

**Distribution maps and identification key of the Belgian scorpionflies,
hangingflies and snowfleas (Mecoptera)**

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Abstract

Eight species of Mecoptera have been observed in Belgium: one snowflea (Boreidae): *Boreus hyemalis* (Linnaeus 1767); two hangingflies (Bittacidae): *Bittacus hageni* Brauer 1860 and *Bittacus italicus* (Müller 1766) and five scorpionflies (Panorpidae): *Aulops alpina alpina* (Rambur 1842), *Panorpa cognata cognata* Rambur 1842, *Panorpa communis* Linnaeus 1758, *Panorpa germanica germanica* Linnaeus 1758 and *Panorpa vulgaris* Imhoff & Labram 1845. Distribution maps for all the species are presented and an identification key has been developed for the Belgian Mecoptera.

Keywords: Belgium, Bittacidae, Boreidae, checklist, Panorpidae.

Samenvatting

Er werden reeds acht soorten Mecoptera waargenomen in België: één sneeuwvlo (Boreidae): *Boreus hyemalis* (Linnaeus 1767); twee hangvliegen of muggenhaften (Bittacidae): *Bittacus hageni* Brauer 1860 en *Bittacus italicus* (Müller 1766) en vijf schorpioenvliegen (Panorpidae): *Aulops alpina alpina* (Rambur 1842), *Panorpa cognata cognata* Rambur 1842, *Panorpa communis* Linnaeus 1758, *Panorpa germanica germanica* Linnaeus 1758 en *Panorpa vulgaris* Imhoff & Labram 1845. Verspreidingskaartjes worden gepresenteerd voor alle soorten en er werd een determinatiesleutel opgesteld voor de Belgische Mecoptera.

Résumé

Huit espèces de Mecoptera ont déjà été observées en Belgique: une puce des Neiges (Boreidae): *Boreus hyemalis* (Linnaeus 1767); deux bittaques (Bittacidae): *Bittacus hageni* Brauer 1860 et *Bittacus italicus* (Müller 1766) et cinq panorpes ou mouches-scorpions (Panorpidae): *Aulops alpina alpina* (Rambur 1842), *Panorpa cognata cognata* Rambur 1842, *Panorpa communis* Linnaeus 1758, *Panorpa germanica germanica* Linnaeus 1758 et *Panorpa vulgaris* Imhoff & Labram 1845. Des cartes de distribution sont présentées pour toutes les espèces et une clé a été développée pour les Mecoptera de Belgique.

Introduction

Mecoptera can be recognised by the downward pointing conical beak which bears the jaws at the tip. They have a complete metamorphosis and their larvae live in the ground. Three families of Mecoptera are present in Belgium, which can be easily recognised. Snowfleas (Boreidae) are active during winter: adults can be found from November till March.

They live in forested areas on mosses, but also on dunes and open sandy heathlands. Due to their small size, they can be easily overlooked. However, on sunny days they sometimes strike the eye when they sit on the snow surface. Snowfleas feed on mosses, detritus and carrion. Hangingflies (Bittacidae) resemble daddy-long-legs (Tipulidae), however, they possess four wings instead of two. They hang with their forelegs in the vegetation and catch small flying

insects with their hind legs. During dusk, they also fly over the vegetation to catch prey with their hanging legs. Hangingflies live in humid areas and because they stay in the shadow, they especially occur in forests. The best time to catch hangingflies is from dusk till dawn. Males of scorpionflies (Panorpidae) are readily recognisable by the genital capsule held forward over the body in the manner of a scorpion, the habit which gives the family its common name. Females have a tapering abdomen, which can be used to deposit eggs into the soil. All the species have maculated wings and although the pattern is quite variable within the species, it can help the identification of the species. Scorpionflies can especially be found during spring and summer in humid and shaded environments. They have a clumsy flight and remain close to the surface. They mainly feed on carrion of worms and insects, but can also suck nectar from flowers, plant fluids as well as honeydew of aphids.

In the present study, an overview is given of the knowledge about the Belgian Mecoptera, distribution maps are plotted for all the species, the phenology is analysed and an identification key is presented, which contains all the species occurring in Belgium, the Netherlands, Luxembourg and the British isles.

Materials and methods

Most of the studied material belongs to the collections of the Gembloux Agricultural University, the University of Mons, the University of Liège and the Royal Belgian Institute for Natural Sciences. Hangingflies were identified using the descriptions of the male genitalia by PETSCHENKA (2006). *Panorpa communis* and *Panorpa vulgaris* were distinguished based on SAUER & HENSLE (1977). A good identification key for the scorpionflies in French has been presented by TILLIER (2008). Because Panorpidae were often misidentified in the studied collections, literature data of this family were not included and distribution maps are only based on preserved specimens and personal observations.

Results

Eight species of Mecoptera have been reported for Belgium, which are all present in the collection of the Royal Belgian Institute of Natural Sciences. A checklist containing all the species occurring in Belgium is given in Table 1.

Table 1. Checklist of the Belgian Mecoptera.

ORDER MECOPTERA

Family Boreidae

1. *Boreus hyemalis* (Linnaeus 1767)

Family Bittacidae

2. *Bittacus hageni* Brauer 1860

3. *Bittacus italicus* (Müller 1766)

Family Panorpidae

4. *Aulops alpina alpina* (Rambur 1842)

5. *Panorpa cognata cognata* Rambur 1842

6. *Panorpa communis* Linnaeus 1758

7. *Panorpa germanica germanica* Linnaeus 1758

8. *Panorpa vulgaris* Imhoff & Labram 1845

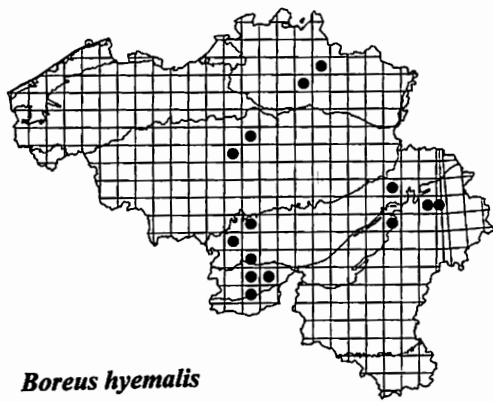
A key for all the Belgian species is presented in Annex 1. Distribution maps are presented in Figure 1 and the phenology of adult Boreidae and Panorpidae is plotted in Figure 2.

Boreus hyemalis (Linnaeus, 1767)

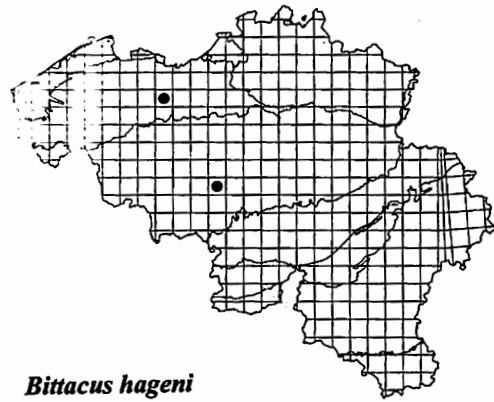
The snowflea *B. hyemalis* has been reported quite frequently (DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; BONDROIT, 1911; NAVAS, 1912; CARPENTIER, 1919; LESTAGE, 1919, 1920; TONNOIR, 1920; ESBEN-PETERSEN, 1921; MARECHAL, 1939a,b; LESTAGE, 1940, 1941a,b; LELEUP, 1947; MEURISSE, 1988; MAGIS & MEURISSE, 1989; HENDRICKX, 1995). However, this is because it is such a peculiar species, which resulted in the publication of almost every record. Based on the available data, the species seems to have a limited distribution (Fig. 1A), but because the species is so small and only active during winter (Fig. 2), it can be easily overlooked. The species is therefore probably more widespread than suggested by the distribution map.

Bittacus hageni Brauer, 1860

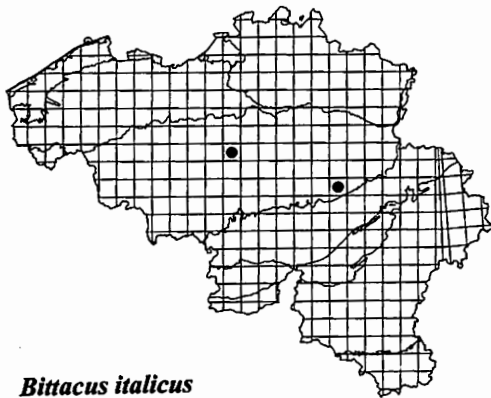
This species has only been found on 19.VII.1881 near Ronquières along the canal by MAC LACHLAN & LAMEERE (MAC LACHLAN, 1881) and in 1921 in Melle (GOETGHEBUER, 1921) (Fig. 1B). These records were often cited (DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; NAVAS, 1912; ESBEN-PETERSEN, 1921; LESTAGE, 1941a; MEURISSE, 1988; MAGIS & MEURISSE, 1989), however, no new records became available. *B. hageni* has recently been discovered in Bellefontaine (Lorraine, northern France) on 27.VIII.2004 (JACQUEMAIN, 2005) and in Montenach on the site Koppenackberg



Boreus hyemalis



Bittacus hageni



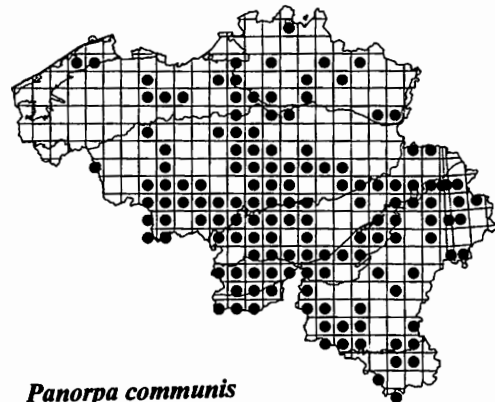
Bittacus italicus



Aulops alpina alpina



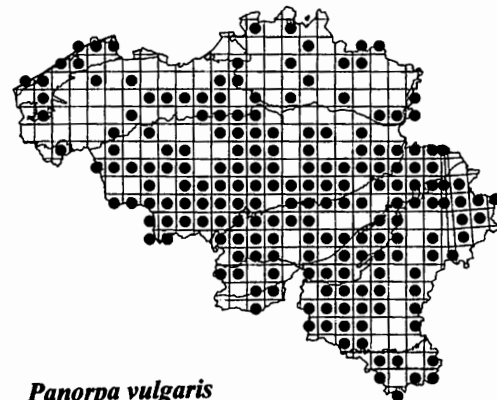
Panorpa cognata cognata



Panorpa communis



Panorpa germanica germanica



Panorpa vulgaris

Figure 1. Distribution of the Belgian Mecoptera: *Boreus hyemalis*, *Bittacus hageni*, *Bittacus italicus*, *Aulops alpina alpina*, *Panorpa cognata cognata*, *Panorpa communis*, *Panorpa germanica germanica* and *Panorpa vulgaris*.

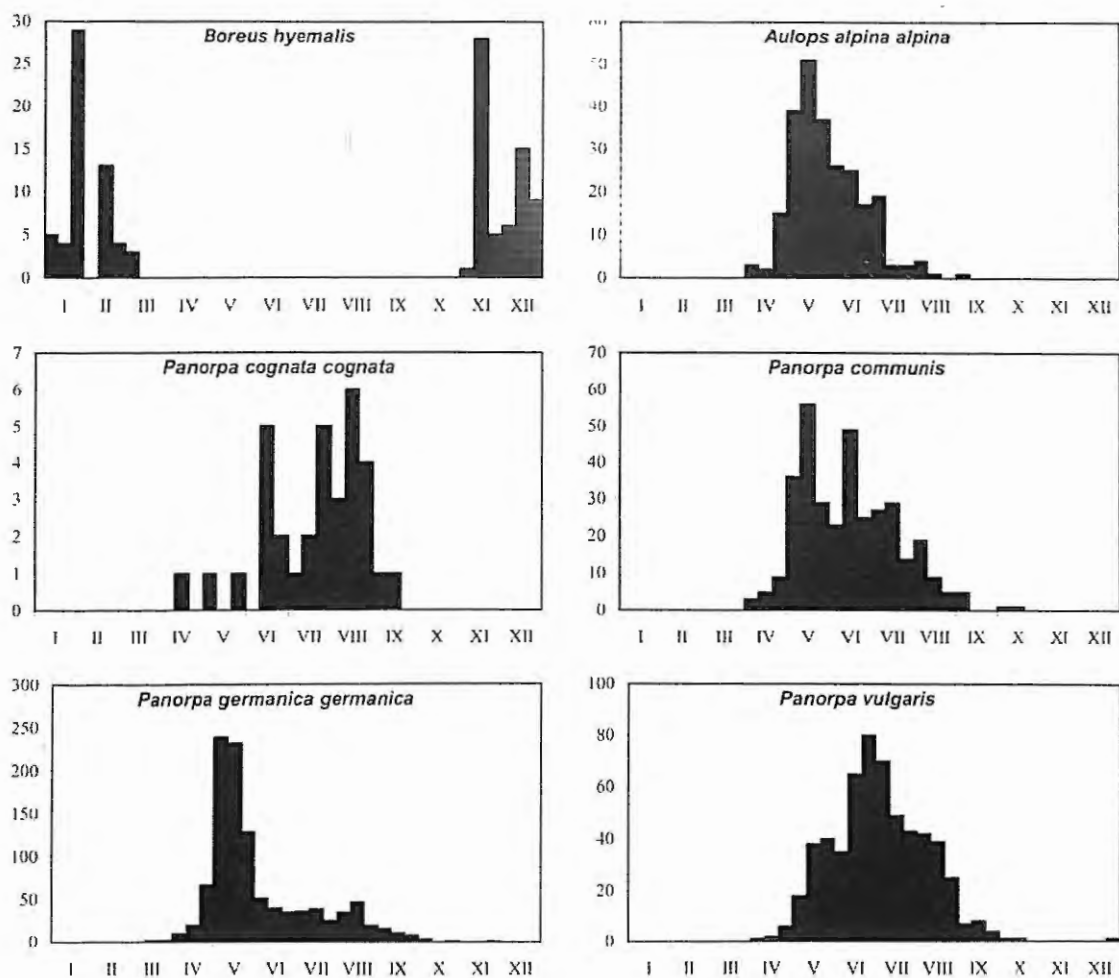


Figure 2. Phenology of the Boreidae and the Panorpidae in Belgium.

(Lorraine, northern France) in August 2005 (CARRIÈRES-KAM & JEITZ, 2007), which are both not that far from the Belgian border.

***Bittacus italicus* (Müller, 1766)**

B. italicus has been found in Ukkel near Vivier d'Oies, where WESMAEL captured several specimens and in Fallais on the river Méhaigne where DONCKIER collected one individual on 23.VI.1879 (DE SELYS-LONGCHAMPS, 1888) (Fig 1C). These records were often cited (LAMEERE, 1900; NAVAS, 1912; ESBEN-PETERSEN, 1921; GOETGHEBUER, 1921; LESTAGE, 1941a; MEURISSE, 1988; MAGIS & MEURISSE, 1989), however, no additional observations have been published.

***Aulops alpina alpina* (Rambur, 1842)**

The maximum activity of this species falls in May and it has hardly been observed after the beginning of July (Fig. 2). MEURISSE (1988)

found a maximum activity in June, probably because most of his data came from the Hautes Fagnes region, where the activity period is often shifted to a later period due to the lower average temperatures. The species prefers shaded, cool and humid environments and is therefore more restricted to forests than the more common scorpionflies. *A. alpina* has often been reported in Belgium (DE SELYS-LONGCHAMPS & MAC LACHLAN, 1877; MAC LACHLAN, 1881; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; FREDERICQ, 1904; NAVAS, 1912; ESBEN-PETERSEN, 1921; LESTAGE, 1922, 1923; NAVAS, 1923b; MAGIS, 1981; MEURISSE, 1988; MAGIS & MEURISSE, 1989; MEURISSE & MAGIS, 1989; ROSE, 2000; MIGNON, 2002). In the Hautes Fagnes, it is the most abundant species (MEURISSE, 1988; MAGIS & MEURISSE, 1989). However, in the rest of Wallonia, it is widespread but not as common as *P. germanica*, *P. communis* and *P. vulgaris*, while in Flanders, it is very rare (Fig. 1D).

***Panorpa cognata cognata* Rambur, 1842**

The activity of this species starts later than for the other Panorpidae: it is hardly observed before the second half of June (Fig. 2). *P. cognata* can be found in relatively warm and dry forests. The species has been reported quite frequently in Belgium (MAC LACHLAN, 1881; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; NAVAS, 1909, 1910, 1912, 1923a,b; ESBEN-PETERSEN, 1921; MAGIS, 1981; MEURISSE, 1988; MAGIS & MEURISSE, 1989; MEURISSE & MAGIS, 1989; ROSE, 2000; MIGNON, 2002). Despite the *P. cognata* occurs all over the country, it is the rarest species of the Panorpidae in Belgium (Fig. 1E).

***Panorpa communis* Linnaeus, 1758**

This species is abundant from May till August and its activity is shifted somewhat more to spring when compared to the related *P. vulgaris* (Fig. 2). *P. communis* has been frequently reported in Belgium (MAC LACHLAN, 1881; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; NAVAS, 1909, 1910, 1912, 1923a,b; ESBEN-PETERSEN, 1921; MAGIS, 1981; MEURISSE, 1988; MAGIS & MEURISSE, 1989; MEURISSE & MAGIS, 1989; ROSE, 2000; MIGNON, 2002). However, part of these reports undoubtedly belonged to *P. vulgaris*, which has not always been considered as a separate species. It is a common species (Fig. 1F), which can be found in all kinds of habitats, as long as shade is present.

***Panorpa germanica germanica* Linnaeus, 1758**

The maximum activity of this species falls in May, which was also observed by MEURISSE (1988), however, it can be found throughout summer, but in relatively lower numbers (Fig. 2). It has been reported frequently in Belgium (DE SELYS-LONGCHAMPS & MAC LACHLAN, 1877; MAC LACHLAN, 1881; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; NAVAS, 1909, 1910, 1912, 1913, 1914, 1921, 1923a,b; ESBEN-PETERSEN, 1921; MAGIS, 1981; MEURISSE, 1988; MAGIS & MEURISSE, 1989; MEURISSE & MAGIS, 1989; MIGNON, 2002). *P. germanica* is the most common scorpionfly in Belgium (Fig. 1G) and it can be found in all types of shaded environments.

***Panorpa vulgaris* Imhoff & Labram, 1845**

Just like the related *P. communis*, this species

is abundant from May till August, but its activity is shifted somewhat more to the summer (Fig. 2). *P. vulgaris* has only been reported a few times (MAC LACHLAN, 1881; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; NAVAS, 1912; ROSE, 2000), undoubtedly because this species has often not been considered as a separate species as has been indicated previously. It is a common species in Belgium and it is even the most common species in Flanders (Fig. 1H).

Discussion

All eight species of Mecoptera that have been observed in Belgium could be confirmed during the present study. Based on the distribution of the European Mecoptera (HOFFMANN, 1966; CARRIERES, 2001; SAURE, 2003; TILLIER *et al.*, 2009), no additional species are expected for Belgium.

In the past, *P. communis* and *P. vulgaris* have often not been considered as separate species. However, the two species are genetically isolated by isolation mechanisms operating pre- and post-mating (SAUER & HENSLE, 1977). The post-mating mechanism is 100% effective and probably depends on a genetic incompatibility. Of 9670 experimental hybrid eggs, only 3 developed to the larval stage, however, these died after some time. Pre-mating isolation mechanisms are the seasonal and spatial isolation of the two species together with specific wing patterns which allow species recognition during courtship. *P. vulgaris* prefers sunny and warm habitats, whereas *P. communis* is almost always more commonly found in cooler and shadier parts. While in several populations of *P. vulgaris*, most if not all progeny of the first generation develop without diapause to produce a second generation, this is true for only a few individuals of *P. communis*. Most of the progeny of the first generation of *P. communis* enter diapause and hibernate without having produced a summer generation. *P. communis* is on average somewhat bigger than *P. vulgaris*, but morphologically, both species differ only very little. However, the wing pattern is distinct and allows the identification of the two species. In Belgium, all available material could be easily identified.

Larvae of *P. communis*, *P. vulgaris*, *P. germanica* and *P. cognata* can choose to go into diapause during the fourth and last larval stage, depending on the day length they are exposed to,

whereas *A. alpina* did not seem to have this ability to choose (SAUER, 1970; SAUER & HENSLE, 1977). In Belgium, facultative bivoltinism has been observed in *P. communis* and *P. germanica* (MEURISSE, 1988; MAGIS & MEURISSE, 1989; MIGNON, 2002), however, *P. vulgaris* was not considered as a separate species in these studies. For *P. cognata*, no bivoltinism has been observed in Belgium yet. This might be due the lack of data of this rare species, but is also possible that it is too cold in Belgium for this thermophilous species in order to produce a second generation.

Despite the developed database contains more than 2000 records, knowledge about the distribution of the Belgian Mecoptera is still fragmentary. As indicated previously, hangingflies might still be present in Belgium despite they have not been observed for almost a century. The snowflea *Boreus hyemalis* might also be more common than suggested by the distribution map (Fig. 1) as it can easily remain unnoticed due to its small size and because adults can only be found during winter (Fig. 2). Although a lot of data are available for scorpionflies, not all parts of Belgium have been studied with the same intensity: students in Gembloux, Mons and Liège collected quite a lot of specimens in Wallonia and Brussels, but for Flanders, far less material was available. The different species of scorpionflies are therefore probably more widespread in Flanders than suggested by distribution maps (Fig. 1).

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Annex I. Identification key to the Belgian Mecoptera.

- 1 Insect about 5 mm long. Female with vestigial wings and a distinctive ovipositor; male with wings modified into stout spines and lacking ovipositor (Fig. 1). Ocelli: absent (Boreidae) *Boreus hyemalis*
- Insect about 10 mm long or more and fully winged, with a wingspan of 20 mm or more. Ocelli present 2

- 2 Wings transparent (Fig. 2). Last abdominal segments not tapering to tip in females and not modified in males. Last tars with one claw, which is not serrated (Bittacidae) 3
- Maculated wings (Fig. 5-8). Tip of male abdomen swollen to form genital capsule which is held forwards over the body in the manner of a scorpion (Fig. 9) and abdomen tapering to tip in females. Last tars with two serrated claws (Panorpidae) 4

- 3 In males, both halves of epiandrium in middle with rounded emergence densely covered with dark spines; tips of epiandrium are downcurved and bear some spines which are concentrated on small tip at apex (Fig. 3). Females hard to distinguish .. *Bittacus hageni*
- In males, both halves of epiandrium with processus with spines at the tip; apical setae of epiandrium cover larger area and are not restricted to apices and tips are not downcurved (Fig. 4). Females hard to distinguish *Bittacus italicus*

- 4 In fore wing, subcostal vein reaches costal vein in middle of wing (Fig. 5); usually wings with only few, pale brown spots. Male genital capsule (Fig. 9A) *Aulops alpina*
- In fore wing, subcostal vein reaches the costal vein after the middle of the wing in region of pterostigma (Fig. 6-7) 5

- 5 Sixth abdominal segment rectangular, not tapering to tip (Fig. 10A). Head reddish. In fore wing, maculation almost restricted to front half, with spot near pterostigma usually reaching middle of wing and distal spot cloudy (Fig. 7). Parameres not bifurcate, callipers long and slender (Fig. 9C) *Panorpa cognata*
- Sixth abdominal segment conical, tapering to tip (Fig. 10B). Head blackish. In fore wing, maculation usually not restricted to front half (Fig. 6, 8). Parameres bifurcate (Fig 9B,D) 6

- 6 Fore wing usually without transversal band (Fig. 6). Parameres bifurcate medially; callipers short and expanded at tip (Fig. 9B) *Panorpa germanica*
- Fore wing usually with transversal band (Fig. 8). Parameres only bifurcate at their extremity; callipers long, not expanded at tip (Fig. 9D) 7

- 7 In fore wing, basal spot small (Fig. 8, left) *Panorpa communis*
- In fore wing, basal spot big (Fig. 8, right) *Panorpa vulgaris*



Figure 1. Habitus *Boreus hyemalis*.

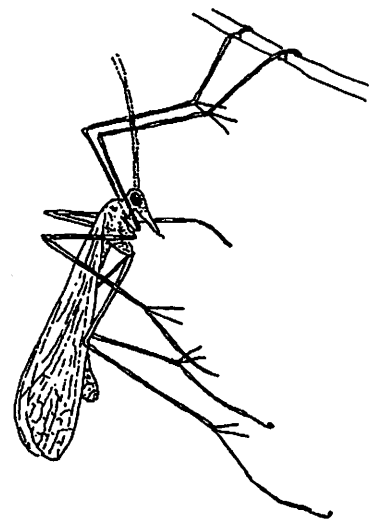


Figure 2. Habitus Bittacidae.

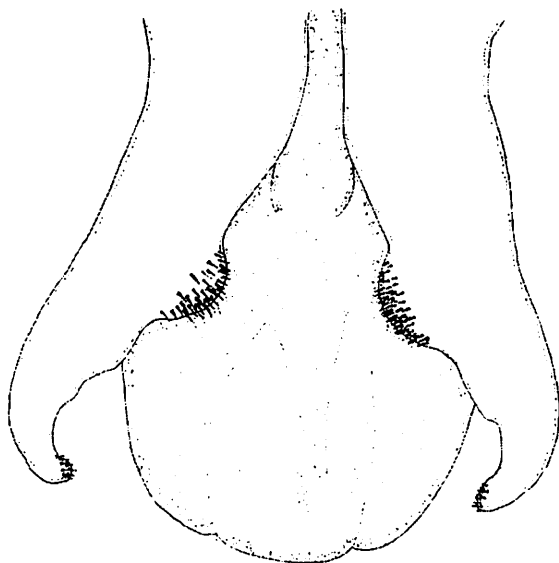


Figure 3. Dorsal view of male abdomen of *Bittacus hageni*: tergum 9 with epiandrium.

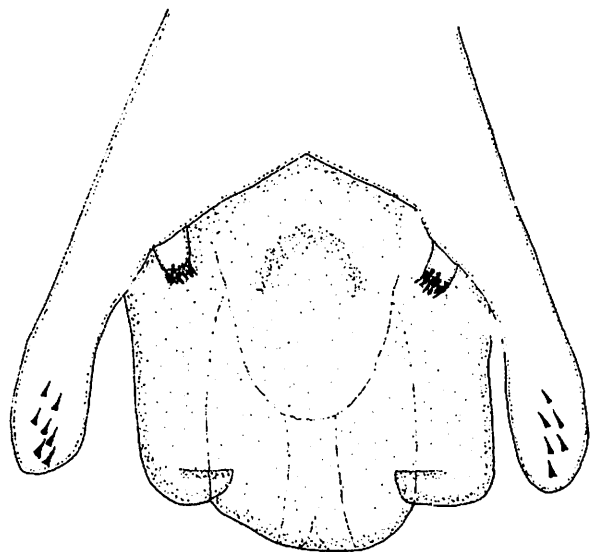


Figure 4. Dorsal view of male abdomen of *Bittacus italicus*: tergum 9 with epiandrium.

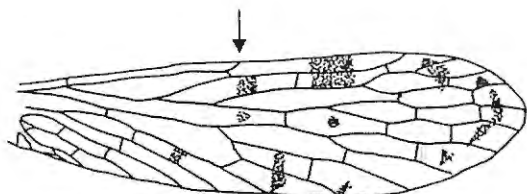


Figure 5. Right fore wing *Aulops alpina*.

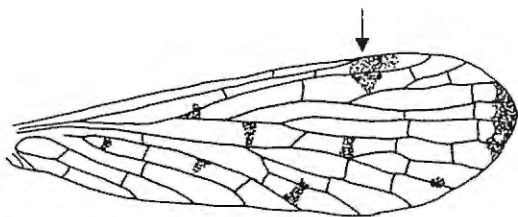


Figure 6. Right fore wing *Panorpa germanica*.

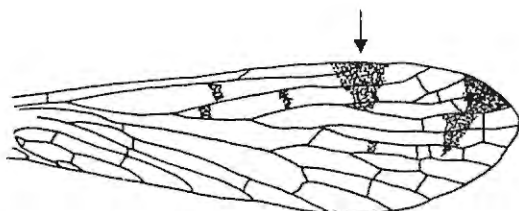


Figure 7. Right fore wing *Panorpa cognata*.

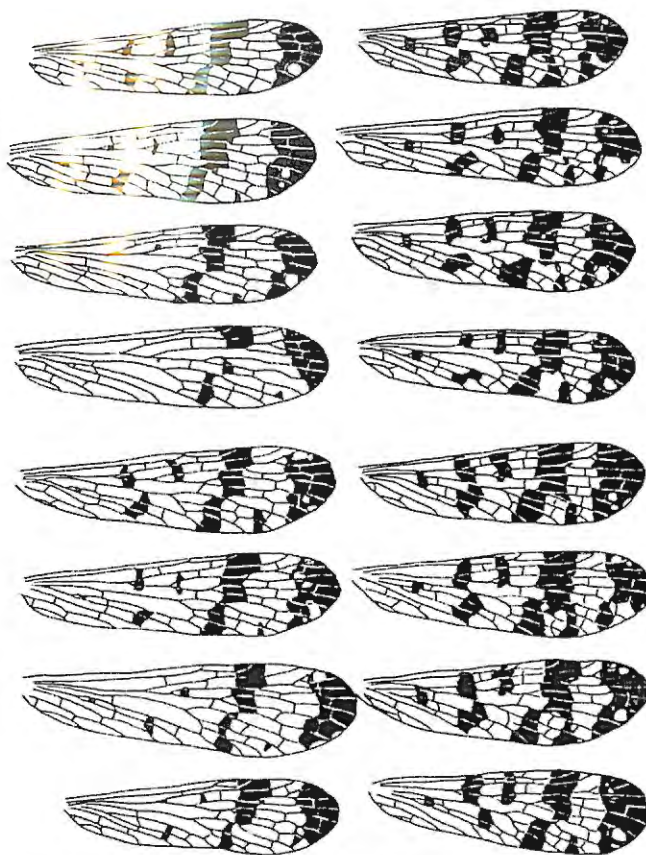


Figure 8. Variability of right fore wing of *Panorpa communis* (left) and *Panorpa vulgaris* (right).

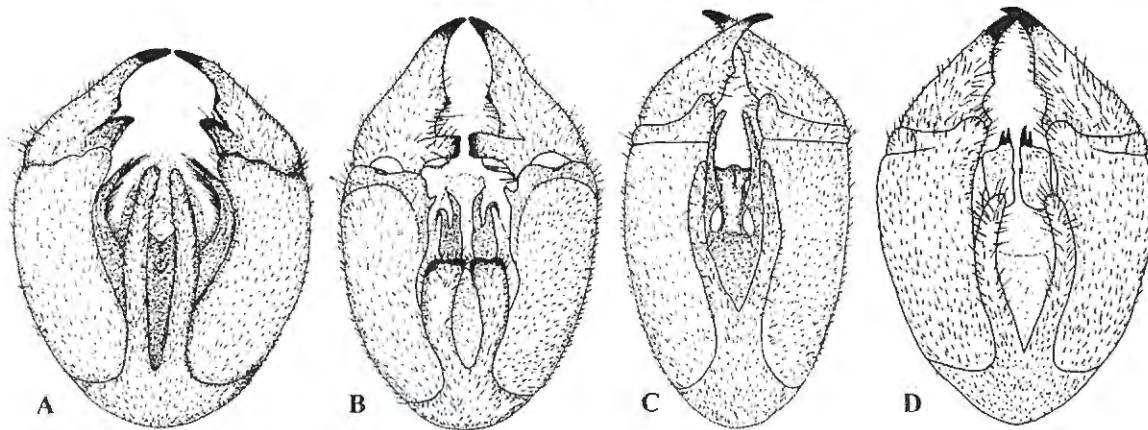


Figure 9. Male genital capsule (ventral view) *Aulops alpina* (A), *Panorpa germanica* (B), *Panorpa cognata* (C) and *Panorpa communis/vulgaris* (D). Note that capsule is held forward over body and then ventral side will be upwards.

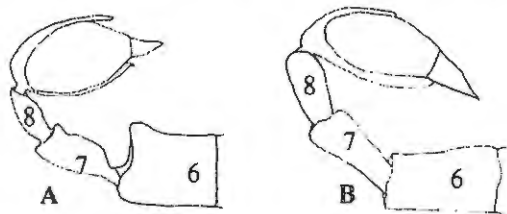


Figure 10. Male last abdominal segments (lateral view) *Panorpa cognata* (A) and *Panorpa germanica* (B).