship of the width of the frons at its narrowest point to the width of head at its widest part. This ratio in *B. nigripes* ranges from 0.224–0.245 in the males, and from 0.293–0.303 in females, while *B. piniariae* has an average range from 0.274–0.286 in the males, and from 0.324–0.333 in females. However, the results are not trustworthy because most specimens examined by us shows intermediate values between the limits presented by DOWDEN who refers to measurements performed by SELLERS. The confusion increased when the first author examined the eight syntypes available in HARTIG's collection in ZSM (see above). SELLERS who has examined the syntypes regarded them to represent two different species and it was later somehow assumed that the specimens that he determined to *B. piniariae* are reared from *Bupalus piniaria*. There is, however, no information available on the labels which would indicate which specimens are reared from *Bupalus piniaria* or *Abraxas grossulariata*. Furthermore EMDEN (1954) also found that the number of intermediates between DOWDEN's limits was far greater than the number falling within his groups and stated that there is insufficient morphological evidence for regarding *B. nigripes* and *B. piniariae* as separate species. However, because of the proposed differences in host-range he treated them as two biological races of the same species *B. nigripes*. MESNIL (1962: 758), who refers to EMDEN, understood *B. piniariae* as a subspecies of *B. nigripes*. HERTING (1984: 186) treated *B. piniariae* as ecologically different from *B. nigripes*, but morphologically indistinguishable.

We have examined numerous specimens of *B. nigripes* reared from various hosts, without finding morphological features which would separate them from specimens reared from *Bupalus piniaria*. The width of the frons at its narrowest point is surely not a stable character. Also the male and female terminalia, when considering a large number of specimens, show no distinct differences. DOWDEN surely could not really recognize *B. pinivorae* as a distinct species, and this fact makes it difficult to interpret some of the results presented in his paper.

We therefore, referring to the results presented above, advise that the name *B. piniariae* is treated in synonymy with *B. nigripes*. Nevertheless, we believe that the final decision on this question should be based on a careful molecular-genetic analysis.

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