

Stem-boring sawflies and Woodwasps in Denmark (Hymenoptera: Cephidae, Siricidae, Xiphydriidae)

Halmhvepse og træhvepse i Danmark (Hymenoptera: Cephidae, Siricidae, Xiphydriidae)

Jakob Maretti Bengtsen Kiilerich¹ & Lars Vilhelmsen^{1*}

¹Natural History Museum of Denmark, SCIENCE, University of Copenhagen, Universitetsparken 15, DK 2100 Copenhagen Ø, Denmark.

*Corresponding author. e-mail: lbvilhelmsen@snm.ku.dk

Abstract

The Cephidae, Siricidae and Xiphydriidae are herbivorous insects all present in Denmark. The collections of the Natural History Museum Aarhus and the Natural Museum of Denmark are used to document the diversity and distribution of these three families. We report nine species of Cephidae in three genera, six species of Siricidae in four genera and two species of Xiphydriidae in one genus. All previous records of the stemwasp *Janus cynosbati* have been misidentified; they belong instead to *Phylloecus niger*, *Phylloecus linearis*, and *Cephus pygmeus*. There are thus no confirmed records of *Janus cynosbati* from Denmark. The *Xeris spectrum* material examined was found to include specimens of *Xeris pallicoxae*, a species previously unrecognized in Denmark. The current survey include illustrated morphological diagnoses of all Danish species, along with résumés of lifestyle, lists of known host organisms, fungal symbionts, and parasites. Distribution maps of all species are presented. We provide an updated key to the Danish species of stem-boring sawflies and woodwasps.

Sammenfatning

Cephidae, Siricidae og Xiphydriidae er tre familier af planteædende hvepse som forekommer i Danmark. Samlingerne i Statens Naturhistoriske Museum og Naturhistorisk Museum Århus er blevet brugt til at dokumentere diversitet og udbredelse af disse tre familier. Vi rapporterer ni arter af Cephidae i tre slægter, seks arter af Siricidae i fire slægter og to arter af Xiphydriidae i en slægt. Alle tidligere angivne fund af halmhvepsen *Janus cynosbati* fra Danmark er fejlbestemt; de tilhører i stedet *Phylloecus niger*, *Phylloecus linearis*, og *Cephus pygmeus*. Der er således ikke nogen bekræftede fund af *Janus cynosbati* fra Danmark. Det undersøgte materiale af træhvepsen *Xeris spectrum* viste sig at indeholde eksemplarer af *Xeris pallicoxae*, en art som ikke tidligere har været erkendt i Danmark. Denne oversigt indeholder illustrerede morfologiske diagnoser af alle danske arter sammen med resuméer af deres levevis, lister over kendte værtsplanter, symbionter og parasitter. Udbredelseskort og en opdateret nøgle til alle danske halm- og træhvepse er inkluderet.

Introduction

The stem-boring sawflies (Cephidae) and woodwasps (Siricidae and Xiphydriidae) are three small families belonging to the 'symphytan' grade of the Hymenoptera (ants, bees, wasps etc.). They represent an intermediate stage in the early evolution of the order, between the basal sawflies (e.g., Tenthredinoidea) and the more advanced and predominantly carnivorous Apocrita (Vilhelmsen & Turrissi, 2011). Like all other 'Symphyta', the stem-boring sawflies and woodwasps do not have a wasp-waist. However, apart from being herbivorous, their lifestyle differ considerably from that of a typical tenthredinoid or true sawfly.

The Cephidae is the largest of the three families, comprising approx. 170 species across 21 genera worldwide (Taeger et al., 2010). They are unique in having a distinct incision visible in lateral view between the first and second abdominal segment (Benson, 1946). Most of their diversity is found in the northern hemisphere subfamily Cephinae; the two other subfamilies combined only have a handful of species in the Afrotropical and Oriental regions (Athetocephinae) and Australia (Australcephinae), respectively. Within Cephinae, the genera *Calameuta* and *Cephus* feed on different types of grasses, including cereals, while *Phylloecus* feeds on stems of herbaceous Rosaceae (Gauld & Bolton, 1996). The larvae feed internally

in their host plant; some members of the Cephinae (e.g., *Cephus pygmeus*) may cause severe crop damage by causing the stem of the host plant to break.

The Siricidae comprises some 120 species in 11 genera. They are generally large animals (several cm body length), the females having impressive ovipositors. The female lay eggs in old or recently dead trees (including freshly felled ones); together with the egg, they place a symbiotic fungus (with the exception of at least some members of the genus *Xeris*, which rely on the fungi of other siricids [Goulet et al., 2015]) in the wood that decomposes cellulose. The larvae feed on the wood predigested by the fungus, tunneling through it as they progress; larval development usually lasts several years. The presence of the siricid larvae may cause damage to the wood and the tree in general. Of the two subfamilies, the Siricinae feeds on conifers, whereas the Tremicinae attack various deciduous trees. Siricidae are primarily present in the northern hemisphere; the genus *Afrotremex* is endemic to the Afrotropical region (Goulet, 2014). However, a few species (e.g., *Sirex noctilio*) have been accidentally introduced to many parts of the world, including places with no native siricid fauna (Australia, South Africa, South America) (Slippers et al., 2011; Goulet, 2014). Here, they may cause damage in commercial pine plantations.

The Xiphydriidae comprises approx. 150 species in 29 genera. They can be differentiated from Siricidae by their smaller size and having an elongate 'neck' formed by the extended propleura (Quinlan and Gauld, 1981). The larvae of Xiphydriidae bore in wood; like siricid larvae, they have symbiotic wood decomposing fungi (Šrůtka et al., 2007). However, xiphydriid larvae bore more shallowly, only attack deciduous trees and are not regarded as particularly harmful. Worldwide, the Xiphydriidae are more widespread than the two other families treated here and have strong representation in the southern hemisphere, being absent only from the Afrotropical region.

The present paper is based on the M.Sc. thesis of the first author, which was undertaken 2017-2018 at the Natural History Museum of Denmark, University of Copenhagen, under the supervision of the second author. This is the first comprehensive treatment of the Danish fauna of stem-boring sawflies and woodwasps since *Danmarks Fauna (18): Træ- og Bladhvepse* (Nielsen and Henriksen, 1915), which is by now heavily outdated. There has been only a few publications dealing with the Danish woodwasp fauna since then. Midtgaard (1986) provided the first Danish records of *Sirex cyaneus* Fabricius, 1781 and *Urocerus augur* (Klug, 1803). Jensen (1988) provided additional records for *Xeris spectrum* (Linnaeus, 1758).

Our contribution aims to update the identification keys for the Danish fauna, both with regard to the species included and illustrations. We also provide more detailed faunistic information for each species, including distribution maps.

Materials and methods

The two main natural history collections in Denmark are at Statens Naturhistoriske Museum/Natural History Museum of Denmark (NHMD) in Copenhagen and Naturhistorisk Museum Aarhus/Natural History Museum Aarhus (NHMA). The holdings of Cephidae, Siricidae and Xiphydriidae of both these collections were surveyed and databased. Identification of all specimens were checked primarily with Quinlan and Gauld (1981), supplemented with the keys from Goulet and Schiff (2015) and Schiff et al. (2012). The NHMD specimens had all label information recorded in Specify under a unique a reference number and included in the museum database; a label with the corresponding reference number was added to each specimen. The information from the NHMA specimens was recorded in an Excel spreadsheet from which it have been transferred to the NHMA database.

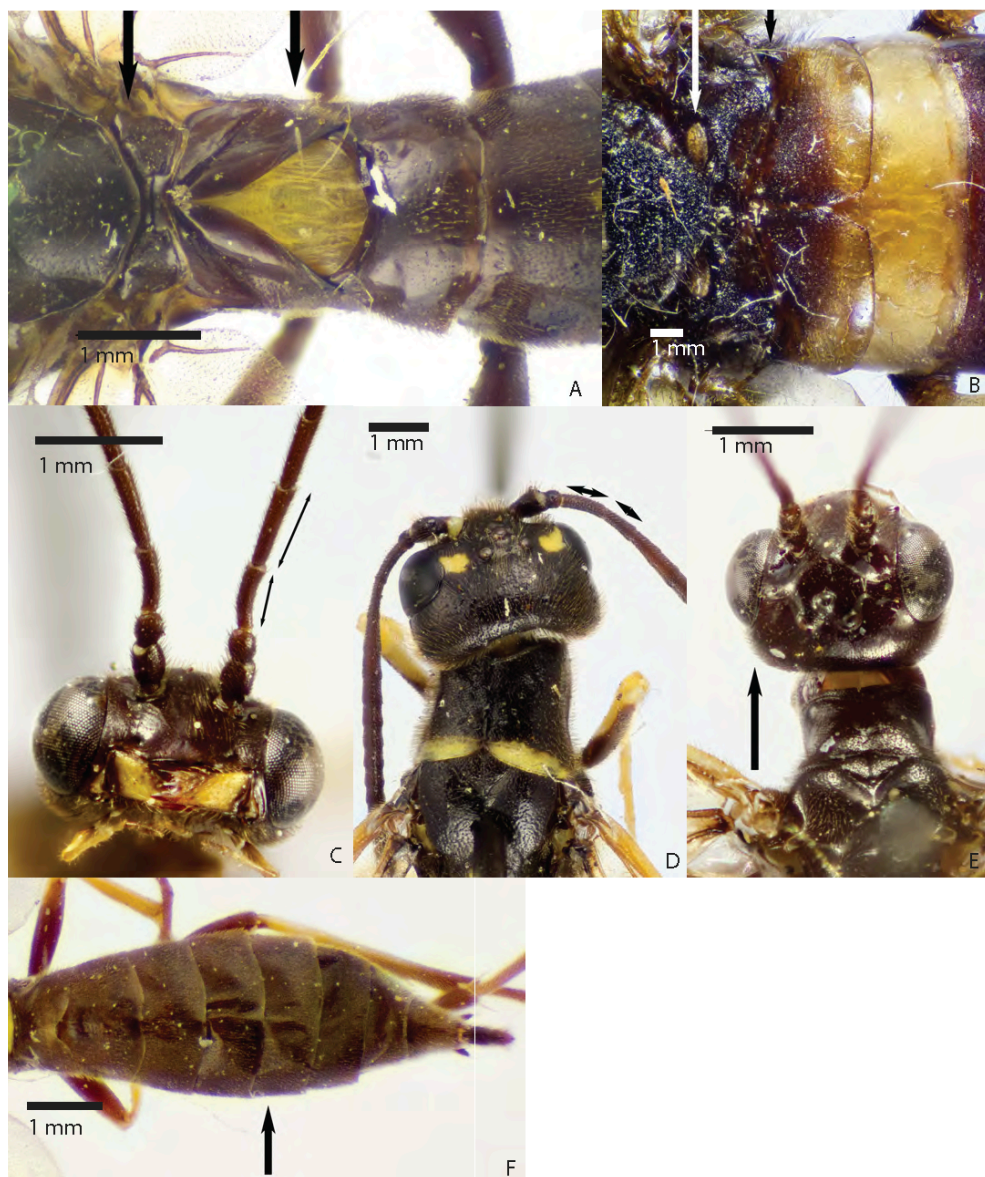


Fig 1. **A.** *Cephus spinipes* female thorax and abdomen. Left arrow: Metanotum (without cenchrus); right arrow: Abdominal tergum 1. **B.** *Urocerus gigas* female thorax and abdomen. Left arrow: Cenchrus; right arrow: Abdominal tergum 1. **C.** *Cephus* sp. face. Arrows indicate relative lengths of 3rd and 4th antennomere. **D.** *Phylloecus linearis* head and thorax. Arrows indicate relative lengths of 3rd and 4th antennomere. **E.** *Cephus nigrinus* male head and thorax. Arrow: Constriction behind eye. **F.** *Cephus nigrinus* female abdomen (arrow) in dorsal view.

The specimens were examined with either a Leica Wild M3B microscope for most observations or a Leica MZ16A microscope when larger magnifications were needed. The descriptions were arranged according to Schiff et al. (2012; Siricidae) and Quinlan and Gauld (1981; Cephidae, Xiphydriidae); the same sources served as inspiration for the identification keys which employ the same terminology. The list of host plants is based on Taeger et al. (1998) unless otherwise noted; the list of parasitoids is based on Yu (2012) unless otherwise noted. The records of host plants and parasitoids have not been confirmed in Denmark.

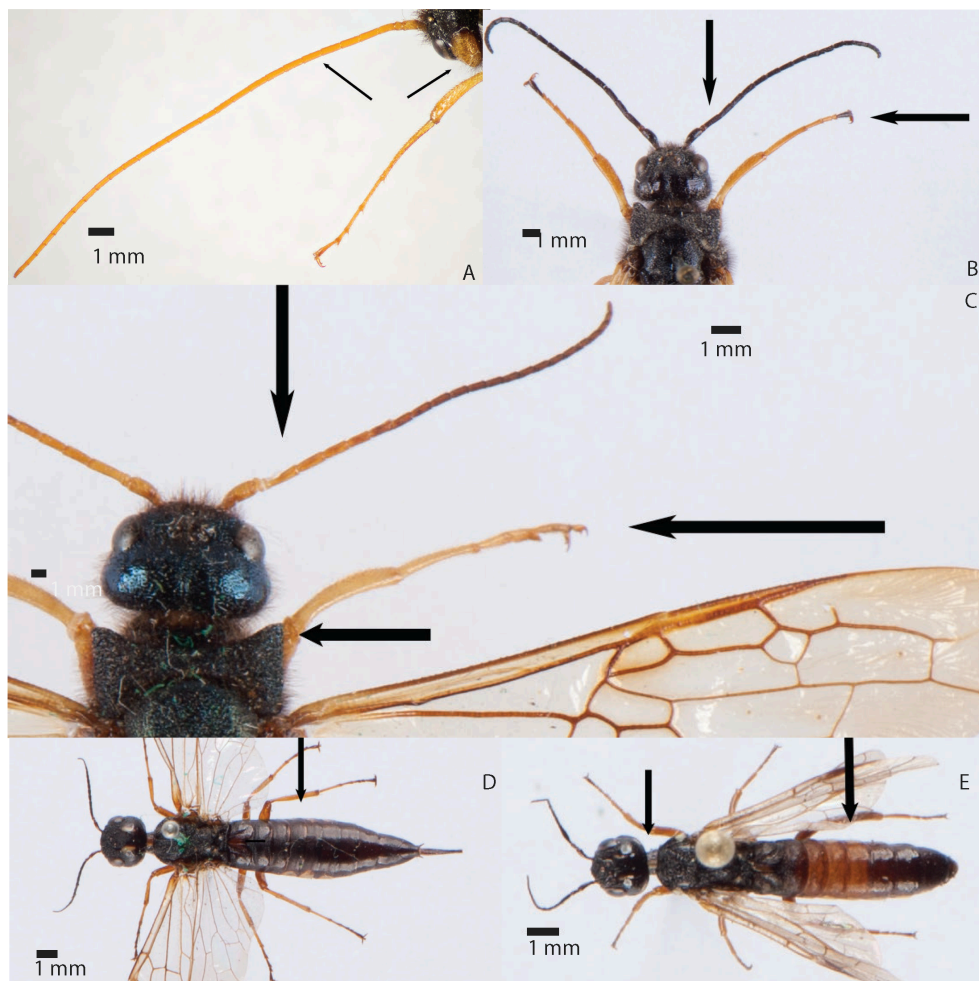


Fig 2. **A.** *Urocerus gigas* head and antennae (left arrow). Right arrow: Yellow spot behind eye. **B.** *Sirex noctilio* head and antennae (upper arrow). Lower arrow: Fore leg. **C.** *Sirex juvenus* head and antennae (upper arrow). Lower arrows: Fore leg. **D.** *Xiphydria camelus* female. Arrow: Abdomen. **E.** *Xiphydria prolongata* male. Left arrow: gap between head and pronotum; right arrow: red band on abdomen.

The following photographic equipment was used to produce images: a Canon EOS 5D Camera with a Canon MP-E 65mm Lens along with a StackShot 3X mounted on a Kaiser RS1 camera stand; a Cannon EOS 7D and an Infinity Model K2-SC lens mounted on a Visionary Digital motorized camera rig and illuminated by a Visionary Digital FX2 Lighting System; a Leica DFC420 camera attached to a Leica MZ16 A microscope. Habitus images were produced using a Nikon D700 Camera with a AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED lens and illuminated by 2 Winstro AD600M outdoor flashes. Image stacks were imported into Adobe Lightroom and then to Zerene Stacker to produce combined multifocus images. Scale bars were added in Adobe Photoshop. Adobe Lightroom was used to retouch images prior to integration in plates. Illustration plates were arranged with Adobe Illustrator.

Each genus was mapped onto a separate map for ease of viewing. Each of the maps were created in QGIS with the map data retrieved from the Danish Agency for Data Supply and Efficiency. Multiple records from the same locality were not differentiated on the map. Very general locality information (e.g., 'Sjælland') was not included on the maps.

Key to Danish species of Cephidae, Siricidae and Xiphydriidae

1. Cenchri absent (Fig 1A). Constriction anteriorly on abdomen visible in lateral view (Fig. 3F)..... 3 (Cephidae).
Cenchri (small membranous pads situated laterally on the metanotum) present (Fig. 1B). No
constriction on basal abdominal segments.2.
2. Head swollen behind the eyes, head appressed to pronotum (Fig. 2B). Mesonotum with notauli
and transscutal articulation absent. Tip of abdomen extended into spine, females with
ovipositor projecting well beyond abdomen (Fig. 11E). Body length usually exceeds 2 cm..... 11 (Siricidae).
Head not very swollen behind the eyes (Fig. 2D), distinct gap between head and pronotum
(Fig. 2E). Mesonotum with notauli and transscutal articulation present. Tip of abdomen without
prominent spine, ovipositor less conspicuous in females (Fig. 2E, 13G). Body length usually
less than 2 cm. 18 (Xiphydriidae).
3. 3rd antennomere longer than 4th (Fig. 1D). Antenna swollen after the 4th antennomere (Fig. 4B).
Left mandible with two or three teeth; if present, the third is fused to one of the other teeth (Fig.
4E). 9 (*Phyllocus*).
3rd antennomere shorter than 4th (Fig. 1C). Antenna swollen more distally than 4th antennomere.
Left mandible with a small third tooth between the two main ones (Fig. 8F).....4.
4. Antenna swollen from 7th antennomere (Fig. 8E). Eyes further apart than height of eye in frontal
view (Fig. 8C). Pronotum wider than long. 6 (*Cephus*).
Antenna swollen from 9th antennomere (Fig. 3C). Eyes not further apart than height of eye in
frontal view (Fig. 3D). Pronotum at least as long as wide (Fig. 7D)..... 5 (*Calameuta*).
5. Hind tibia black (Fig. 3F). Abdominal tergites with narrow yellow bands at least on tergites 4 to
6, possibly 3, and 7 as well (Fig. 3F). Tarsal claws with small subapical tooth (Fig. 3E).
..... *Calameuta filiformis*.
Hind tibia yellow with at most black band apically (Fig. 3G). Abdomen completely black in
females (Fig. 3G); abdominal tergites 4, 5, and often 6 broadly banded with yellow in males
(Fig. 3H). Tarsal claws bifurcate at apex (Fig. 3G)..... *Calameuta pallipes*.
6. Abdomen marked prominently with yellow (Fig. 3A, B). Head at most slightly constricted behind
eyes (Fig. 9A).....7
Abdomen all black, at most yellow spots on lateral margins of tergites (Fig. 1F). Head distinctly
constricted behind eyes (Fig. 1E). *Cephus nigrinus*.
7. Abdominal tergites 4-6 posterolaterally with yellow spots, often also on tergites 3 and 7 (Fig.
3A). *Cephus brachycercus*.
Tergites 4 and 6 with transverse yellow bands (Fig. 3B).....8.
8. Hind tibia yellow with at most a ring of reddish black at apex (Fig. 14D). Tarsal claws with erect
inner tooth (Fig. 14D). *Cephus spinipes*.
Hind tibia with inner side of apex or whole tibia reddish black (Fig. 14E). Tarsal claws with inner
tooth nearly parallel with outer tooth (Fig. 14E). *Cephus pygmeus*.
9. Pronotum completely black (Fig. 4A). Usually only two abdominal tergites with yellow bands
(Fig. 4C). No abdominal sternites marked with yellow. *Phyllocus niger*.
Pronotum marked with yellow or white on posterior margin (Fig. 4B). Abdomen usually with at
least four tergites marked with yellow or white (Fig. 4D)..... 10.
10. Interantennal furrow distinct, accommodates anterior ocellus (Fig. 4F). 4th antennomere 0.75
times as long as 3rd antennomere (Fig. 4F). Females with face usually clearly marked with
yellow. *Phyllocus linearis*.
Interantennal furrow more or less obsolete (Fig. 4E). 4th antennomere segment 2/3 times the
length of 3rd antennomere or shorter. Females with face usually black, at most with small yellow
spots (Fig. 4E). *Phyllocus xanthostoma*.

11. Antennae with 14-15 antennomeres (Fig. 5B). Distance between the eyes dorsally between 0.7 and 1.2 times as long as the maximum height of an eye (Fig. 5D). Distance between the inner edges of the two antennal sockets more than three times the distance between the outer edge of an antennal socket and the closest edge of the nearest eye (Fig. 5D). Forewing vein 2rm absent (Fig. 5F) *Tremex fuscicornis*.
 Antenna with more than 16 antennomeres (Fig. 5A). Distance between the eyes dorsally between 1.2 and 1.6 times as long as the maximum high of an eye (Fig. 5C). Distance between the inner edges of the two antennal sockets less than three times the distance between the outer edge of an antennal socket and the closest edge of the nearest eye (Fig. 5C). Forewing vein 2rm present (Fig. 5E). 12 (*Siricinae*).
12. Pronotum with a white or yellow band on dorsolateral margin (Fig. 6A, B). Hind tibia with one apical spur (Fig. 6H).....13 (*Xeris*).
 Pronotum uniformly colored (Fig. 2B-C). Hind tibia with two apical spurs.....14.
13. White band on pronotum smooth between projections (Fig. 6A). In female, coxae reddish brown, similar to rest of legs (Fig. 6C); in male, hind femur of blended color (Fig. 6C) and hind tarsomere 2 with dark band (Fig. 6G).*Xeris pallicoxae*.
 White band on pronotum coarsely sculptured between projections (Fig. 6B). In female, coxae dark brown, contrasting with brighter color of the rest of the legs (Fig. 6D); in male, hind femur and tarsomeres 2-5 reddish brown (Fig. 6H). *Xeris spectrum*.
14. Head with large white or yellow spot behind the eye (Fig. 2A). Antennae yellow (Fig. 2A) 15. (*Urocerus*).
 Head without spots. Antenna black, basal antennomeres might be paler (Fig. 2B, C).....
16 (*Sirex*).
15. Spots behind eye separated by dark band at least the width of the distance between the posterior ocelli (Fig. 12B). In females, hind tibia mostly yellow with at most apex darkened; ovipositor sheath less than 1.6 times the length of the hind tibia.....*Urocerus gigas*.
 Spots behind eye almost adjacent, separated by narrow dark band. In females, hind tibia with at least distal half darkened; ovipositor sheath at least 1.6 times the length of the hind tibia. *Urocerus augur*.
16. Basal antennomeres brown or yellow (Fig. 2C). 5th tarsomere on all legs yellow (Fig. 2C).....
 *Sirex juvencus*.
 Antenna completely black (Fig. 2B). 5th tarsomere on all legs yellow or black (Fig. 2B).....17.
17. 5th tarsomere on all legs yellow; in females, ovipositor 0.78-0.9 times the length of the fore wing. *Sirex cyaneus*.
 5th tarsomere on all legs black; in females, ovipositor 0.60-0.7 times the length of the fore wing. *Sirex noctilio*.
18. Abdomen completely black (Fig. 2E). *Xiphydria camelus*.
 Abdomen with a broad red band (Fig. 2F). *Xiphydria prolongata*.

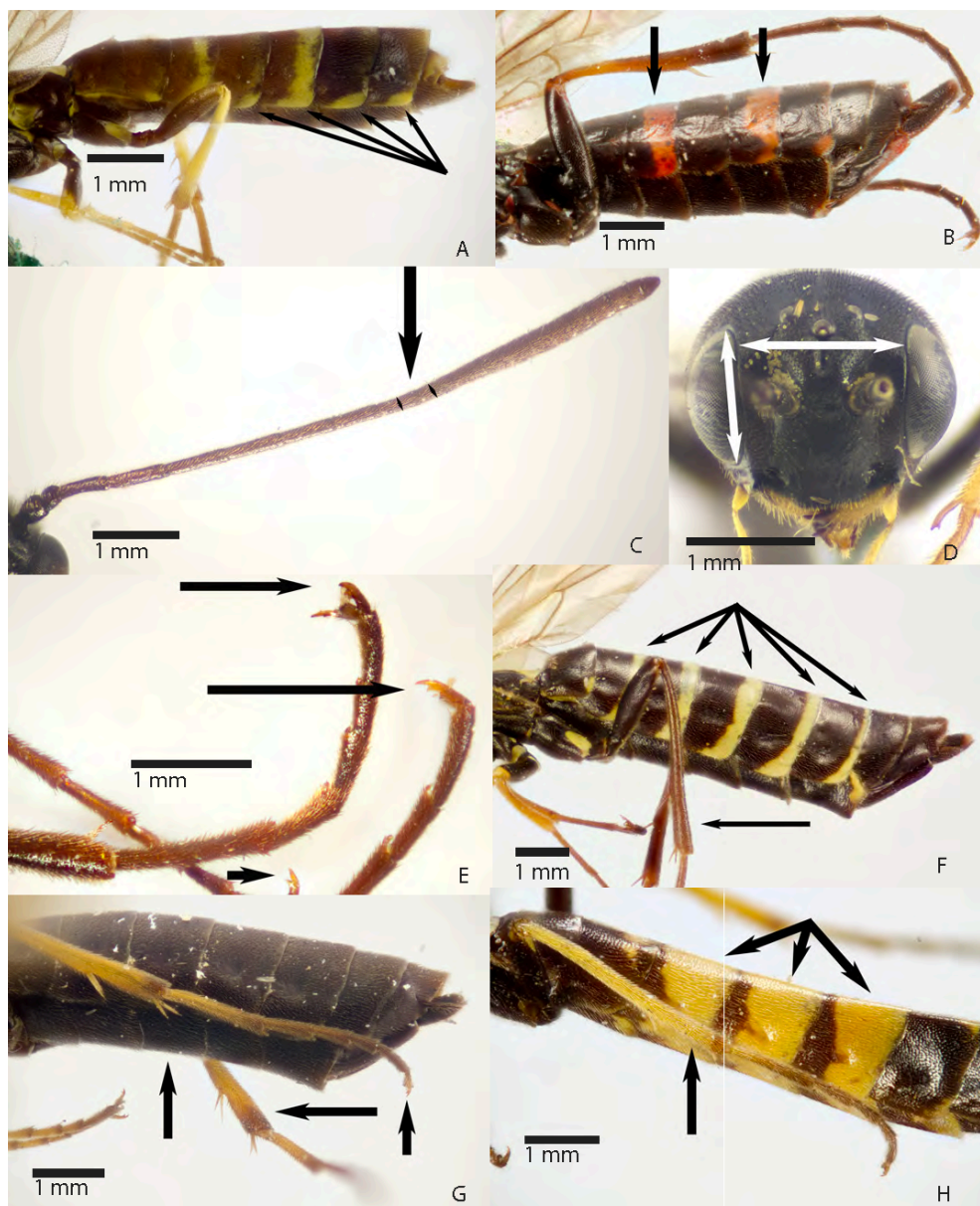


Fig 3. **A.** *Cephus brachycercus* male abdomen. Arrows: Yellow markings on abdominal terga. **B.** *Cephus pygmeus* female abdomen. Arrows: Coloured bands on abdomen. **C.** *Calameuta filiformis* antenna. Arrow: 9th antennomere. **D.** *Calameuta filiformis* face. **E.** *Calameuta filiformis* hind tarsus and claws (arrows). **F.** *Calameuta filiformis* abdomen and hind tibia (lower arrow). Upper arrows: yellow bands on abdomen. **G.** *Calameuta pallipes* female abdomen (left arrow), hind tibia (middle arrow) and claw (right arrow). **H.** *Calameuta pallipes* male abdomen and tibia (lower arrow). Upper arrows: Yellow bands on abdomen.



Figure 4. **A.** *Phyllocerus niger* female head and pronotum (arrow). **B.** *Phyllocerus linearis* female head and pronotum (lower right arrow). Lower left arrows indicate relative lengths of 3rd and 4th antennomere; upper arrows indicates relative widths of 3rd and 4th antennomere. **C.** *Phyllocerus niger* abdomen. Arrows: Yellow bands on abdomen. **D.** *Phyllocerus linearis* male abdomen. Arrows: Yellow bands on abdomen. **E.** *Phyllocerus xanthostoma* female face. Lowest arrows: Mandibles; mid arrows: interantennal area. **F.** *Phyllocerus linearis* female face. Lower arrow: Interantennal furrow; upper arrows: Yellow markings.

Cephidae

Description: Medium size, body length usually 10-15 mm. Antennae with 16-30 antennomeres, long and either clubbed (Fig. 3C) or threadlike (fig. 7A). Pronotum slightly expanded posteriorly in dorsal view (Fig. 7D), hind margin almost straight. Mesonotum with notauli present, transscutal articulation absent. Metanotum with cenchri absent (Fig. 1A). Fore tibia with one apical spur (Fig. 7B). Mid and hind legs usually with preapical spines (Fig. 7C). First abdominal tergite broadly subdivided by posteriorly broadening membrane area (Fig. 1A). Abdomen constricted in lateral view between tergum 1 and 2 (Fig. 3F). Ovipositor extends slightly beyond posterior end of abdomen (Fig. 10E).

Lifestyle: The adults usually occur in May-June. The adults are non-feeding and short-lived, usually living for 7-10 days after emergence (Shanower and Hoelmer, 2004; Delaney et al.,

2010). The females lay their eggs in the stem, shoots or twigs of their host plant. Host plants are either woody plants, Rosaceae (*Phylloecus*) or grasses (*Calameuta*, *Cephus*). In the latter, after hatching, the larva slowly eats its way towards the base of the stem. The larvae are cannibalistic and will eat any other eggs or larvae they encounter. They frequently girdle the stems when they reach the base; this may cause the stem to collapse eventually. The larva is usually active over the summer; it overwinters in the remains of the stem it has been feeding on. Next spring, the mature larva will make an opening to the outside and spin a cocoon in which to pupate. Pupation times depend on ambient temperatures, but is usually about two weeks.

***Calameuta* Konow, 1896**

Description: Head black, mandibles yellow with brown teeth (Fig. 3D). Eyes close together, being approx. as close or closer together than height of eye (Fig. 3D). Antennae strongly clubbed, thickening significantly from 9th antennomere (Fig. 3C). Pronotum as long as or longer than wide (Fig. 7D).

***Calameuta filiformis* (Eversmann, 1847)**

Figs 3, 7, 16, 33, 34.

Records: Lolland, LFM, Schiødte, 2 spec. (NHMD 19994 – 189995), Bornholm, B, 24/06/1964, O. M. B.V.P., 2 spec. (NHMD 189998, NMHD 190000). Bøffelkobbøl, SJ, 05/06/1886, Wustnei, 1 spec. (NHMD 190002). Norringure Skov, EJ, 03/06/2002, Rune Bygebjerg, 1 spec. (NHMA). Hjerl Hede, NWJ, 29/5/1988, Hans Thomsen Schmidt, 2 spec. (NHMA). Stubbergård Sø, NWJ, 08/06/1988, Hans Thomsen Schmidt, 1 spec. (NHMA). Hesselø, NWZ, 30/05/1990, Søren Tolsgaard, 1 spec. (NHMA). Ulvshale, LFM, 9/05/2003, Søren Tolsgaard, 1 spec. (NHMD). Nybølle Lunder, LFM, 30/05/2003, Søren Tolsgaard, 1 spec. (NHMA). Endelave Byen (Ø), LFM, 03/07/2005, Søren Tolsgaard, 1 spec. (NHMA).

Description: Antennae with 22-24 antennomeres (Fig. 7E). Hind tibia entirely black (Fig. 3F). Claws with small accessory subapical tooth (Fig. 3E). Abdomen with broad yellow hind margins on tergites 4-6, sometimes also on tergites 3 and 7 (Fig. 3F).

Distribution: Less common than *Calameuta pallipes* in Denmark, only present in SJ, NWJ, NWZ and NEZ (Fig. 34).

Host plants: Common Reed (*Phragmites australis*), False Oatgrass (*Arrhenatherum elatius*), Common Couchgrass (*Elytrigia repens*), Reed Canary Grass (*Phalaris arundinacea*), Bushgrass (*Calamagrostis epigejos*).

Parasites: *Chlorocytyus breviscapus* (Pteromalidae; Haarder, unpublished record), *Homoporus destructor* (Pteromalidae; Noyes, 2019), *Endromopoda detrita* (Ichneumonidae).

***Calameuta pallipes* (Klug, 1803)**

Figs 3, 7, 17, 33, 34.

Records: Ristinge Klint, F, 31/05-02/06/1983, 1 spec. (NHMD 191660). Bornholm, B, 23/05/1934, Larsson, 1 spec. (NHMD 191679). Knudsmose, WJ, 30/05/1939, 1 spec. (NHMD 191688). Tvillum, EJ, 06/06/1920, Esben Petersen, 1 spec. (NHMD 191718). Store Vildmose, NEJ, 01/06/1973, S. Andersen, V. Michelsen, 1 spec. (NHMD 191748). Bøffelkobbøl, SJ, 05/06/1886, Wustnei, 11 spec. (NHMD 191749 – 191759). Madeskov, SJ, 17/06/1886, Wustnei, 1 spec. (NHMD 191760). Skejten, Fuglsang, LFM, 12/06/1968, Leif Lyneborg, 1 spec. (NHMD 191761). Snave, Hindsholm, F, 19/06/1971, 1 spec. (NHMD 191762). Amager



Figure 5. **A.** *Sirex juvenus* female antennae (arrow). **B.** *Tremex fuscicornis* female antennae (arrow). **C.** *Urocerus gigas* female face. **D.** *Tremex fuscicornis* female face. **E.** *Sirex juvenus* female wing. Arrow: Vein 2m. **F.** *Tremex fuscicornis* female wing.

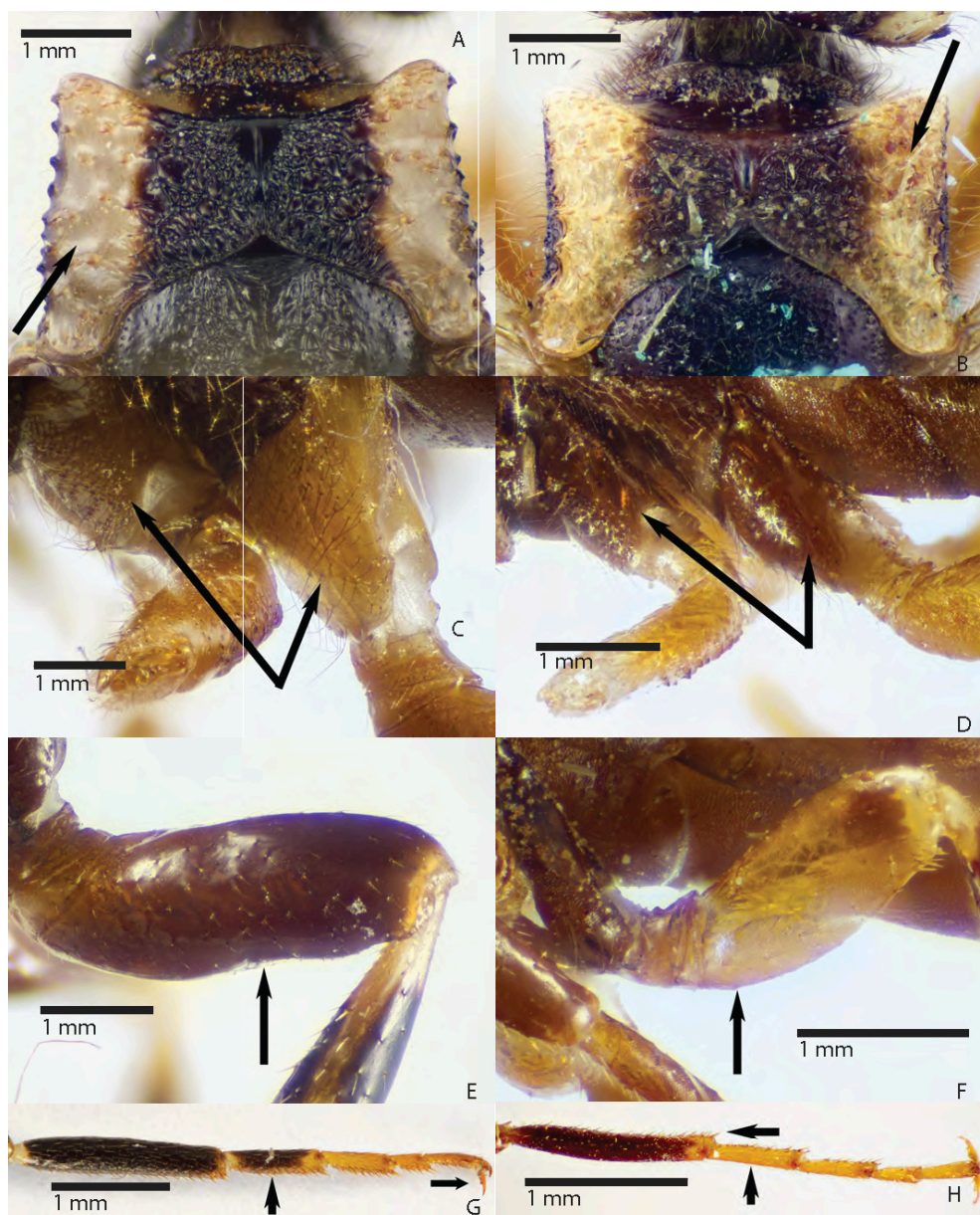


Fig 6. **A.** *Xeris pallicoxae* pronotum in dorsal view. Arrow: white band. **B.** *Xeris spectrum* pronotum in dorsal view. Arrow: white band. **C.** *Xeris pallicoxae* female mid and hind coxae (arrows) in lateral view. **D.** *Xeris spectrum* female mid and hind coxae (arrows) in lateral view. **E.** *Xeris pallicoxae* male hind femur (arrow) in lateral view. **F.** *Xeris spectrum* male hind femur (arrow) in lateral view. **G.** *Xeris pallicoxae* male tarsomere 2 (left arrow). Right arrow: Claw. **H.** *Xeris spectrum* male tarsomere 2 (lower arrow). Upper arrow: Tibial spur.

Fælled, NEZ, 06/06/1943, Worm Hansen, 1 spec. (NHMD 189349). Amager Fælled, NEZ, 09/09/1943, Worm Hansen, 1 spec. (NHMD 189350). Amager Fælled, NEZ, Worm Hansen, 11 spec. (NHMD 189351–189355, NHMD 189358–189363). Ørgård, Nors, Thy, NWJ, 10-30/06/1954, 7 spec. (NHMD 189364–189370). Stensbæk Plantage, SJ, Worm Hansen, 6 spec. (NHMD 189371–189376). Klitplantagen Læsø, EJ, 02/06/1970, 1 spec. (NHMD 189377). Hørup, SJ, 18/06/1883, 1 spec. (NHMD 189378). Tved Plantage, NWJ, 10/06/1960, 11 spec. (NHMD 191510–191520). Hansted Reservat, NWJ, 10/06/1960, 29 spec. (NHMD 191521–191548). Tved Plantage, NWJ, 10/06/1960, 1 spec. (NHMD 191549). Tipperne, WJ, 12/06/1973, Erik Rald, 2 spec. (NHMD 274237–274238). Tipperne, WJ, 15/06/1973, Erik Rald, 1 spec. (NHMD 274240). Tipperne, WJ, 16/06/1973, Erik Rald, 1 spec. (NHMD 274239). Tipperne, WJ, 22/06/1976, Erik Rald, 1 spec. (NHMD 274247). Høvænge, NEZ, 25/05/1990, S. Kristensen, 1 spec. (NHMD 274241). Vindeholme Skov, LFM, 24/05/1990, S. Kristensen, 2 spec. (NHMD 274244, 2742469). Vindeholme Skov, LFM, 25/05/1990, S. Kristensen, 1 spec. (NHMD 274242). Mellemskov, LFM, 03/06/1990, S. Kristensen, 1 spec. (NHMD 274243). Errindlev Skov, LFM, 03/06/1990, S. Kristensen, 1 spec. (NHMD 274245). Hesselø, NWZ, 30/05/1990, Søren Tolsgaard, 1 spec. (NHMA). Moesgård, EJ, 22/05/2002, Søren Tolsgaard, 1 spec. (NHMA). Store Sjørup Strand, EJ, 02/06/2002, Søren Tolsgaard, 1 spec. (NHMA). Øster Hurup Strand, NEJ, 25/06/2006, Søren Tolsgaard, 1 spec. (NHMA). Kalsenakke, EJ, 20/05/2017, Søren Tolsgaard, 1 spec. (NHMA). Sæd Grænsecafe, 13/06/2017, Søren Tolsgaard, 1 spec. (NHMA).

Description: Head and thorax black or dark brown. Antennae with 16–20 antennomeres (Fig. 7F). 5th palpomere of maxilla much shorter than 6th (Fig. 7G). Femur black on all legs. Fore and mid femur with light spot apically. Tibia mostly yellow. Claws bifurcate apically (Fig. 3G). **Female:** Abdomen entirely black (Fig. 3G). **Males:** Abdomen black with tergites 4, 5 and 6 with broad apical yellow bands (Fig. 3H).

Distribution: Common in Denmark, present in all faunal districts (Fig. 34).

Host plants (from Haris, 2011): Common Couchgrass (*Elytrigia repens*), Bushgrass (*Calamagrostis epigejos*), Reed Canary Grass (*Phalaris arundinacea*).

Parasites: *Endromopoda detrita* (Ichneumonidae).

***Cephus* Latreille, 1803**

Description: Eyes in frontal view much further apart than height of eye (Fig. 1C). Antennae thickened from 7th antennomere (Fig. 7H). Pronotum broader than long. **Female:** Sawsheath tapering off evenly behind, being narrower apically than basally (Fig. 15A, B). **Males:** 8th abdominal sternite with apical patch of spines and a fringe of flattened setae (Fig. 8A).

***Cephus brachycercus* Thomson, 1871**

Figs 3, 8, 18, 33, 34.

Records: Tisvilde, NEZ, 08/06/1897, 1 spec. (NHMD 191773). Lolland, LFM, Schiødte, 1 spec. (NHMD 189863).

Description: Head, thorax and abdomen black. Antennae brown with 18–19 antennomeres (Fig. 8B). Mandibles with prominent yellow spot centrally (Fig. 8C). Abdominal tergites with yellow spots posteroventrally on tergites 4–6, often also on tergite 3 and 7 (Fig. 3A). Tibiae yellow with dark band apically, tarsi dark brown (Fig. 8D) (Muche, 1981).

Distribution: Very rare in Denmark, only found in northern Zealand and Lolland (Fig. 34).

Host plants: Unknown.

Parasites: Unknown.

***Cephus nigrinus* Thomson, 1871**

Figs 1, 8, 19, 33, 34.

Records: Freerslev hegn NEZ, 22/05/1960, 6 spec. (NHMD 190064-190068). Jonstrup Vang, NEZ, 11/06/1970, 1 spec. (NHMD 190069). København, NEZ, Schiødte, 3 spec. (NHMD 190073, NHMD 190162-190163). Horsens, EJ, Schiødte, 1 spec. (NHMD 190075). Ry, EJ, Schiødte, 4 spec. (NHMD 190082, 190157-190159). Boserup, SZ, Schiødte, 1 spec. (NHMD 190100, NHMD 190161). Horsens, EJ, Schiødte, 6 spec. (NHMD 190151-190156). Sønderborg, SJ, 12/06/1885, Wustnei, 2 spec. (NHMD 190637, 190639). Sønderborg, SJ, 19/05/1886, Wustnei, 1 spec. (NHMD 190633). Sønderborg, SJ, 20/05/1885, Wustnei, 1 spec. (NHMD 190628). Sønderborg, SJ, 20/05/1886, Wustnei, 2 spec. (NHMD 190630-190631). Sønderborg, SJ, 02/06/1886, Wustnei, 1 spec. (NHMD 190629). Sønderborg, SJ, June/1888, Wustnei, 1 spec. (NHMD 190643). Sønderborg, SJ, May/1888, Wustnei, 1 spec. (NHMD 190648). Korsør, SZ, 25/05/1927, Eric B Hoffmeyer, 1 spec. (NHMD 190665). Hadsten, EJ, 28/05/1917, Esben Petersen, 1 spec. (NHMD 190669). Rudersdal, NEZ, 21/05/1932, O. Hørring, 2 spec. (NHMD 190674, NHMD 190679). Rudersdal, NEZ, 24/05/1932, O. Hørring, 2 spec. (NHMD 190680-190681). Høruphav, SJ, 05/06/1898, Wustnei, 1 spec. (NHMD 190712). Torrig, LFM, 10/06/1845, Jørgensen, 1 spec. (NHMD 197030). Vejle, EJ, Schiødte, 1 spec. (NHMD 191764). Klintebjerg, F, 27/05/1997, B. Baunegaard, 1 spec. (NHMD 191766). Horsens, EJ, 07/07/1870, O. G. Jensen, 1 spec. (NHMD 191766). Nekselø, NWZ, 30/05/1971, B. Petersen, 1 spec. (NHMD 191322). Jægerspris Nordskov, NEZ, B. Petersen, 1 spec. (NHMD 191337). Hansted Reservatet, EJ, 11/06/1960, 2 spec. (NHMD 191406, 191411). Draved Skov, SJ, 24/05/1971, 1 spec. (NHMD 191455). Draved Skov, SJ, 27/05/1971, 1 spec. (NHMD 191486). Jægerspris, NEZ, 26/05/1985, 1 spec. (NHMD 191493). Årup Skov, SJ, 18/06/1977, Hans Thomsen Schmidt, 1 spec. (NHMA). Stubbegård Sø, 08/06/1988, Hans Thomsen Schmidt, 1 spec. (NHMA).

Description: Antennae with 19-20 antennomeres (Fig. 8E). Head black or brown (Fig. 1E). Mandibles yellow. Maxillary palp yellow centrally, brown or black apically and basally (Fig. 8F). Head constricted behind eyes (Fig. 1E). Thorax and abdomen black or dark brown (Fig. 1E, F). Hind femur black with yellow spot apically (Fig. 8G). Fore and mid legs with tibiae yellow and basal tarsal segments, apical tarsal segments brown (Fig. 8G). Hind tibia yellow and marked with brown apically, basal tarsal segments yellow, apical tarsal segments brown or black (Fig. 8H). Abdomen black, rarely with yellow spots laterally on some tergites (Fig. 1F).

Distribution: Relatively widespread in Denmark, recorded in SJ, EJ, NWJ, F, SZ, NEW, NEZ, LFM and B. (Fig. 34).

Host plants: American Milletgrass (*Milium effusum*), Common Meadowgrass (*Poa pratensis*) (Benson, 1946).

Parasites: *Endromopoda detrita* (Ichneumonidae).

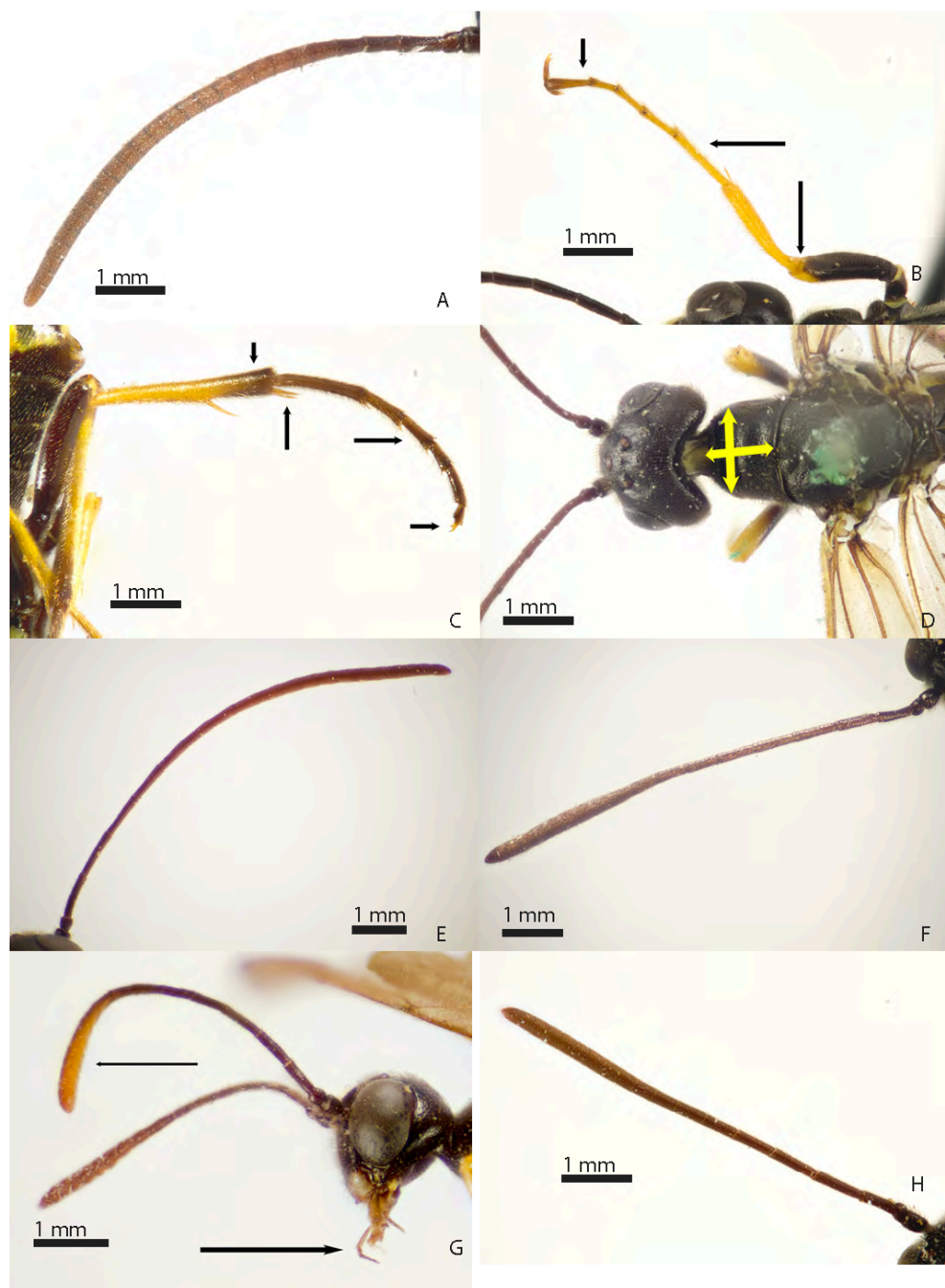


Fig 7. A. *Phylloecus niger* antenna. B. *Cephus pygmeus* foreleg. Left arrow: 5th tarsomere; mid arrow: 1st tarsomere, right arrow: tip of fore femur. C. *Cephus spinipes* hind leg. Upper left arrow: Tip of hind tibia; lower left arrow: Apical tibial spur; upper right arrow: 3rd tarsomere; lower right arrow: Claw. D. *Calameuta pallipes*. E. *Calameuta filiformis* antenna. F. *Calameuta pallipes* antenna. G. *Calameuta pallipes* head. Left arrow: Antennal club; right arrow: Maxillary palp. H. *Cephus spinipes* antenna.

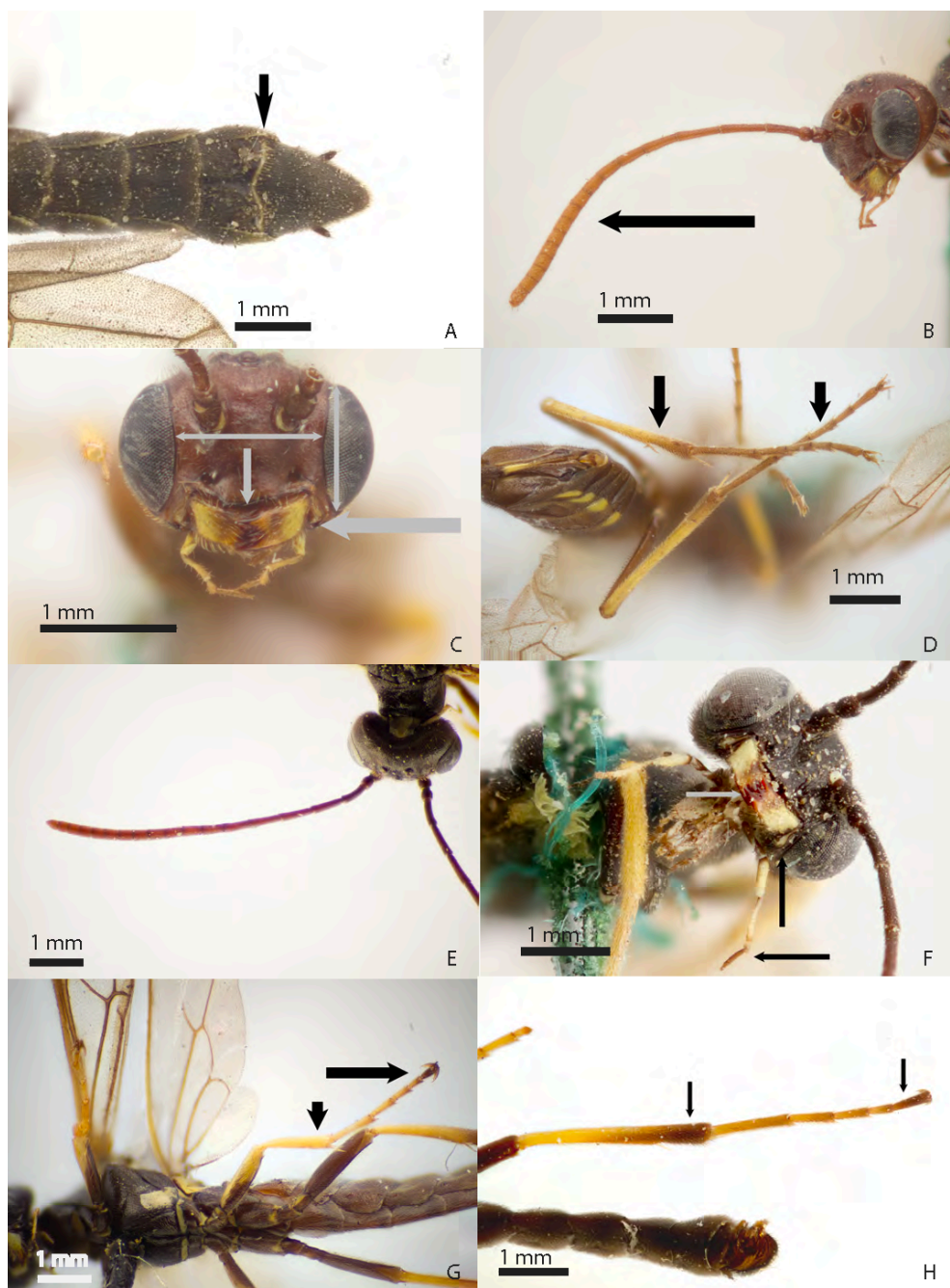


Fig 8. **A.** *Cephus nigrinus* male abdomen, ventral view. Arrow: Setal fringe. **B.** *Cephus brachycercus* antenna. Arrow: Antennal club. **C.** *Cephus brachycercus* face. Right arrow: Mandible base; middle arrow: Mandible teeth. **D.** *Cephus brachycercus* leg. Left arrow: Tip of hind tibia; right arrow: Hind tarsus. **E.** *Cephus nigrinus* antenna. **F.** *Cephus nigrinus* face. Upper black arrow: Mandible base; white arrow: Mandible teeth; lower black arrow: Maxillary palp. **G.** *Cephus nigrinus* fore and mid legs. Left arrow: Tip of mid tibia; right arrow: 5th tarsomere. **H.** *Cephus nigrinus* hind leg. Left arrow: Tip of hind tibia; right arrow: 5th tarsomere.

***Cephus pygmeus* (Linnaeus, 1767)**

Figs 3, 7, 9, 14, 20, 33, 34.

Cephus pygmeus is sometimes misspelled as *Cephus pygmaeus* (Taeger et al., 2010).

Records: Roden Skov, LFM, 18/06/1946, Worm-Hansen, 2 spec. (NHMD 187149-187150). Toreby pr Flintinge, LFM, 29/06/1945, Worm-Hansen, 7 spec. (NHMD 187151, 187153-187154, 187158, 187160, 187162). Sønderborg, SJ, 12/06/1885, Wustnei, 4 spec. (NHMD 187164, 187167, 187175, 187179). Sønderborg, SJ, 02/06/1885, Wustnei, 2 spec. (NHMD 187166, 187177). Sønderborg, SJ, 17/6/1885, Wustnei, 2 spec. (NHMD 187165, 187171). Korsør, SZ, 26/06/1926, Erik Hoffmeyer, 1 spec. (NHMD 187180). Farum, NEZ, 30/05/1946, Worm-Hansen, 5 spec. (NHMD 187181-187185). Øst Assels, NWJ, 3/7/1942, Worm-Hansen, 1 spec., (NHMD 187187). Sengeløse, NEZ, 06/07/1991, B. Baungaard, 1 spec. (NHMD 187193). Ryget Skov, NEZ, 23/06/1946, Asger Fog, 1 spec. (NHMD 187195). Strandby, NEJ, 15/07/1816, Esben-Petersen, 1 spec. (NHMD 187198). Ho, WJ, 1 spec. (NHMD 187199). Svinninge, NWZ, 16/5/1948, Worm-Hansen, 3 spec. (NHMD 187598-187600). Strandmøllen NEZ, June/1877, Schiødte, 1 spec. (NHMD 187609). Strandby, NEJ, Juli/1877, Schiødte, 1 spec. (NHMD 187613). Sønderborg, SJ, 02/06/1886, Wustnei, 10 spec. (NHMD 187628, 187644-187652). København, Schiødte, 2 spec. (NHMD 187720-187721). Ho, WJ, Schiødte, 4 spec. (NHMD 187765-187768). Bornholm, B, Schiødte, 1 spec. (NHMD 187770). Sorø, SZ, Schiødte, 1 spec. (NHMD 187771). Stigsnaes, SZ, Erik Hoffmeyer, 1 spec. (NHMD 187791). København, NEZ, Schiødte, 1 spec. (NHMD 187816). Møn, LFM, Schiødte, 1 spec. (NHMD 187821). Falster, LFM, Schiødte, 2 spec., (NHMD 187823, NHMD 189865). Horsens, EJ, Schiødte, (NHMD 187824). Strandby, NEJ, 20/07/1929, Esben-Petersen, 1 spec. (NHMD 187525). Basnæs, SJ, 12/06/1927, Esben-Petersen, 1 spec. (NHMD 187524). Korsør, SZ, Erik B. Hoffmeyer, 1 spec. (NHMD 187522). Sønderborg, SJ, June/1889, Wüstnei, 1 spec. (NHMD 187526). Sønderborg, SJ, Wüstnei, 1 spec. (NHMD 187527). Stignæs, SZ, 01/07/1926, 1 spec. (NHMD 187528). Kongelunden, NEZ, 07/06/1942, Worm-Hansen, 1 spec. (NHMD 187523). Vorsø, EJ, 22/06/1935, O. Hørring, 17 spec. (NHMD 187517-187520, 187505-187509, 187495, 187493, 187490, 187488, 187486, 187483-187484). Humlebæk, NEZ, 12/07/1925, O. Hørring, 1 spec. (NHMD 187460). Jonstrup Vang, NEZ, 19/06/1970, Henrik Enghoff, 1 spec. (NHMD 187456). Ermelunden, NEZ, 13/06/1970, Henrik Enghoff, 1 spec. (NHMD 187455). Jonstrup Vang, NEZ, 11/06/1970, Henrik Enghoff, 1 spec. (NHMD 187457). Sønderby, NEZ, 12/06/1901, Chr. Jørgensen, (NHMD 187464). Æbelø, F, 25/06/1943, Worm-Hansen, 1 spec. (NHMD 187521). Tisvilde Hegn, NEZ, 14/06/1989, O. Lomholdt, 1 spec. (NHMD 187459). Tisvilde Hegn, NEZ, 22/06/1987, O. Lomholdt, 1 spec. (NHMD 187458). Samsø, EJ, 25/06/1962, O. Lomholdt, 1 spec. (NHMD 187530). Ry, EJ, June/1856, Schiødte, 1 spec. (NHMD 189319). Årup Skov, SJ, 22/06/1977, Hans Thomsen Schmidt, 1 spec. (NHMA). Stubbergård Sø, NWJ, 08/06/1988, Hans Thomsen Schmidt, 1 spec. (NHMA). Hadsund, EJ, 01/06/2002, Søren Tolsgaard, 1 spec. (NHMA). Øster Hurup Strand, NEJ, 25/06/2006, Søren Tolsgaard, 1 spec. (NHMA).

Description: Head completely black or brown (Fig. 9A). Head and thorax shiny, without any pits (Fig. 9A). Mandible mostly yellow, with brown teeth (Fig. 9B). Antennae with swollen club, preapical antennomeres broader than long (Fig. 9C). Fore femur black with yellow spot apically, tibia and tarsus yellow, claws black (Fig. 9D). Mid and hind femur black, tibiae yellow with black markings apically, tarsal segments black (Fig. 3B). Abdomen primarily black or dark brown. Some tergites colored with broad yellow bands, 4+6 always banded, tergites 3, 7 and 8 often banded, tergites 5 and 9 rarely banded (Fig. 3B).

Distribution: Common in Denmark, found in all faunal districts (Fig. 34). A *Cephus pygmeus* specimen in NHMD was misidentified as *Janus cynosbati* (Linnaeus, 1758).

Host plants: Wheatgrass (*Agropyron* sp.) (Benson, 1946), Brome Grass (*Bromus* sp.) (Benson, 1946), Barley (*Hordeum vulgare*, *Hordeum* sp.) (Benson, 1946; Gol'berg, 1986), Tufted Grass (*Phleum* sp.) (Benson, 1946), Rye (*Secale cereale*, *Secale* sp.) (Benson, 1946; Malipatil, 2008), Wheat (*Triticum aestivum*, *Triticum* sp.) (Benson, 1946; Gol'berg, 1986), Hoary Cress (*Lepidium draba*), Common Oat (*Avena sativa*) (CABI).

Parasites: Braconidae: *Bracon* (*Glabrobracon*) *praetermissus*, *Bracon minutor*, *Zelex chlorophthalmus*; Ichneumonidae: *Barycnemis gravipes*, *Bathytrix fragilis*, *Collyria calcitrator* (Streams and Coles, 1965), *Endromopoda detrita*, *Gambrus tricolor*, *Gelis fallax*, *Pleolophus vestigialis*, *Scambus sagax*, *Theroscopus hemipteron*; Eulophidae (Noyes, 2019): *Elachertus fenestratus*, *Necremnus tidius*, *Pediobius nigratarsis*, *Tetrastichus* sp. (Streams and Coles, 1965); Eupelmidae (Noyes, 2019): *Brasema allynii*, *Eupelmus atropurpureus*, *Eupelmus vesicularis*; Eurytomidae (Noyes, 2019): *Bruchophagus squamea*; Pteromalidae (Noyes, 2019): *Norbanus meridionalis*, *Norbanus obscurus*, *Norbanus scabriculus*.

***Cephus spinipes* (Panzer, 1800)**

Figs 1, 7, 9, 14, 15, 21, 33, 34.

Records: Sønderborg, SJ, June/1890, Wüstnei, 2 spec. (NHMD 188060-188061). Ristinge Klint, F, 31/5-2/6/1983, O. Lomholdt, 1 spec. (NHMD 188064). Løgnor, LFM, 11/6/1942, Krigger, 1 spec. (NHMD 188065). Kristianssæde, LFM, 26/6/1964, P. Jensen, 1 spec. (NHMD 188066). Nekselø, NWZ, 30/5/1971, B. Petersen, 1 spec. (NHMD 188067). Basnæs, SZ, 12/06/1827, Erik B. Hoffmeyer, 3 spec. (NHMD 188068-188070). Kerteminde, F, Schiødte, 1 spec. (NHMD 188071). Krenkerup, LFM, 20/06/1915, Lavr Jørgensen, 1 spec. (NHMD 188072). Vejle, Schiødte, 3 spec. (NHMD 188073-188075). Falster, LFM, Schiødte, 1 spec. (NHMD 188076). Horsens, EJ, Schiødte, 1 spec. (NHMD 188077). Vorsø, EJ, 1 spec. (NHMD 188082). Rørvig, NWZ, 1 spec. (NHMD 188083). Horsens, EJ, 1 spec. (NHMD 188087). Sønderborg, SJ, Wustnei, 1 spec. (NHMD 188088). Madeskov, SJ, 8/7/1881, Wustnei, 2 spec. (NHMD 189888-189889). Bøffelkobbøl, SJ, 8/6/1886, Wustnei, 1 spec. (NHMD 189896). Ermelunden, NEZ, 16/06/1970, Erik Rald, 1 spec. (NHMD 191768). Tisvilde Hegn, NEZ, 08/06/1978, Erik Rald, 1 spec. (NHMD 191769). Hårup Sande, EJ, 28/04/2011, Nicholas Bell, 1 spec. (NHMA). Skåde, EJ, 16/05/1988, Søren Tolsgaard, 1 spec. (NHMA). Horreby Lyng, LFM, 05/06/2002, Søren Tolsgaard, 1 spec. (NHMA). Fløjstrup, Alling, EJ, 08/06/2005, Søren Tolsgaard, 1 spec. (NHMA). Løjstrup Skov, EJ, 12/06/2015, Søren Tolsgaard, 1 spec. (NHMA). Rold Skov, NEJ, 21/06/2016, Søren Tolsgaard, 1 spec. (NHMA).

Description: Antennae with 18-20 antennomeres (Fig. 7H). Mandibles yellow with black or brown teeth apically (Fig. 9E). Face marked with yellow triangle situated between mandible and ventral margin of eye (Fig. 9E). Maxillary and labial palp yellow with apical palpomere brown (Fig. 9E). Fore and mid tibiae yellow, basal tarsal segments yellow, apical segments brown (Fig. 9F). Hind tibia yellow and marked with brown basally, tarsal segments brown (Fig. 9G). Claws with erect inner tooth (Fig. 9G).

Distribution: Relatively widespread in Denmark, being found in LFM, F, SJ, EJ, NEJ, SZ, and NEZ. Observations are most common in EJ and on LFM (Fig. M5).

Host plants: Timothy Grass (*Phleum pratense*), Cocks'-foot (*Dactylis glomerata*).

Parasites: Chalcidoidea spp., *Eupelmus* sp. (Eupelmidae).

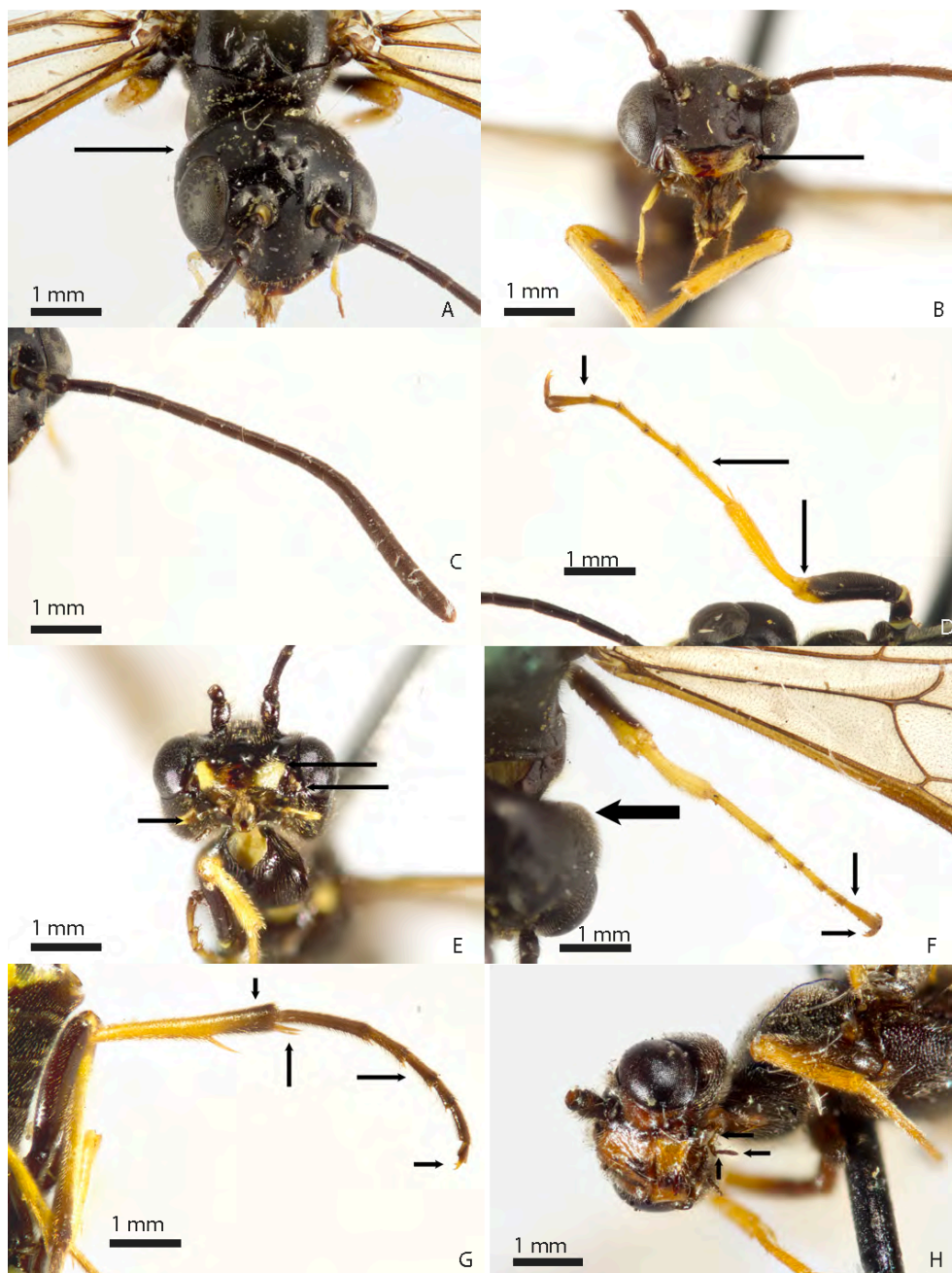


Fig 9. **A.** *Cephus pygmeus* head. Arrow: Constriction behind eye. **B.** *Cephus pygmeus* face. Arrow: Mandible base. **C.** *Cephus pygmeus* antenna. **D.** *Cephus pygmeus* fore leg. Left arrow: 5th tarsomere; middle arrow: 1st tarsomere, right arrow: Tip of femur. **E.** *Cephus spinipes* face. Left arrow: Mandible base. **F.** *Cephus spinipes* fore leg. Left arrow: Area behind eye; upper right arrow: 5th tarsomere; lower right arrow: Claw. **G.** *Cephus spinipes* hind leg. Upper left arrow: Tip of hind tibia; lower left arrow: Apical tibial spur; upper right arrow: 3rd tarsomere; lower right arrow: Claw. **H.** *Phylloecus niger* face. Arrows: Maxillary palp.

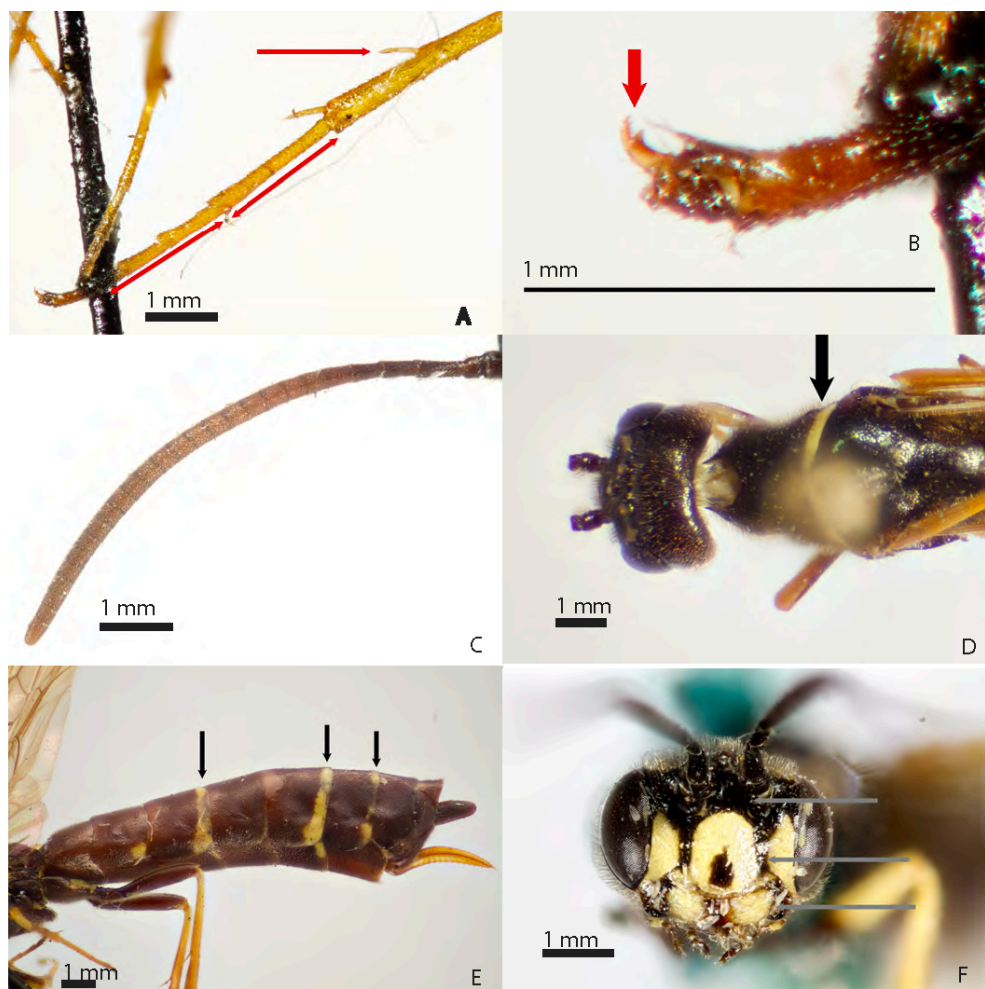


Fig 10. **A.** *Phylloecus niger* hind leg. Upper arrow: Preapical tibial spur; lower arrows: Tarsomeres. **B.** *Phylloecus niger* claw (arrow). **C.** *Phylloecus niger* antenna. **D.** *Phylloecus xanthostoma* head and pronotum. Arrow: Yellow band on pronotum. **E.** *Phylloecus xanthostoma* abdomen. Arrows: Yellow bands on terga. **F.** *Phylloecus xanthostoma* male face. Arrows: Yellow markings.

***Phylloecus* Newman, 1838**

(formerly *Hartigia* Schiødte, 1839)

Description: Antennae with 3rd antennomere longer than 4th (Fig. 4B). Antennae swells slightly after fourth antennomere and following antennomeres of equal thickness (Fig. 4B). Left mandible with small accessory tooth between two main teeth fused to inner tooth or absent (Fig. 4E). Maxilla with 4th palpomere not much longer than 6th; latter inserts near apex of 5th palpomere (Fig. 9H). Hind tibia with one preapical spine (Fig. 10A). Tarsal claws with two apical teeth and no basal lobe (Fig. 10B). First tarsomere on hind leg approximately as long as following three tarsomeres (Fig. 10A).

***Phylloecus linearis* (Schrank, 1781)**

Figs 1, 4, 22, 33, 35.

Records: Møn, LFM, Schiødte, 1 spec. (NHMD 189815). Sønderby, NEZ, 19/06/1901, 1 spec. (NHMD 189821). Sønderborg, SJ, 25/06/1886, Wustnei, 1 spec. (NHMD 189822). Borumraa, EJ, 15/06/1922, Hoffmeyer, 1 spec. (NHMD 189825). Maribo, LFM, 11/6/1937, 2 spec. (NHMD 189828). Sønderby, NEZ, 12/06/1901, 1 spec. (NHMD 189320).

Description: Antennae with 4th antennomere 0.75 x length of 3rd antennomere (Fig. 4B). Mandibles and face clearly marked with yellow. Face without any punctures. Interantennal furrow deep, accommodates median ocellus (Fig. 4F). Posterior edge of pronotum lined with yellow, yellow band on pronotum divided by short black band in the middle (Fig. 1D). At least four tergites with yellow transverse bands (Fig. 4D).

Distribution: Rare in Denmark. Found in NEZ, LFM, EJ, and SJ (Fig. 35). A *Phylloecus linearis* specimen in NHMD was misidentified as *Janus cynosbati*.

Host plants (from Benson, 1946): Common Agrimony (*Agrimonia eupatoria*), Meadowsweet (*Filipendula ulmaria*), Great Burnet (*Sanguisorba officinalis*).

Parasites: *Gambrus tricolor*, *Glypta nigrina*, *Scambus nigricans* (all Ichneumonidae).

***Phylloecus niger* (Harris, 1779)**

Figs 4, 7, 9, 10, 23, 33, 35.

Records: Madeskov, SJ, 30/5/1840, Wustnei, 1 spec. (NHMD 189839). Madeskov, SJ, 18/05/1884, Wustnei, 1 spec. (NHMD 190132). Madeskov, SJ, 18/06/1884, Wustnei, 1 spec. (NHMD 189901). Madeskov, SJ, 30/05/1884, Wustnei, 1 spec. (NHMD 189902). Anholt, EJ, Wustnei, 1 spec. (NHMD 189841). Vejle, EJ, Schiødte, 1 spec. (NHMD 189900). Gindeskov, NWJ, 25/06-05/07/1942, Worm-Hansen, 1 spec. (NHMD 189318). Vindeholme Skov, LFM, 27/05/2003, Rune Bygebjerg, 1 spec. (NHMA).

Description: Head and pronotum densely punctured. Antennae with 26-30 antennomeres (Fig. 10C). Pronotum black or dark brown (Fig. 4A). Front, mid and hind tibia and tarsus yellow or orange (Fig. 4C). Abdomen with at most two tergites with yellow bands laterally (Fig. 4C). Abdominal sternites dark brown or black (Fig. 4C).

Distribution: *P. niger* is a very rare species found on Lolland, Anholt, and Als (Fig. 35). Two *Phylloecus niger* specimens from NHMD were misidentified as *Janus cynosbati*.

Host plants: Brambles (*Rubus* sp.) (Benson, 1946), Red Raspberry (*Rubus idaeus*), Dog Rose (*Rosa canina*), Corymb Rose (*Rosa corymbifera*), Sherard's Downy Rose (*Rosa sherardii*), Blackberry (*Rubus fruticosus*).

Parasites: Unknown.

***Phylloecus xanthostoma* (Eversmann, 1847)**

Figs 4, 10, 24, 33, 35.

Records: Kjærgård, EJ, 17/06/1828, Esben-Petersen, 1 spec. (NHMD 189848). Falster, LFM, Schiødte, 1 spec. (NHMD 189851). Sønderborg, SJ, Wustnei, 1 spec. (NHMD 189850). Madeskov, SJ, 22/06/1894, Wustnei, 1 spec. (NHMD 189900). Sejerø, NWZ, 09/06/1963, Lomholdt, 1 spec. (NHMD 189853).

Description: Face with only scattered punctures (Fig. 4E). 4th antennomere 0.67 x as long as 3rd antennomere (Fig. 4E). Interantennal furrow faint (Fig. 4E). Posterior edge of pronotum usually lined with yellow, divided by short black band medially (Fig. 10D). Abdomen with at least four tergites with yellow lateral bands (Fig. 10E). Sternites may be marked laterally with yellow (Fig. 10E). **Females:** Head usually black, may have small spots of yellow. **Males:** Mandibles and frons marked heavily with yellow (Fig. 10F).

Distribution: *P. xanthostoma* is rare in Denmark with only five records. It has been found in northern Jutland, on Falster, Sejerø and in Sønderborg municipality (Fig. 35).

Host plants: Meadowsweet (*Filipendula ulmaria*).

Parasites: Braconidae: *Bracon obscurator*; Ichneumonidae: *Apechthis rufata*, *Ephialtes manifestator*, *Gregopimpla inquisitor*, *Perithous scurra*, *Pimpla turionellae*, *Xorides praecatorius*; Eulophidae: *Euderus albitarsis* (Noyes, 2019); Pteromalidae: *Chlorocyrtus diversus*.

Siricidae

Description: Large, highly variable in body size (14-40mm, excluding ovipositor), females larger than males. Well-defined subantennal groove below eyes accommodating curved scape (Fig. 11A). Pedicel wider than long (Fig. 11A). Antennae with 13-30 antennomeres (Fig. 2A, B). Maxillary and labial palp with one and two-three palpomeres, respectively. Pronotum concave anteriorly, accommodating head (Fig. 2C). Mesonotum with notauli and transscutal articulation absent. Forewing cell 3R1 enlarged towards apex, forewing vein R1 and Rs2 ending with short petiole (Fig. 15B). Fore tibia with one apical spur (Fig. 11B). In females, tarsomere 1 0.7 to 1 x as long as tibia (Fig. 11C); in males, tibia and tarsomeres 1-3 greatly thickened or flattened laterally (Fig. 11D). Abdomen cylindrical with first tergite medially divided (Fig. 2B). Prominent spine (cornus) project posteriorly from tergum 10 (Fig. 11E) in females, from sternum 9 (Fig. 11F) in males.

Lifestyle: Siricids are large woodliving wasps. All siricids live in a mutualistic symbiotic relationship with a wood degrading basidiomycete fungus (Slippers et al., 2011; Schiff et al., 2012) which they transfer to the wood together with their eggs. Besides egg and fungus, the female will also transfer phytotoxic mucus which in conjunction with the fungus will weaken and potentially kill the host tree (Schiff et al., 2012). Members of the genus *Xeris*, who lack the fungal symbiont, will seek out trees already infested by other siricids and oviposit in the wood (Slippers et al., 2011). The larvae will tunnel towards the heartwood but relocate to just under the surface prior to pupation (Morgan, 1968). Female larvae store fungal spores in external pockets on the first abdominal segment (Parkin, 1942). The pupal stage is of approx. four weeks duration. If conditions are unfavorable or if the pupa hatches too late in the year the adult can spend the winter inside the tree (Slippers et al., 2011). The duration of larval development varies greatly between species, but in our latitudes, it usually requires more than one year (Schiff et al., 2012). After hatching the adult females (except *Xeris*) will pick up the fungus from the larval tunnel walls and store them in internal sacks at the base of the ovipositor (Schiff et al., 2012). Flight times vary by species and range from June to October. The adult is relatively short-lived (approx. 10 days) as they do not feed. The males usually emerge a few days before the females (Aparicio et al., 2013). After emergence, the adults congregate in treetops where they mate when the weather is warm (Morgan, 1968). The females are more frequently encountered as they search for a place to oviposit, whereas the males usually stay in the treetops.

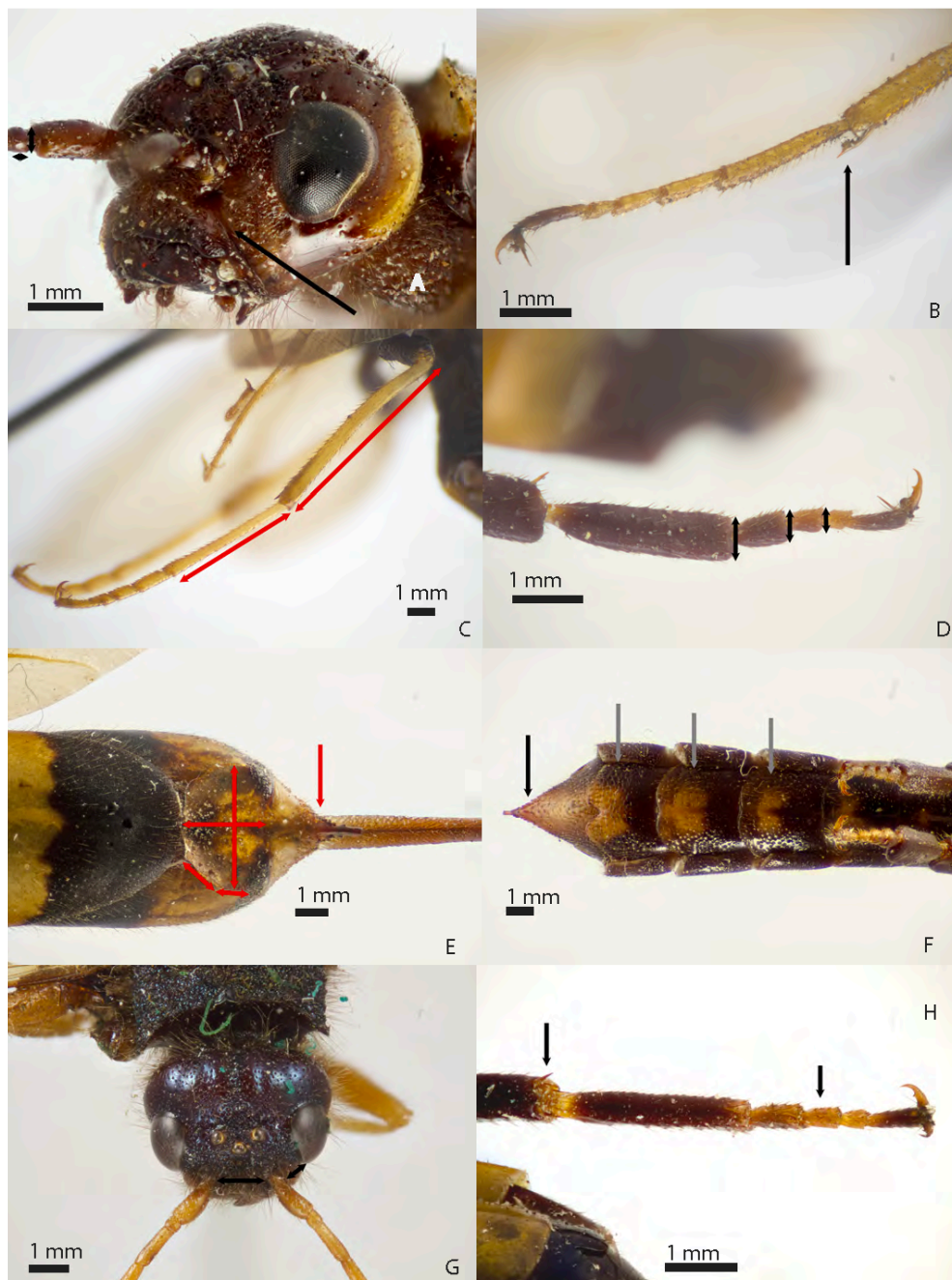


Fig 11. **A.** *Xeris spectrum* head. Arrow: Subantennal groove. **B.** *Sirex noctilio* distal fore leg. Arrow: Apical spur. **C.** *Urocerus gigas* female distal hind leg. Arrows: Relative length of tibia and 1st tarsomere. **D.** *Sirex noctilio* hind tarsus. **E.** *Tremex fuscicornis* female abdomen, dorsal. Left arrows: Dimensions of median basin; right arrow: Cornus. **F.** *Tremex fuscicornis* male abdomen, ventral. Black arrow: Cornus on sternum 9; grey arrows: Brown markings on sternites. **G.** *Sirex juvenus* head. **H.** *Sirex noctilio* male hind tarsus. Left arrow: Apical tibial spurs; right arrow: 3rd tarsomere.

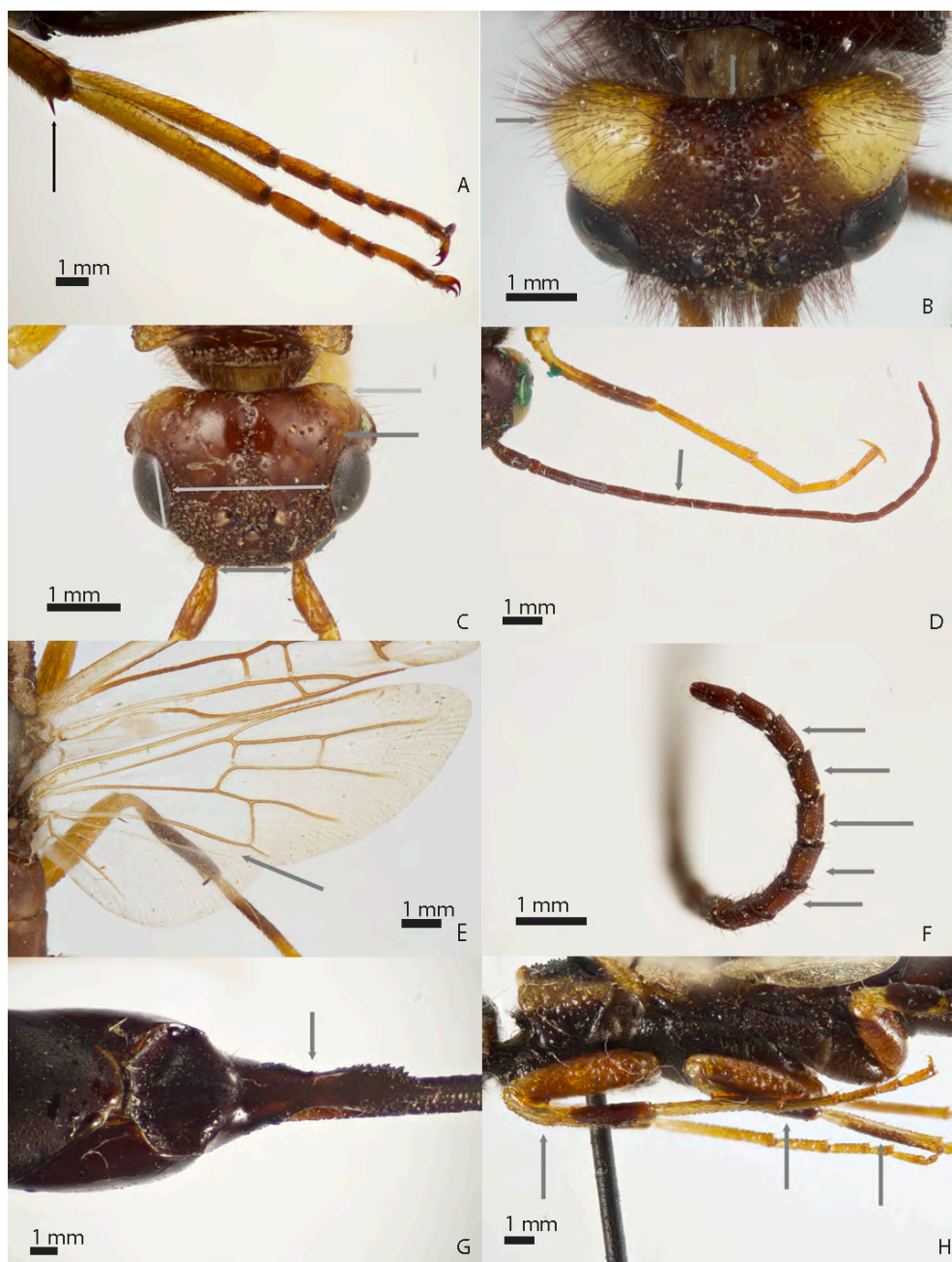


Fig 12. **A.** *Tremex fuscicornis* female hind leg. Arrow: Apical tibial spur. **B.** *Urocerus gigas* head. Left arrow: Lateral yellow spot; right arrow: Darkened area separating spots. **C.** *Xeris spectrum* head, dorsal. Right arrow: Ridges on vertex; remaining arrows: Dimensions. **D.** *Xeris spectrum* antennae (arrow). **E.** *Xeris spectrum* hind wing. Arrow: Anal area. **F.** *Xeris spectrum* female antenna. Arrows: Sensory pits. **G.** *Xeris spectrum* female abdomen tip, dorsal. Arrow: Cornus. **H.** *Xeris pallicoxae* male fore leg. Left arrow: Fore tibia; middle arrow: Mid tibia, right arrow: Mid 1st tarsomere.

***Sirex* Linnaeus, 1760**

Description: Antennae with 16 to 21 antennomeres (Fig. 2D). Distance between antennal sockets 1.5 to 2 times distance between eye and antennal socket (Fig. 11G). Head entirely black or dark brown, and without bright spots behind eye (Fig. 11G). Pronotum smooth or pitted on less than half of anterior vertical surface. Hind tibia with two apical spurs (Fig. 11H). 5th tarsomere either as long as 2nd tarsomere or in males of some species as long as 2nd + 3rd tarsomere (Fig. 11H). Tarsal claws with large secondary tooth (Fig. 11H). Female: Median basin (the round or oval depression basally on tergum 10) wider than long and round. Cercus highly reduced. Cornus triangular and not constricted basally, of variable length.

***Sirex cyaneus* Fabricius, 1781**

Midtgaard (1986) reported two specimens of this species, one each in the NHMD and NHMA. We have not come across specimens matching the locality information in Midtgaard (1986).

Description: *S. cyaneus* can be separated from *S. juvencus* by having the antennae completely black, and from *S. noctilio* by having the 5th tarsomere in all legs yellow and the females having a comparatively longer ovipositor. We can neither confirm nor reject the records of *S. cyaneus* in Denmark. We have included the species in the key.

***Sirex juvencus* (Linnaeus, 1758)**

Figs 2, 5, 11, 15, 25, 33, 36.

Records: Tranegårdsskolen, NEZ, 31/07/1910, 1 spec. (NHMD 193281). Ishøj, NEZ, 22/08/1976, 1 spec. (NHMD 13288). København, 30/05/1934, 1 spec. (NHMD 203665). Kåruphøj, NWZ, 03/08/2002, H. Henriksen, 1 spec. (NHMD 2036666). Herning, WJ, 19/08/1972, K. O. Leth, 1 spec. (NHMD 203666). Albertslund, NEZ, 20/01/1972, Jan Hoffmann, 1 spec. (NHMD 203807). Herning, WJ, 15/09/1938, Leth, 1 spec. (NHMD 203826). Schjønning og Arvé København, NEZ, 31/08/1955, 1 spec. (NHMD 203862). Ribe, SJ, 16/07/1950, Worm H, 1 spec. (NHMD 203898). København, NEZ, 05/09/1950, I. Andersen, 1 spec. (NHMD 203918). Slagelse, NWZ, 1925, P.K. Nielsen, 1 spec. (NHMD 203919). Gammel Mors, NWJ, 05/09/1943, Nielsen, 1 spec. (NHMD 203919). Albertslund, NEZ, 20/01/1972, Hoffmann, 1 spec. (NHMD 204212). Silkeborg, EJ, 20/04/1937, Esben Petersen, 2 spec. (NHMD 204218, 204224). Kulhuse, NEZ, 14/08/1928, O. Hørring, 2 spec. (NHMD 204237, 204247). København, NEZ, 04/07/1935, O. Hørring, 1 spec. (NHMD 204324). Hellerup, NEZ, 31/12/1904, A. Bruun, 1 spec. (NHMD 204335). Vemmetofte, SZ, 04/08/1896, R. H. Stamm, 1 spec. (NHMD 204339). Maribo, LFM, 13/08/1919, 1 spec. (NHMD 206017). Glostrup, NEZ, 22/08/1942, T. Wolf, 1 spec. (NHMD 206026). Tibirke, NEZ, 1905, A. Kløker, 1 spec. (NHMD 206043). Slagelse, NWZ, 24/08/1912, R. K. Niclous, 1 spec., (NHMD 206068). Ravneholm, NEZ, 01/09/1929, 1 spec. (NHMD 206151). Silkeborg, EJ, 28/01/1931, Esben-Petersen, 1 spec. (NHMD 206457). Silkeborg, EJ, 20/04/1937, Esben-Petersen, 1 spec. (NHMD 206456). Aldershvile, NEZ, Schiødte, 6 spec. (NHMD 206565, 206615, 206628, 206656, 208311, 208553). København, NEZ, 15/04/1905, G. Larsen, 1 spec. (NHMD 206611). Bromølle, NWZ, Schiødte, 1 spec. (NHMD 206703). Anholt, EJ, 27/7-10/08/1975, E. Schmidt Nielsen, 1 spec. (NHMD 206739). Zoologisk Museum, København, NEZ, 18/08/1981, 1 spec. (NHMD 208213). Bøvlingberg, NWZ, 12/05/2012, Ole Hehl, 1 spec. (NHMD 193392). Dyrehaven, NEZ, 03/09/1911, 1 spec. (NHMD 193602). Fælledparken, København, NEZ, 22/05/1976, I. J. La, 1 spec. (NHMD 193603). Brande, WJ, 09-08-1976, Agl, 1 spec. (NHMD 193604). Høstemark Bredelag, NEJ, 04/07/1995, Jens Peder Jensen, 1 spec. (NHMA). Aarhus, EJ, 1915, Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, EJ, 19/09/1935, Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, EJ, 05/15/1940, Victor Sigfred

Knudsen, 1 spec. (NHMA). Rude Hegn, NEZ, 05/08/1896, Carl C.R. Larsen, 1 spec. (NHMA). Rude Hegn, NEZ, 15/07/1899, Carl C.R. Larsen, 1 spec. (NHMA). Hadsten, EJ, 20/04/1977, Arne Lindebo, 2 spec. (NHMA). Ravnsnæs, NEZ, 16/07/1943, K. Lindhardt, 1 spec. (NHMA). Odder, EJ, July/1904, PR, 1 spec. (NHMA). Svenstrup, NEJ, 12/07/1909, Schoubye, 1 spec. (NHMA). Bramming, WJ, 01/09/1976, D. Schultz, 1 spec. (NHMA). Fromsseier Plantage, Vorbasse, WJ, 04/10/1970, Skøtt, 2 spec. (NHMA). Rold Skov, NEJ, October/1954, Hjalmar Ussing, 1 spec. (NHMA). Faaborg, Alleskoven, F, 24/07/1894, 1 spec. (NHMA). Faaborg, Alleskoven, F, 19/08/1985, 2 spec. (NHMA). Risinge, F, 12/8-18/8/1901, 4 spec. (NHMA). Løjenkær, EJ, 1904, 1 spec. (NHMA). Silkeborg, EJ, 02/09/1909, 1 spec. (NHMA). Silkeborg, EJ, July/1910, 1 spec. (NHMA). Aalborg, 23/08/1918, 1 spec., (NHMA). Fastrup, EJ, 05/08/1927, 8 spec. (NHMA). Torild Skov, Fastrup, 01/09/1927, 6 spec. (NHMA). Fastrup, EJ, 01/09/1927, 3 spec. (NHMA). Aarhus, tømmer fra Silkeborg, August/1929, 3 spec. (NHMA). Aarhus Tømmerhandel, EJ, April/1937, 1 spec. (NHMA). Aarhus, EJ, 25/06/1938, 3 spec. (NHMA). Randers, September/1956, 1 spec. (NHMA). Aarhus, EJ, September/1965.

Description: Basal antennomeres yellow to reddish brown, apical antennomeres black (Fig. 2C). Head, thorax and abdomen black sometimes with bluish tinge (Fig. 2C). Femur, tibia and tarsus on all legs yellow to reddish brown (Fig. 2C). **Male:** Head and thorax black with metallic bluish tinge. Abdominal tergites 1 and 2 black, tergites 3 and 4 yellow to red, sometimes stained with dark brown or black. Subsequent tergites yellow to red or brown, with exception of tergite 8 which is brown anteriorly (Fig. 25B). Apical tarsomeres black or dark brown. Hind legs dark brown, except for yellow femur and base of tibia. **Female:** Head, thorax and abdomen black sometimes with bluish tinge. Apical tarsomeres yellow.

Distribution: *S. juvencus* is a common species in Denmark, found in all faunal districts except Bornholm (Fig. 36).

Host plants: European Spruce (*Picea abies*) (Schiff et al., 2012), Scots Pine (*Pinus sylvestris*), European Silver Fir (*Abies alba*).

Fungal symbiont: *Amylostereum areolatum* (Hajek et al., 2013).

Parasites: *Ephialtes manifestator*, *Perithous septemcinctorius*, *Pseudorhyssa alpestris* (Spradbery, 1970), *Rhyssa persuasoria*, *Rhyssella approximator*, *Stenarella domator* (all Ichneumonidae).

***Sirex noctilio* Fabricius, 1793**

Figs 2, 11, 26, 33, 36.

Records: Aldershvile, Bagsværd, NEZ, Schiødte, 2 spec. (NHMD 208311, 208553). Tisvilde, NEZ, 29/08/1897, R.H. Stamm, 1 spec. (NHMD 208248). Fyn, F, August/1856, Schiødte, 1 spec. (NHMD 208249). Tibirke, NEZ, 1905, Klöcker, 1 spec. (NHMD 208251). Nakskov, LFM, 01/09/1935, H.P.M. Palisøe, 1 spec. (NHMD 208264). Prinsessegade, København, NEZ, 19/08/1948, Sv. Knammer, 1 spec. (NHMD 208269). Sindeshvilevej, NEZ, 04/07/1953, Knud O. Rasmussen, 1 spec. (NHMD 208307). Hørsholm, NEZ, 27/08/1964, Tuxen, 1 spec. (NHMD 208388). Arnager, B, 01/07/1976, 1 spec. (NHMD 208408). Magasin du Nord, Odense, F, 07/04/1984, Møller, 1 spec. (NHMD 208462). Rude Hegn, NEZ, Drewsen Schiødte, 1 spec. (NHMD 208554). Christianshavn, København, 13/09/1885, Chr Jørgensen, 2 spec. (NHMD 193289-193290). Høskov, EJ, 10/09/1960, AC, 1 spec. (NHMA). Aarhus, EJ, 18/08/1978, P. Sjøstor, 1 spec. (NHMA). Lisbjerg, EJ, 15/06/1940, Knud Juul, 1 spec. (NHMA). Rude Hegn, NEZ, 05/08/1896, Carl C. R. Larsen, 1 spec. (NHMA). Ry Sønderkov,

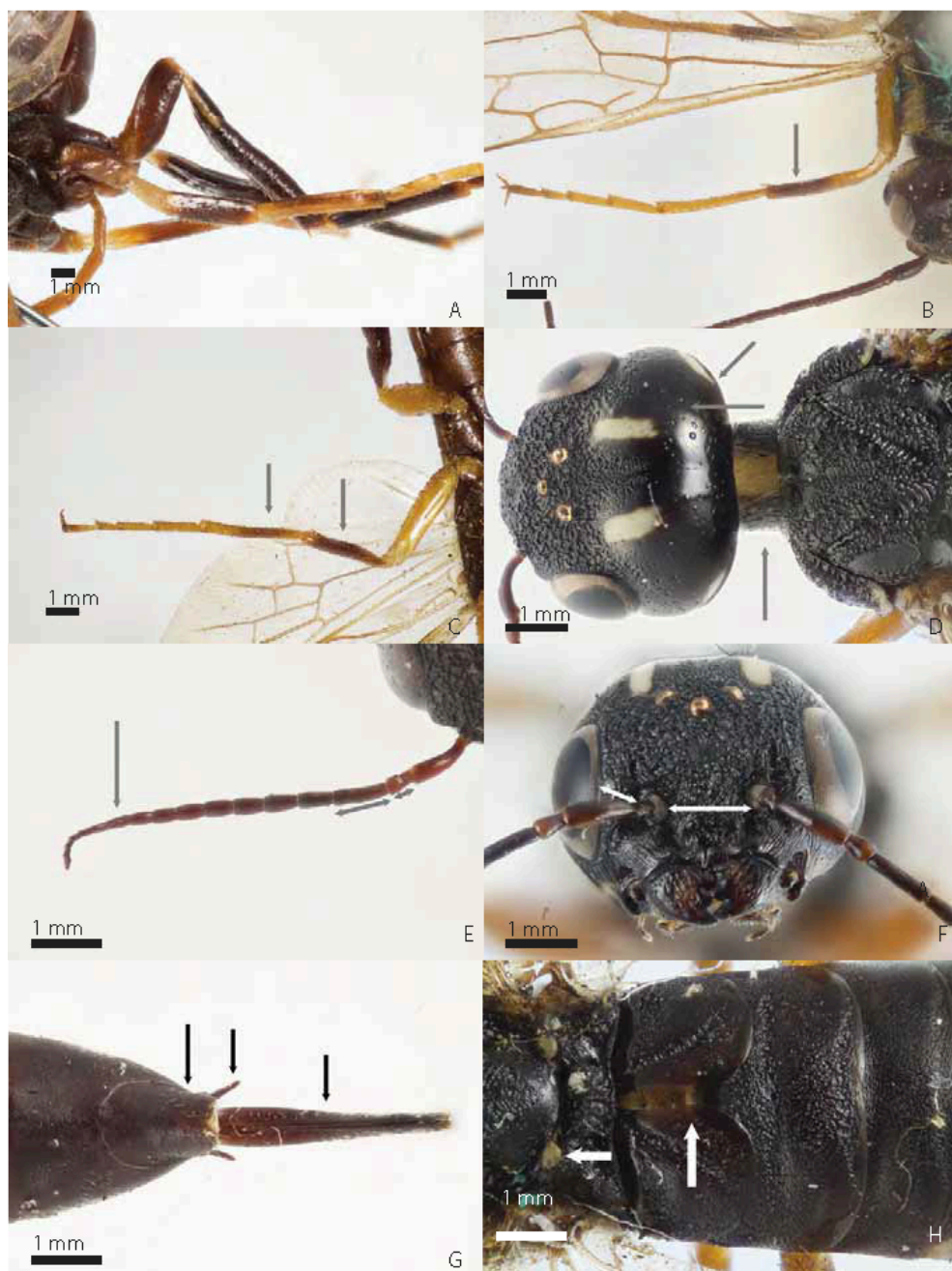


Fig 13. **A.** *Xeris pallicoxae* male mid leg. **B.** *Xeris spectrum* male foreleg. Arrow: Fore tibia. **C.** *Xeris spectrum* male midleg. Left arrow: 1st tarsomere; right arrow: tibia. **D.** *Xiphydria camelus* head and pronotum. Top arrow: Pale spot on occiput; middle arrow: Pits on vertex; lower arrow: Gap between head and pronotum. **E.** *Xiphydria camelus* antenna (left arrow); right arrows: Dimensions, 3rd and 4th antennomeres. **F.** *Xiphydria camelus* face. Arrows: Dimensions, see text. **G.** *Xiphydria camelus* female abdomen. Left arrow: Projection; middle arrow: Cercus; right arrow: Ovipositor sheath. **H.** *Xiphydria camelus* thorax and abdomen. Left arrow: Cenchrus; right arrow: Slit between two halves of Tergum 1.

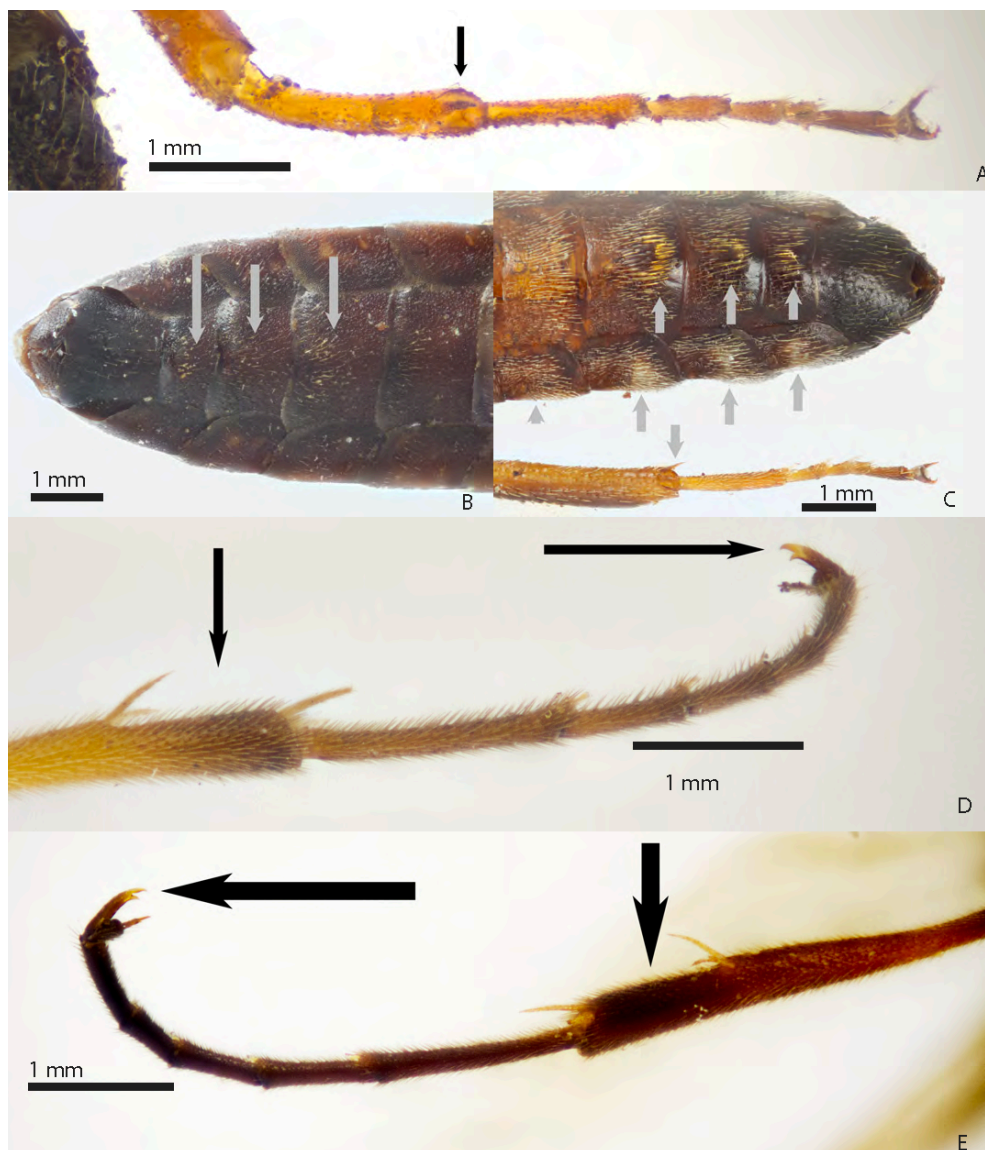


Fig 14. **A.** *Xiphydria prolongata* fore leg. Arrow: Apical spur. **B.** *Xiphydria camelus* male abdomen in ventral view. Arrows: Scattered hairs on sternites. **C.** *Xiphydria prolongata* male abdomen in ventral view. Upper arrows: Tufts of setae on abdominal sterna; middle arrows: Hairs laterally on terga; lower arrow: Apical tibial spurs. **D.** *Cephus spinipes* hind tibia (left arrow), tarsus and claw (right arrow). **E.** *Cephus pygmeus* hind tibia (right arrow), tarsus and claw (left arrow).

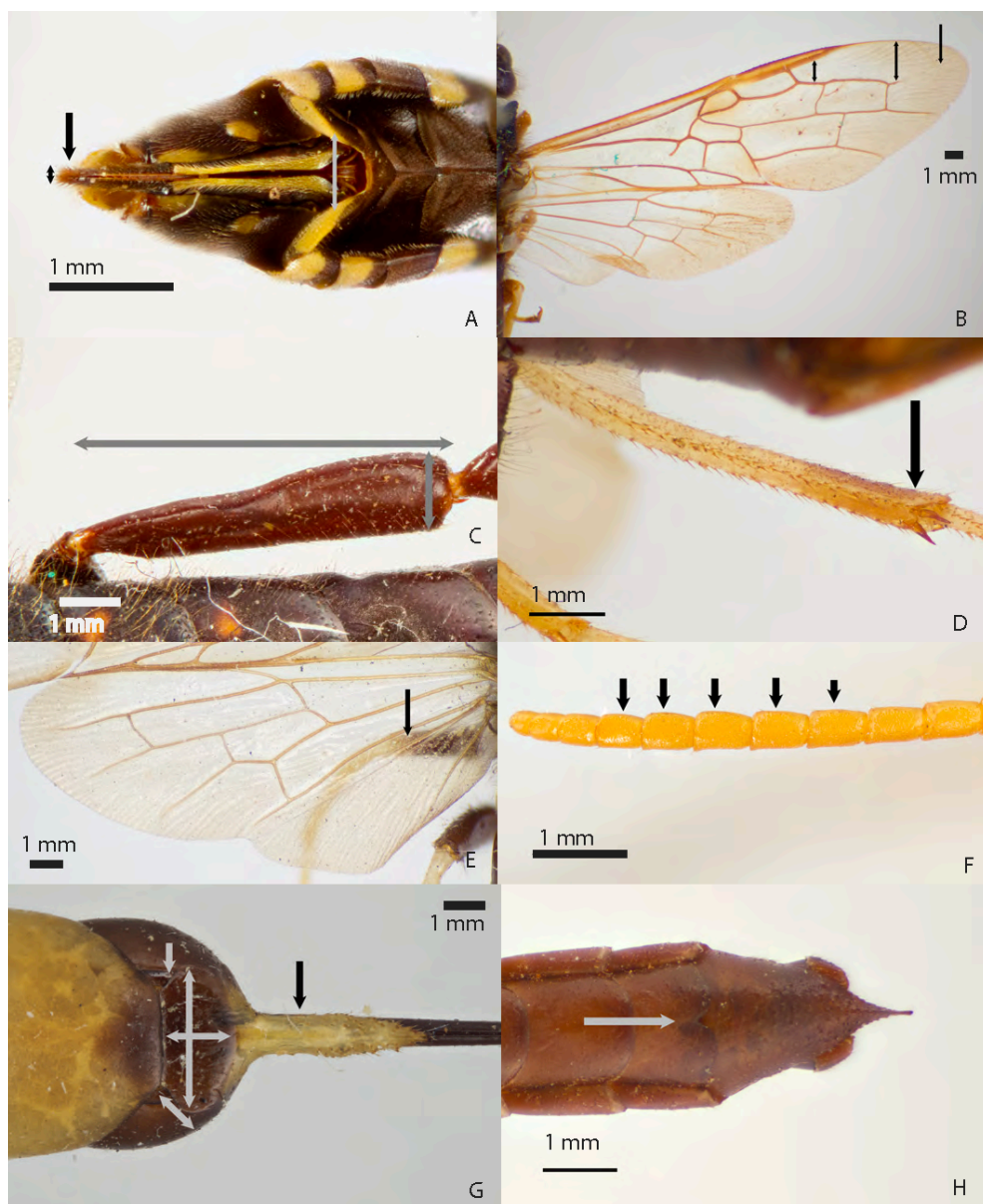


Fig 15. **A.** *Cephus spinipes* ovipositor ventral. Black arrows: Tip and width of ovipositor. **B.** *Sirex juvencus* wings. Arrows: Cell 3R1. **C.** *Tremex fuscicornis* male hind tibia. Arrows: Dimensions of tibia. **D.** *Urocerus gigas* hind tibia. Arrow: Hind tibial spurs. **E.** *Urocerus gigas* female hind wing. Arrow: Anal area. **F.** *Urocerus gigas* female antenna. Arrows: Sensory pits. **G.** *Urocerus gigas* tip of female abdomen, dorsal. Grey arrows: Dimensions of median basin; black arrow: Cornus. **H.** *Xeris spectrum* tip of abdomen in ventral view. Arrow: Incision on sternum 7.

EJ, 23/08/1969, Arne Lindebo, 1 spec. (NHMA). Silkeborg, EJ, 30/06/1914, 1 spec. (NHMA). Skørping, NEJ, 01/07/1934, 1 spec. (NHMA).

Description: Antennae entirely black (Fig. 2B). Femur, tibia and tarsus on all legs yellow to reddish brown, apical tarsal segments black. **Male:** Head and thorax black with metallic bluish tinge. Abdomen dark brown except for wide yellow or reddish brown band covering tergites 4 to 7. **Female:** Head, thorax and abdomen black sometimes with bluish tinge. Legs yellow or reddish brown (Fig. 2B). **Males:** Hind legs dark brown, except for yellow femur and basal tarsal segments (Fig. 11H).

Distribution: Relatively rare with most records from the Copenhagen and Silkeborg regions and a few from B, F and NJ (Fig. 36).

Host plants: Douglas Fir (*Pseudotsuga menziesii*) (CABI), Scots Pine (*Pinus sylvestris*), Coast Pine (*Pinus contorta*) (CABI), Spruce (*Picea* sp.) (Schiff et al., 2012), Larch (*Larix* sp.) (CABI), Austrian Pine (*Pinus nigra*) (CABI), European Silver Fir (*Abies alba*), European Spruce (*Picea abies*) (CABI).

Fungal symbiont: *Amylostereum areolatum* (Hajek et al., 2013).

Parasites: Ibalidae: *Ibalia leucospoides* (CABI); Icheumonidae: *Odontocolon geniculatum*, *Pseudorhyssa alpestris*, *Pseudorhyssa nigricornis*, *Rhyssa persuasoria* (CABI).

Tremex Jurine, 1807

Description: Antennae with 13-15 antennomeres (Fig. 5B). Distance between eyes approx. as long as height of eye. Head without bright spots posteriorly on head (Fig. 5D). Pronotum pitted over less than half its vertical surface (Fig. 5D). Forewing vein 2rm absent (Fig. 5F). Hind tibia with one apical spur (Fig. 12A). **Males:** Hind tibia approximately 5 x as long as maximum width (Fig. 15C). **Female:** Second tarsomere 2 to 3 times longer than wide (Fig. 12A). Cornus short in dorsal view (Fig. 11E). Median basin wider than long and with the edge highly sclerotized for 75% of its length (Fig. 11E). Cercus absent.

Tremex fuscicornis (Fabricius, 1787)

Figs 5, 11, 12, 15, 27, 33, 37.

Records: Ry, EJ, J.C. Schiødte, 22 spec. (NHMD 197914-197916, 197918-197921, 197953-197954, 197959-197962, 197971-197973, 198004-198008, 198048, 198100-198108, 199071-199087, 199148-199149, 199187, 199190, 199210). Fyn, F, A. Klöcker, 2 spec. (NHMD 198010, 199342). Teglstup Hegn, NEZ, 16/6/2014, Ole Martin, 8 spec. (NHMD 198061-198068). Tofte Skov, NEJ, 3/9/2005, Jan Pedersen, 1 spec. (NHMD 198090). Jylland, Westermann, 2 spec. (NHMD 199220, 199301). [No locality] 28/9/1899-8/11/1899, Chr. Jørgensen, 2 spec. (NHMD 199306, 199313).

Description: Head brown or black, thorax black (Fig. 5D). Antennae black with basal antennomeres brown (Fig. 5B). Setae on frons as long as or longer than distance between lateral ocelli (Fig. 5D). **Females:** Anterior part of pronotum reddish brown or black. Coxae and trochanter black on all legs, rest of legs usually yellow. Middle and hind femur black. Abdominal tergum 1 black, tergum 2 yellow sometimes with posterior margin brown. Tergites 3-9 posteriorly with brown band covering most of median part of tergite, yellow usually visible laterally. Tergum 10 mostly yellow with at most narrow brown band. Sternites black in basal half and reddish brown in apical half. Ovipositor sheath brown. Median basin significantly wider than long (Fig. 11E). **Males:** Abdomen black with brown markings medially on

abdominal sternites 5-8 (Fig. 11F). Forelegs brown. Middle legs black with red to brown tibiae and tarsi. Hind legs black to dark brown with apical tarsomeres lighter brown, sometimes yellow. Sternites densely pitted (Fig. 11F).

Distribution: Very rare in Denmark, with very few records (Fig. 37).

Host plants: Birch (*Betula sp.*) (CABI), Poplar (*Populus sp.*) (CABI), Elm (*Ulmus sp.*) (CABI), Common Hornbeam (*Carpinus betulus*) (CABI), Beech (*Fagus sp.*) (CABI), Cherry (*Prunus sp.*) (CABI), Ash (*Fraxinus sp.*) (Artdatabanken 2018), Willow (*Salix sp.*) (CABI), Eurasian Aspen (*Populus tremula*), Black Poplar (*Populus nigra*) (Schiff et al. 2012), Silver Poplar (*Populus alba*) (CABI), Walnut (*Juglans regia*) (CABI), European Beech (*Fagus sylvatica*) (CABI), Downy Birch (*Betula pubescens*) (CABI), Norway Maple (*Acer platanoides*) (CABI), Boxelder Maple (*Acer negundo*) (Schiff et al., 2012).

Fungal symbiont: *Cerrena unicolor* (Pazoutová and Srutka, 2007).

Parasites: *Megarhyssa perlata*, *Megarhyssa superba* (both Ichneumonidae).

***Urocerus* Geoffroy, 1762**

Description: Antennae with 22-31 antennomeres (Fig. 2A). Distance between lateral ocelli approx. as long as distance between eye and nearest lateral ocellus (Fig. 5C). Anterior surface of pronotum and mesoscutum densely pitted. Hind tibia with two apical spurs (Fig. 15D). Hind wing with anal cell (Fig. 15E). **Female:** Apical antennomeres with oval sensory pits on dorsal and ventral surfaces (Fig. 15F). Median basin on tergum 9 much wider than long with lateral edges lined with black furrows (Fig. 15G). Cerci almost completely reduced. Cornus long, narrow and basally constricted (Fig. 15G).

***Urocerus augur* (Klug, 1803)**

Midtgaard (1986) reported six specimens of this species, four supposedly in the NHMD and two in NHMA. We have not come across specimens matching the locality information in Midtgaard (1986) except perhaps for one specimen in NHMA from 1964 which we identified as *U. gigas*.

Description: The main difference between *U. augur* and *U. gigas* is the width of the separation of between the pale spots on the head posterior to the eyes: almost adjacent in *U. augur*, more widely separated in *U. gigas*. We thus cannot confirm or reject most records of *U. augur* in Denmark. We have included the species in the key.

***Urocerus gigas* (Linnaeus, 1758)**

Figs 1, 2, 5, 11, 12, 15, 28, 33, 36.

Records: Horsens, EJ, 16/08/1880, O.G. Jensen, 1 spec. (NHMD 1992289). Østrup Lunde, NEZ, 23/08/1958, 1 spec. (NHMD 192302). Lyngbyvej, NEZ, 08/03/1970, Sandvad, 1 spec. (NHMD 192378). Højby, NWZ, 25/07/1938, 1 spec. (NHMD 192394). Bognæs, NEZ, 28/07/1985, 1 spec., (NHMD 192406). Sønderborg, SJ, 22/07/1901, Chr. Jørgensen, 1 spec. (NHMD 192436). Sønderkov, NEJ, 30/06/1988, 1 spec. (NHMD 192444). Holsteinborg, SZ, 05/06/1895, 1 spec. (NHMD 192488). København, NEZ, 07/07/1914, Chr. Jørgensen, 1 spec. (NHMD 192489). Geelskov, NEZ, 26/06/1964, O. Lomholdt, 2 spec. (NHMD 196401-196402). Faaborg, F, 16/07/1927, C. S. Larsen, 1 spec. (NHMD 196406). Humlehaven, NEZ, 02/07/2002, S. Skipper, 1 spec. (NHMD 196409). Geelskov, NEZ, 28/06/1894, Løvensdal, 1 spec. (NHMD 196427). Københavns Omegn, NEZ, Schiødte, 1 spec. (NHMD 196430). Gadevang, NEZ, 23/08/1967, Bjarne Elvstand, 1 spec. (NHMD 196503). Emdrup, NEZ,

01/07/1996, Martin Leopold, 1 spec. (NHMD 196510). Hindsholmen, F, 06/08/1936. H. Lemcke, 1 spec. (NHMD 196550). Æbelø, 25/6-9/7/1943, Worm-Hansen, 3 spec. (NHMD 196591, 196665, 196666). Lyngbakken, Faaborg, F, 23/07/1925, Esben-Petersen, 1 spec. (NHMD 196639). Kildehuse, NWZ, 18/08/1908, R. H. Stamm, 1 spec. (NHMD 196661). København, NEZ, 1853, Westerm, 1 spec. (NHMD 196662). Maribo, LFM, 20/07/1925, Esben-Petersen, 1 spec. (NHMD 196663). Korsør, SZ, 17/08/1927, Hoffmeyer, 1 spec. (NHMD 196664). Vedersø Klit, WJ, 10/07/1938, Peder Nielsen, 2 spec. (NHMD 196667-196668). København, NEZ, 01/07/1906, M. Hauser, 1 spec. (NHMD 196669). Assels Mors, NWJ, 18/08/1942, F. Nielsen, 1 spec. (NHMD 196670). Langebæk, SZ, 01/07/1910, R. H. Stamm, 1 spec. (NHMD 196671). Kongens Lyngby, NEZ, 28/06/1967, 1 spec. (NHMD 196672). Nexø, B, 08/08/1930, Rosenberg, 1 spec. (NHMD 196673). København, NEZ, 18/07/1930, Rosenberg, 1 spec. (NHMD 196674). Stensbæk Plantage, SJ, 21/07/1950, Worm-Hansen, 1 spec. (NHMD 196675). Vejle, EJ, Summer 1940, Erik. J. Larsen, 1 spec. (NHMD 196676). Holte, NEZ, Kofoed, 1 spec. (NHMD 196678). Hillerød, NEZ, 01/06/1933, H. V. Rævsjær, 1 spec. (NHMD 196679). Tuborgvej, NEZ, 18/09/1935, 1 spec. (NHMD 196680). Kerteminde, F, 07/07/1936, P. Nielsen, 1 spec. (NHMD 196685). Hellebæk, NEZ, Stamm, 1 spec. (NHMD 196687). Kompagnistræde, NEZ, 29/06/1959, 1 spec. (NHMD 196690). Botanisk Have, NEZ, 18/07/1960, 1 spec. (NHMD 196691). Randkløve, B, P. Johnsen, 2 spec. (NHMD 196747, 197669). Tisvilde, NEZ, A. Klöcker, 2 spec. (NHMD 197725-197726). Aldersvile, NEZ, Schiødte, 1 spec. (NHMD 197727). Odense, F, 25/08/1885, Valeur, 1 spec. (NHMD 197728). Gammel Torv, København, NEZ, 1928, A. Stilling, 1 spec. (NHMD 197729). Vorsø, EJ, 1937, S.L. Tuxen, 1 spec. (NHMD 197730). Silkeborg, EJ, 23/07/1949, Peder Nielsen, 1 spec. (NHMD 197734). Silkeborg, EJ, 25/08/1953, Peder Nielsen, 1 spec. (NHMD 197732). Silkeborg, EJ, 07/09/1953, Peder Nielsen, 1 spec. (NHMD 197733). Helnæs, F, O. Hørring, 1 spec. (NHMD 197735). Holstebro, WJ, 29/06/1934, Hundested, 1 spec. (NHMD 197736). Stursbøl, SJ, 08/08/1931, 1 spec. (NHMD 197737). Slagelse, SZ, 30/08/1902, PK. Nielsen, 1 spec. (NHMD 19937). Ypnasted, B, 09/03/1933, KL. Henriksen, 1 spec. (NHMD 197741). Æbelø, F, 25/6-09/07/1943, 20 spec. (NHMD 209185, 209191, 209199-209216, NHMD 209760). Ikast, WJ, 20/07/1932, O. Hørring, 1 spec. (NHMD 209217). Herning, EJ, 03/09/1935, 1 spec. (NHMD 209219). København, NEZ, 23/06/1948, (NHMD 209587). Brande, WJ, 20/08/1991, H. A. Møller, 1 spec., (NHMD 209593). Baunegård, NEZ, 21/07/1989, R. Bunek, 1 spec. (NHMD 209636). Herning Æggepakkeri, WJ, 03/08/1937, Leth, 1 spec. (NHMD 209660). Anholt, EJ, 27/07-10/08/1975, E. Schmidt Nielsen, 1 spec. (NHMD 209670). Herning, WJ, 01/07/1916, 1 spec. (NHMD 209753). Sydhavnen, København, NEZ, 06/07/1944, R. Becker, 1 spec. (NHMD 209764). Stengade Skov, F, 21/07/1980, G. Lasson, 1 spec. (NHMD 209766). Stenbæk Skov, SJ, 03/07/1950, Worm-Hansen, 1 spec. (NHMD 209770). Falster, LFM, 07/07/1944, 1 spec. (NHMD 209772). Stenbæk Plantage, 08/07/1950, Worm-Hansen, 1 spec. (NHMD 209779). Herning, WJ, 21/08/1935, K. O. Leth, 1 spec. (NHMD 209781). Ålborg, NEJ, 16/07/1938, K. Flagstaj, 1 spec. (NHMD 209783). Studiestræde, København, NEZ, 06/08/1924, Jul, Clausen, 1 spec. (NHMD 209787). Ordrup, NEZ, Jauber, 1 spec. (NHMD 209794). Engesvang, WJ, 05/07/1930, Esben-Petersen, 1 spec. (NHMD 209802). Herning, WJ, 15/08-03/09/1935, Leth, 8 spec. (NHMD 209803-209805, 209807, 209817-209820). Skallingen, WJ, 01/09/1978, E. Rald, 1 spec. (NHMD 209806). Gallehus, SJ, 29/07-11/08/1984, Worm-Hansen, 1 spec. (NHMD 109808). Rørvig, NWZ, 11/07/1970, H. Enghoff, 1 spec. (NHMD 209809). Sønderby, NEZ, 06/08/1959, Jy, Grindsted, 1 spec. (NHMD 209822). Tisvilde, NEZ, 13/07-18/07/1865, 5 spec. (NHMD 212197, 212201, 212199-212200, 212203). Jyderup Skov, NWZ, 14/07/1938, Lemche, 1 spec. (NHMD 212204). Sødum, SJ, 07/08/1927, J.P. Kryger, 1 spec. (NHMD 212205). Svendborg, SJ, 28/05/1894, 1 spec. (NHMD 212206). Jægerpris, NEZ, 10/09/1909,

1 spec. (NHMD 212214). Rude Hegn, NEZ, 21/08/1901, 1 spec. (NHMD 212832). Hindsholm, F, 09/07/1971, 1 spec. (NHMD 212842). Amager Fælled, 03/06/1965, Ole Karsholt, 1 spec. (NHMD 225434). Boderup Klitplantage, WJ, 05/08/2018, Jan Pedersen, 2 spec. (NHMD 274233-274234). Tipperne, WJ, 12/08/1974, Jens G, 1 spec. (NHMD 274235). Landbrugshøjskolen, København, NEZ, 12/08/1964, 1 spec. (NHMD 192352). Mou, NEJ, 04/09/1966, Jens Peder Jensen, 1 spec. (NHMA). Skæring, EJ, 03/09/1956, E. C., 1 spec. (NHMA). Bramdrupdam, EJ, 10/7/1976, K. Forchhammer, 1 spec. (NHMA). Randers, EJ, 12/08/1976, K. Forchhammer, 1 spec. (NHMA). Pandum, NEJ, 18/07/1964, P. H. Georgsen, 2 spec. (NHMA). Aarhus, EJ, 03/06/1962, K. Holm, 1 spec. (NHMA). Fakkegrav, EJ, 25/07/1918, Ove Høeg-Guldberg, 1 spec. (NHMA). Juelsminde, EJ, 03/07/1984, Ove Høegh-Guldberg, 1 spec. (NHMA). Mou, NEJ, 10/08/1983, Jens Peder Jensen, 1 spec. (NHMA). Høstemark Bredsig, NEJ, 25/07/1985, Jens Peder Jensen, 1 spec. (NHMA). Skåde, EJ, 16/09/1985, S. Berglum Jensen, 1 spec. (NHMA). Aarhus, EJ, 12/05/1964, Palle Johnsen, 2 spec. (NHMA). Aarhus, EJ, 1964, Palle Johnsen, 2 spec. (NHMA). Hanning, WJ, 27/07/1942, Knud Juul, 1 spec. (NHMA). Aarhus, EJ, Victor Sigfred Knudsen 2 spec. (NHMA). Udbyhøj, EJ, Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, kælder med gran, 1915, Victor Sigfred Knudsen, 7 spec. (NHMA). Aarhus, EJ, 1929, 1 spec. (NHMA). Aarhus, EJ, 1940, Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, EJ, 1942 Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, EJ, June/1943, Victor Sigfred Knudsen, 1 spec. (NHMA). Aarhus, EJ, 04/08/1943, Victor Sigfred Knudsen, 1 spec. (NHMA). Rude Hegn, NEZ, 05/08/1896, Carl. C. R. Larsen, 1 spec. (NHMA). Moesgård Århus, EJ, 15/02/1976, A. G. Rasmussen, 1 spec. (NHMA). Sevel, NWJ, 9/7-22/7/1988, Hans Thomsen Schmidt, 5 spec. (NHMA). Romsø, F, August/1970, Stud. 1 spec. (NHMA). Svinkløv, NEJ, 15/07/1992, Søren Tolsgaard, 1 spec., (NHMA). Gøttrup 20/07/1992, Søren Tolsgaard, 1 spec., (NHMA). Mariendal Strand, EJ, June/1999, Søren Tolsgaard, 1 spec. (NHMA). Moesgård Strand, EJ, 19/06/2002, Søren Tolsgaard, 1 spec. (NHMA). Skiveren, NEJ, 20/07/2010, Søren Tolsgaard, 1 spec. (NHMA). Østerild Klitplantage, NEJ 31/07/2011, Søren Tolsgaard, 1 spec. (NHMA). Heilskov, V. F. Egtved, WJ, 27/0/1962, Ernst Torp, 1 spec. (NHMA). Jelling Skov, EJ 25/07/1965, Ernst Torp, 1 spec. (NHMA). Jelling Højgårdsvej, EJ 02/07/1975, Ernst Torp, 1 spec. (NHMA). Jelling, EJ 06/08/1978, Ernst Torp, 1 spec. (NHMA). Låsby Krat, EJ, August/1939, Hjalmar Ussing, 1 spec. (NHMA). Tisvilde, NEZ, 09/06/1907, H. Weis (ded)., 1 spec. (NHMA). Risskov, EJ, June/1909, 1 spec. (NHMD). Aalborg, NEJ 21/07/1911, 1 spec. (NHMA). Svejbæk, EJ, 20/07/1916, 1 spec. (NHMA). Silkeborg, EJ, 08/08/1916, 1 spec. (NHMA). Sønderborg, SJ, 22/7/1920, 1 spec. (NHMA). Aarhus, EJ, September/1928, 1 spec. (NHMA). Aarhus, EJ, July/1930, 1 spec. (NHMA). Silkeborg, EJ, 16/05-22/05/1934, 2 spec. (NHMA). Silkeborg, EJ, 20/07/1935, 2 spec. (NHMA). Gøttrup, NWJ, 18/07/1936, 1 spec. (NHMA). Aarhus, EJ, August/1935, 1 spec. (NHMA). Frijsenborg, EJ, 08/07/1936, 1 spec. (NHMA). Læsø, NEJ, 09/09/1936, 1 spec. (NHMA). Vedersø Klit, WJ, 21/07/1937, 2 spec. (NHMA). Aarhus, EJ, 28/07/1937, 1 spec. (NHMA). Aarhus, EJ, 25/06/1938, 1 spec. (NHMA). Aarhus, EJ, 10/07/1938, 1 spec. (NHMA). Vojens, SJ, July/1943, 1 spec. (NHMA). Hinge, EJ, 22/07/1972, 1 spec. (NHMA). Bjerringbro, EJ, 23/07/1972, 1 spec. (NHMA).

Description: Antennae yellow, may be slightly darkened at base (Fig. 2A). Head black, bright spots behind eyes divided by broad black band (Fig. 12B). Vertex densely pitted between two bright spots, spots less pitted. (Fig. 12B) Thorax black. Abdominal tergite 1 black anteriorly, posteriorly yellow. **Female:** Tergites 2, 8 and 9 yellow, tergites 3-6 black or dark brown. Cornus yellow. **Male:** tergites 2-6 brown or red, tergum 7 dark brown, may have two lighter spots laterally.

Distribution: *U. gigas* is the most common siricid in Denmark, being present in all faunal districts (Fig. 36).

Host plants: False Cypress (*Chamaecyparis* sp.) (Schiff et al., 2012), Silver Fir (*Abies alba*), Cedar (*Cedrus* sp.) (Schiff et al., 2012), Larch (*Larix* sp.) (Schiff et al., 2012), European Spruce (*Picea abies*), Sitka Spruce (*Picea sitchensis*) (Schiff et al., 2012), Scots Pine (*Pinus sylvestris*) (Schiff et al., 2012), Douglas Fir (*Pseudotsuga menziesii*) (Schiff et al., 2012).

Fungal symbiont: *Amylostereum chailletii* (Thomsen and Harding, 2011).

Parasites: *Coleocentrus excitatory*, *Megarhyssa perlata*, *Megarhyssa superba*, *Rhyssa persuasoria*, *Stenarella domator* (all Ichneumonidae).

***Xeris* Costa, 1894**

Description: Antennal sockets 1.5 to 2.5 x as far apart as antennal socket and eye (Fig. 12C). Distance between eyes approx. 1.5 x height of eye (Fig. 12C). Gena with short vertical ridge posteriorly (Fig. 12C). Gena with white spot dorsally (Fig. 12C). Antennae with more than 16 antennomeres; antennomeres 3-4 x as long as wide (Fig. 12D). Raised parts of vertex smooth (Fig. 12C). Pronotum smooth on anterior surface. Hind tibia with one apical spur (Fig. 6H). Hind wings without anal cell (Fig. 12E). **Female:** Apical antennal segments with sensory oval pits dorsally and ventrally (Fig. 12F). Median basin half as long to as long as wide (Fig. 12G). Cornus long, narrow and lateral edges may be constricted (Fig. 12G). **Male:** Apical antennal segments with oval sensory pits only on the ventral surface. Sternum 7 with posterior margin with short V-shaped incision (Fig. 15H).

***Xeris pallicoxae* Goulet, 2015**

Figs 6, 12, 13, 29, 33, 37.

Records: Søvind Skov, EJ, 25/07/1980, T. S. Jensen, 2 spec. (NHMD 193079, NHMD 193094). Ryget Værløse, NEZ, 26/06/1948, 1 spec. (NHMD 193270). Søvind Skov, EJ, 25/06/1980, T. S. Jensen, 2 spec. (NHMD 193271-193272). Hundested Havn, NEZ, 12/07/2015, Ole Martin, 1 spec. (NHMD 213536).

Description: Head, thorax and abdomen black. Antennae black or dark brown. Pronotum with lateral white stripe; areas between projections in stripe smooth (Fig. 6A). **Female:** Legs reddish brown, including coxae (Fig. 6C). Ovipositor as long as or slightly longer than abdomen. Cornus slightly constricted in middle. **Males:** Forelegs reddish brown except for brown apical half of tibia (Fig. 12H). Middle leg reddish brown with apical half of tibia and middle of first tarsomere dark brown (Fig. 12H). Hind legs primarily brown or black with coxa of mixed color and tarsomeres 3-5 reddish brown, tarsomere 2 with extensive black band or spot (Fig. 6G).

Distribution: This species has only been recorded from EJ and NEZ. It has been overlooked so far as it has only recently been described. Most of the material recorded from Denmark was mixed up with material of *X. spectrum* at the NHMD. The specimens collected in Søvind Skov in 1980 by T.S. Jensen were reported in Jensen (1988) as *X. spectrum*. According to Goulet et al. (2015; p. 74), a female was 'intercepted in New Zealand, Auckland', presumably in a shipment from Denmark. *X. pallicoxae* and *X. spectrum* can be separated by the characters listed in the key.

Host plants (from Goulet et al., 2015): European Spruce (*Picea abies*), Fir (*Abies* spp.), Monterey Pine (*Pinus radiata*).

Parasites: Unknown.

***Xeris spectrum* (Linnaeus, 1758)**

Figs 6, 12, 13, 15, 30, 33, 37.

Records: Dyrehaven, NEZ, 1 spec. (NHMD 193106). Dyrehaven, NEZ, 07/1871, 1 spec. (NHMD 193269). Dyrehaven, NEZ, 06/1872 1 spec. (NHMD 193267, 193284). Dyrehaven, NEZ, 06-07/1871, 3 spec. (NHMD 193268, 193285-193286). Hundested Havn, NEZ, 19/07/2015, Ole Martin, 1 spec. (NHMD 213487). Frijsendal, EJ, 02/08/2015, Søren Tolsgaard, 1 spec. (NHMA). Bredebro, SJ, 15/06/2017, Søren Tolsgaard, 1 spec. (NHMA). Blokhus Klitplantage, NEJ 18/07/2017, Søren Tolsgaard, 1 spec. (NHMA). Aarhus, EJ, 01/08/1925, 1 spec. (NHMA).

Description: Head, thorax and abdomen black. Antennae black or dark brown. Pronotum with lateral white stripe; sculpture between projections in stripe coarse (Fig. 6B). Tarsal claws with short basal accessory tooth (Fig. 6H). **Female:** Legs reddish brown, except for dark coxae (Fig. 6D). Ovipositor as long as or slightly longer than abdomen. Cornus slightly constricted in middle (Fig. 12G). **Males:** Forelegs reddish brown or yellow, except for brown apical half of tibia which is black or dark brown (Fig. 13B). Middle leg reddish brown with apical half of tibia and middle of first tarsomere dark brown (Fig. 13C). Hind legs primarily brown or black with coxa and tarsomeres 2-5 reddish brown, no dark marking on tarsomere 2 (Fig. 6H).

Host plants: Fir (*Pinus* sp.) (Kolk and Starzyk, 1996), European Spruce (*Picea abies*) (Kolk and Starzyk, 1996), Silver Fir (*Abies alba*), Larch (*Larix* sp.) (Kolk and Starzyk, 1996), Sitka Spruce (*Picea sitchensis*), Maritime Pine (*Pinus pinaster*), Scots Pine (*Pinus sylvestris*) (Kolk and Starzyk, 1996), Douglas Fir (*Pseudotsuga menziesii*) (Kolk and Starzyk, 1996).

Parasites: *Coleocentrus excitator*, *Poemenia hectica*, *Rhyssa persuasoria* (all Ichneumonidae).

Xiphydriidae

Description: Head globular (Fig. 13D). Antennae with 13-18 antennomeres (Fig. 13E). 3rd antennomere approx. 3 x shorter than 4th (Fig. 13E). Distance between antennal sockets 1.2-2 x distance between antennal socket and eye (Fig. 13F). Vertex and occiput sparsely pitted (Fig. 13D). Pronotum convex (Fig. 13D). Propleura elongate, forming 'neck'; visible gap between head and pronotum (Fig. 13D). Mesonotum with notauli and transscutal articulation present. Metanotum with cenchri present (Fig. 13H). Fore tibia with one or two unequal apical spurs (Fig. 14A), mid and hind tibia with two apical spurs (Fig. 14C). Abdomen with tergum 1 divided medially by narrow slit (Fig. 13H). **Female:** Abdomen with a short blunt projection posteriorly (Fig. 13G). Ovipositor projects shortly posterior of abdomen (Fig. 13G).

Lifestyle: Xiphydriid woodwasps lay their eggs in the surface layers of the trees they infect (Kravchenko, 1973; Deyrup, 1984). During oviposition they infect the tree with a symbiotic fungus (Pažoutová et al., 2010). Xiphydriids usually oviposit in damaged or dead trees, with no preference for standing or fallen trees. After hatching the larvae will bore 4-5 cm into the wood; it will pupate 0.5 to 2 cm from the surface. Larval development lasts for approximately one year (Chrystal and Skinner, 1932; Kravchenko, 1973). The pupal period lasts for somewhere between two and three weeks. Infections usually last multiple years, with the lower trunk being attacked during the early years with the oviposition sites moving up along the trunk and branches in later years (Kravchenko, 1973). Flight periods for xiphydriids last from June to August.



Figs. 16-19. 16. *Calameuta filiformis* **A.** Female habitus. **B.** Male habitus. 17. *Calameuta pallipes* **A.** Female habitus. **B.** Male habitus. 18. *Cephus brachycercus* **A.** Female habitus. **B.** Male habitus. 19. *Cephus nigrinus* **A.** Female habitus. **B.** Male habitus.



Figs. 20-23. 20. *Cephus pygmeus* **A.** Female habitus. **B.** Male habitus. 21. *Cephus spinipes* **A.** Female habitus. **B.** Male habitus. 22. *Phylloecus linearis* **A.** Female habitus (German specimen). **B.** Male habitus. 23. *Phylloecus niger* **A.** Female habitus (German specimen). **B.** Male habitus (German specimen).



Fig. 24. *Phylloecus xanthostoma* **A.** Female habitus (German specimen).

***Xiphydria camelus* (Linnaeus, 1758)**

Figs 2, 13, 14, 31, 33, 35.

Records: Hundested havn, NEZ, 05/07/2015, Ole Martin, 1 spec. (NHMD 213018). Tofte Skov, NEJ, 1826, Westermann, 1 spec. (NHMD 210588). Nærum, NEZ, 06/06-07/06/1960, BBP, 3 spec., (NHMD 211335, 211336, 211342). Arenakke, NEZ, March/1967, 3 spec., (NHMD 211351-211353). Falster, LFM, Schiødte, 3 spec., (NHMD 211230-211232). Silkeborg, EJ, J. C. Schiødte, 1 spec., (NHMD 211245). Sundby Storskov, LFM, 28/05/1942, Kryger, 2 spec., (NHMD 211185-211186). Nøddebo, NEZ, 16/06/1980, Pau Reenberg, 1 spec., (NHMD 211115). Bjæverskov NEZ, 23/02/1971, Friss Jensen, 2 spec., (NHMD 211162-211163). Horsens, EJ, Schidte, 1 spec., (NHMD 211295). Fuglslev, EJ, T. Munk, 1 spec., (NHMD 618452). Dyrehave, NEZ, Schiødte, June/1887, 1 spec., (NHMD 211315). Lolland, LFM, Schiødte, 1 spec., (NHMD 211252). Tofte Skov, NEJ, T. Munk, 1 spec., (NHMD 618451). Nøddebo, NEZ, 16/06/1980, Paul Reenberg, 1 spec., (NHMD 211116). Lyngby, NEZ, 08/06/1921, 1 spec., (NHMD 212018). Rosingen, LFM, 09/06/1917, 1 spec., (NHMD 212189). Frederikssund, NEZ, July/1955, 1 spec., (NHMD 212160). Falster, LFM, Benson, 1 spec., (NHMD 211988). Silkeborg, SJ, 12/06/1912, Esben Petersen, 1 spec., (NHMD 211984). Ulveskoven, 15/06/1930, NWJ, 1 spec., (NHMD 211989). Trelleborg, NWZ, 14/06/1894, Elan Birk, 1 spec., (NHMD 212188). Hareskov og Søndersø, NEZ, 05/06/1906, Carl C.R. Larsen, 1 spec. (NHMA). Damhusmosen, NEZ, 06/06/1911, Carl C.R. Larsen, 5 spec. (NHMA). Dyrehaven til Rådvad, NEZ, 24/06/1911, Carl C.R. Larsen, 2 spec., (NHMA). Ryet, NEZ, 22/06/1975, Ole Martin, 1 spec. (NHMA). Aarhus, EJ, 01/09/1943, S.P., 1 spec. (NHMA). Gjerrild Norstrand, 11/08/1999, Søren Tolsgaard, 1 spec. (NHMA). Kristianssæde Skov, LFM, 06/06/2002, 1 spec. (NHMA). Gribskov, NEZ, 17/06/1913, Weis, H., 1 spec. (NHMA). Hals Nørreskov, NEJ, 14/06/1925, 1 spec. (NHMA). Falstrup, EJ, 05/08/1927, 1 spec., (NHMA).

Description: Abdomen entirely black except for a lateral band of white spots ventrally (Fig. 2E). **Males:** Abdominal sternites with evenly placed short hairs (Fig. 14B).

Distribution: Common in Denmark, found in SZ, NEZ, NWZ, LFM, F, NEJ, and EJ (Fig. 35).

Host plants: Downy Birch (*Betula alba*), Common Alder (*Alnus glutinosa*), Field Maple (*Acer campestre*), Silver Birch (*Betula pendula*), Field Elm (*Ulmus minor*), Eurasian Aspen (*Populus tremula*), Sycamore (*Acer pseudoplatanus*).

Parasites: Aulacidae: *Aulacus* sp. (Skinner & Thomson, 1960); Braconidae: *Spathius exarator*; Ichneumonidae: *Megarhyssa perlata*, *Megarhyssa superba*, *Perithous scurra*, *Pseudorhyssa alpestris*, *Rhyssella approximator*; Pteromalidae: *Xiphydriophagus meyerinckii*.

***Xiphydria prolongata* (Geoffroy, 1785)**

Figs 2, 13, 14, 32, 33, 35.

Records: South Zealand, SZ, Schiødte, 5 spec., (NHMD 210581, 210580, 210576, 210579, 210577). Falster, LFM, Schiødte, 1 spec., (NHMD 210582). Silkeborg, EJ, Schiødte, 1 spec., (NHMD 211244). Tofte Skov, NEJ, 04/07/2004, J. Pedersen, 1 spec., (NHMD 210587). Næstved, SZ, Schiødte, 1 spec., (NHMD 210585). Næstved, SZ, 21/06/1858, Schiødte, 1 spec., (NHMD 210584). Ulvshale, LFM, 10/06/2003, Søren Tolsgaard, 1 spec. (NHMA).

Description: Abdomen black with wide red band from tergum 4 to 7; tergum 3 and 8 may also be marked with red. White spots ventrally on each tergite (Fig. 2F). **Males:** Abdominal sternites with centrally placed tufts of long hairs (Fig. 14C).

Distribution: Rare species in Denmark found primarily on Zealand and LFM with a few records from NJ (Fig. 35).

Host plants: Elm (*Ulmus* sp.) (Pažoutová et al., 2010), Poplar (*Populus* sp.) (Pažoutová et al., 2010), Willow (*Salix* sp.) (Pažoutová et al., 2010), Goat Willow (*Salix caprea*).

Fungal symbiont: Primarily *Daldinia childiae*, rarely other *Daldinia* or *Hypoxyton* spp. (Šrůtka et al., 2007).

Parasites: Braconidae: *Spathius exarator*, *Spathius rubidus*; Ichneumonidae: *Lissonota conflagrate*, *Pseudorhyssa alpestris*, *Rhyssella approximator*; Pteromalidae: *Xiphydriophagus meyerinckii*.

Discussion

Nine species of Cephidae have been recorded from Denmark. The most common are *Calameuta* spp. and *Cephus* spp. *Calameuta pallipes* and *Cephus pygmeus* are both very widespread in Denmark, being present either in all or all but one of the faunal districts, respectively. *Phylloecus* spp. are rarer, all species being recorded from less than half of the faunal districts. The latest record was a *Phylloecus niger* specimen in 2003; these uncommon and inconspicuous wasps are probably easily overlooked. Most records of *Phylloecus* spp. are from NEZ, but this is probably a sampling artifact. The contrast in abundance is not surprising as *Calameuta* and *Cephus* bore in widespread grasses, in the case of *Cephus pygmeus* including common cereals, whereas *Phylloecus* spp. primarily uses less abundant Rosaceae as hosts. Four specimens were placed under *Janus cynosbati* in the NHMD collection; however, they all turned out to be misidentified. There are no confirmed records of this species for Denmark as far as we know. Nielsen and Henriksen (1915) stated that *Janus*



Figs. 25-28. 25. *Sirex juvenicus* **A.** Female habitus. **B.** Male habitus. 26. *Sirex noctilio* **A.** Female habitus. **B.** Male habitus. 27. *Tremex fusicornis* **A.** Female habitus. **B.** Male habitus. 28. *Urocerus gigas* **A.** Female habitus. **B.** Male habitus.

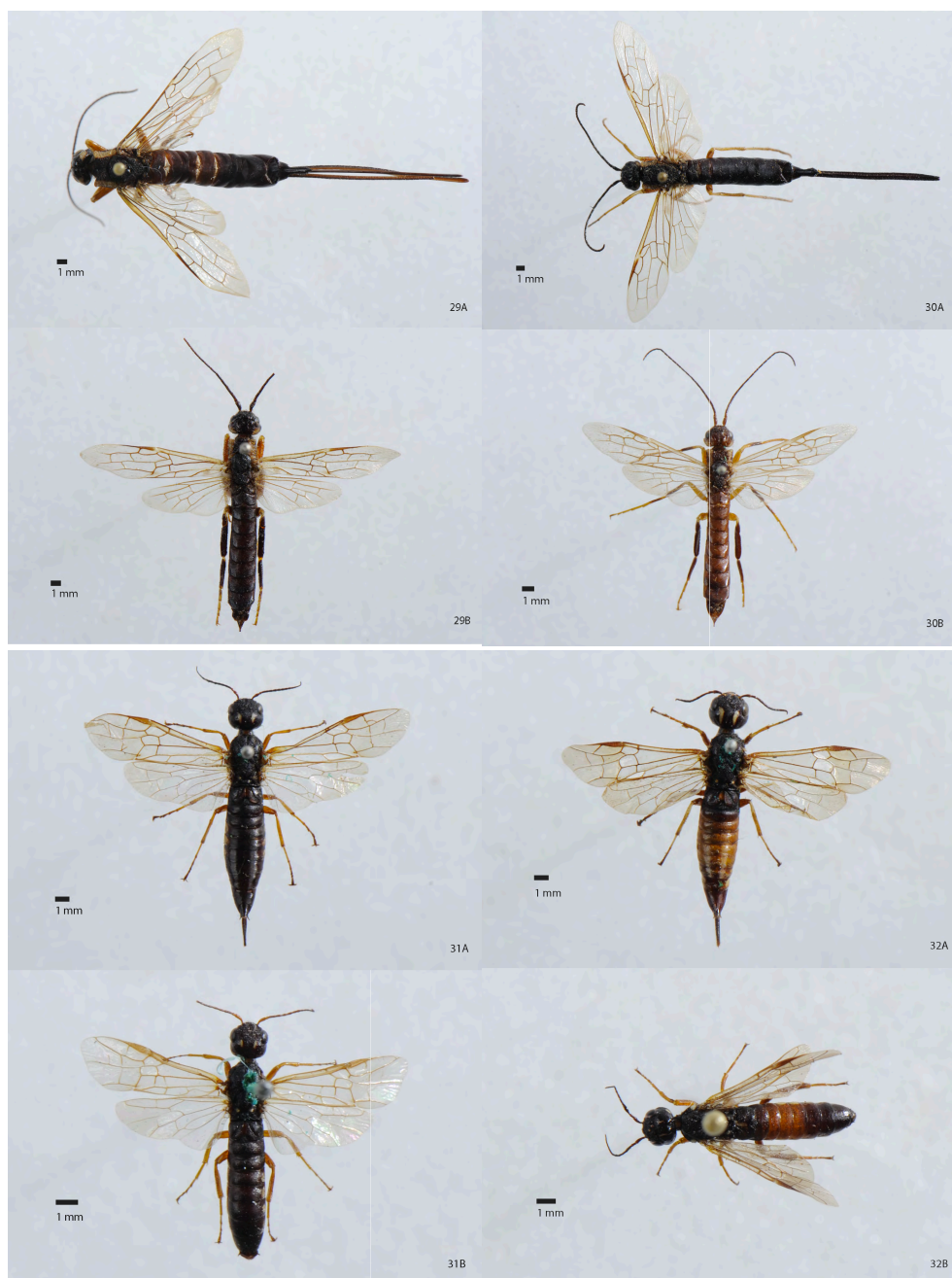


Fig. 29-32. 29. *Xeris pallicoxae* **A.** Female habitus. **B.** Male habitus. 30. *Xeris spectrum* **A.** Female habitus. **B.** Male habitus. 31. *Xiphydria camelus* **A.** Female habitus. **B.** Male habitus. 32. *Xiphydria prolongata* **A.** Female habitus. **B.** Male habitus.

cynosbati has been recorded from Hald (WJ) though no records in either collections correspond to this location. The species is also included in <https://allearter.dk/>, documented by the material in NHMD. *Janus cynosbati* must be considered doubtful as a Danish species.

Eight species of Siricidae have been recorded in Denmark, *Sirex juvencus* and *Urocerus gigas* being the most widespread. *Tremex fuscicornis* is rare and was not collected in Denmark between 1899 and 2005. Most of the records are from the 19th century and scattered across the country; none are from NWJ, WJ or SJ. As other rare species, *Tremex fuscicornis* has probably been overlooked for extended periods. *Xeris pallicoxae* and *X. spectrum* are comparatively rare, most records being from NEZ with a few from F, SJ and EJ. The bias towards NEZ is probably a sampling artifact. The ranges of the two *Xeris* spp. are largely overlapping; one male of each species was collected in Hundested Havn in July 2015 within a week of each other (NHMD213536 & NHMD213487). We were unable to confirm the records of *Sirex cyaneus* and *Urocerus augur* (Midtgaard, 1986; see also above), but since we were not able to check all the material assigned to these species, we still consider it possible that they have been observed in Denmark.

Two species of Xiphydriidae are found in Denmark. There are no records of from NWJ, WJ, SJ and B. *Xiphydria camelus* is well represented in the remaining faunal districts, especially in NEZ. *Xiphydria prolongata* is rare, but its distribution resembles that of *X. camelus*.

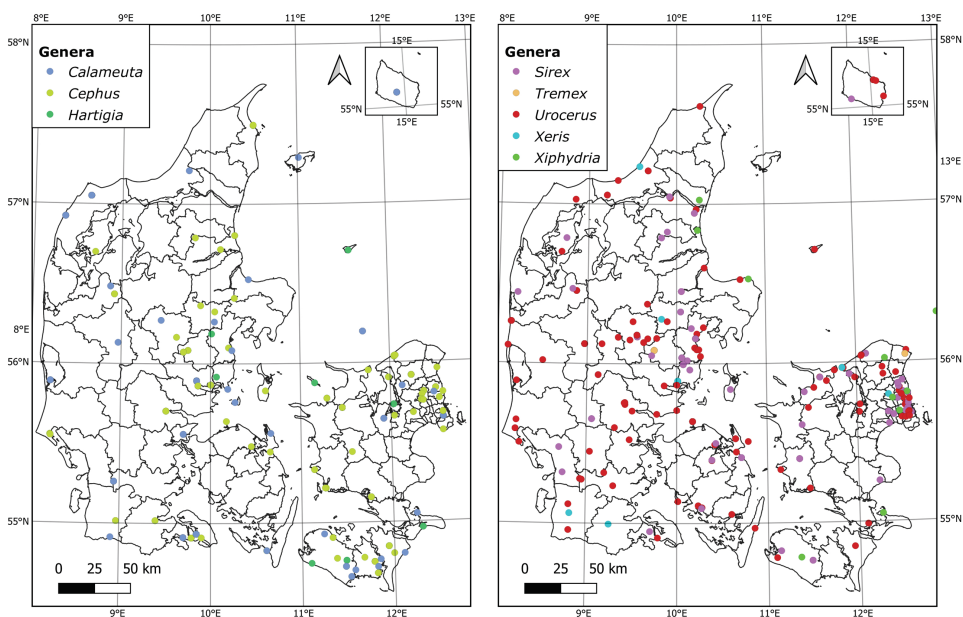


Fig. 33. Distribution maps. **A.** Cephidae genera. **B.** Siricidae and Xiphydriidae genera.

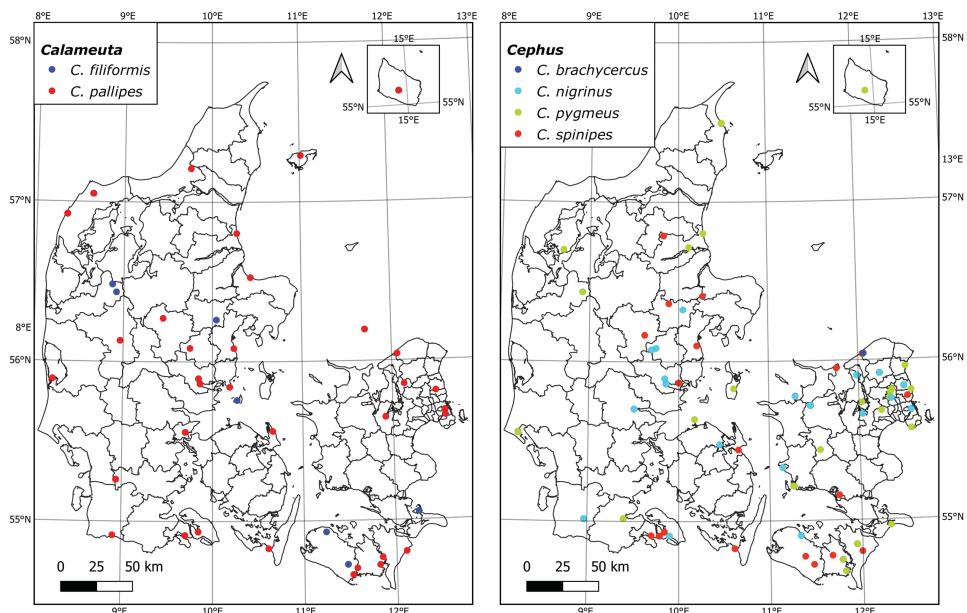


Fig. 34. Distribution maps. A. *Calameuta* spp.. B. *Cephus* spp.

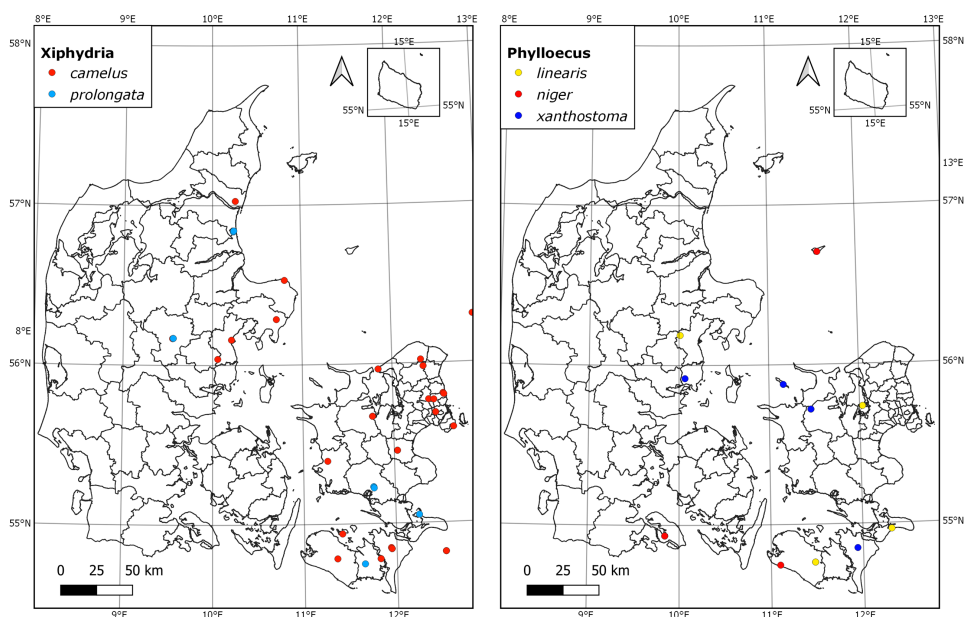


Fig. 35. Distribution maps. A. *Phylloecus* spp. B. *Xiphydria* spp.

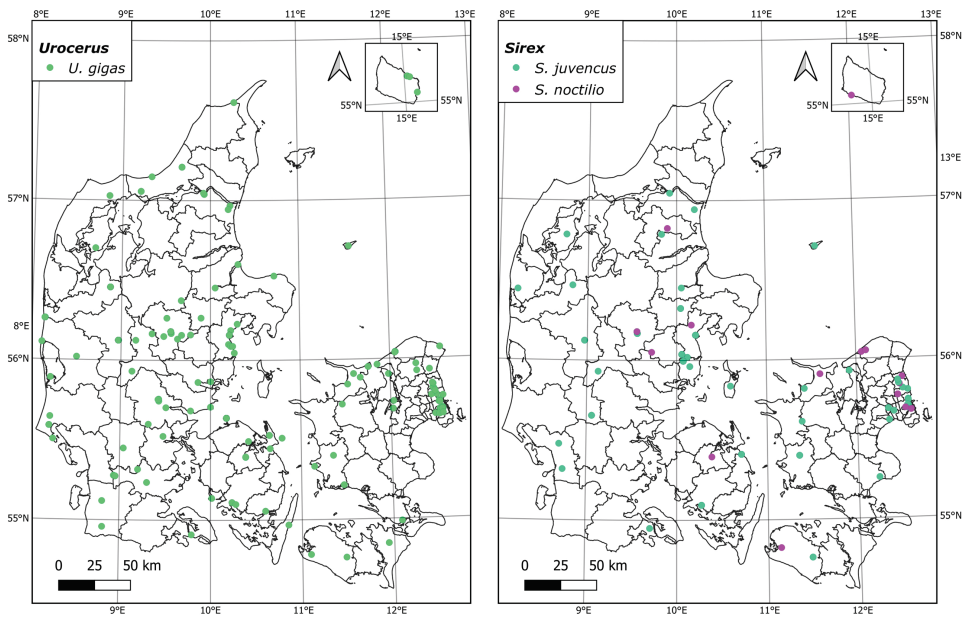


Fig. 36. Distribution maps. **A.** *Urocerus* spp. **B.** *Sirex* spp.

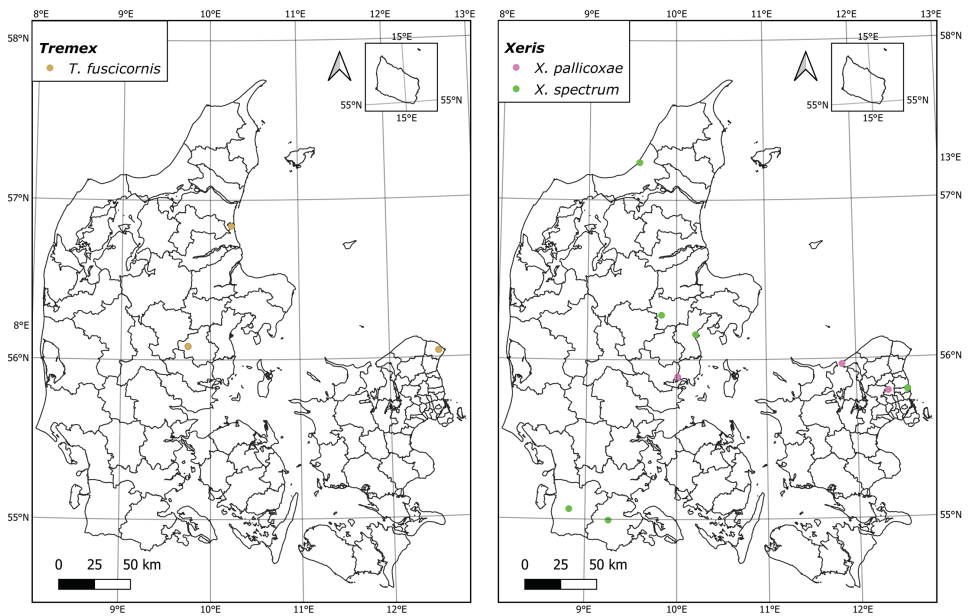


Fig. 37. Distribution maps. **A.** *Tremex* spp. **B.** *Xeris* spp.

Acknowledgements

We thank the following people: Thomas J. Simonsen and Søren Tolsgaard allowed access to the collection at the NHMA and helped processing the material there. Henrik Enghoff and Jan Pedersen helped with processing specimens in the NHMD collection; Henrik Enghoff in addition provided templates for the maps. Alexey Solodovnikov (NHMD) translated a Russian text and allowed the use of his imaging setup; Aslak Kappel Hansen (NHMD) provided instructions for the latter. Anders Alexander Illum (NHMD) provided instruction for additional photo equipment and helped with administrative issues that arose during the thesis work. Martin Stein (NHMD) helped setting up an account in Specify and with problems associated with databasing. Simon Haarder and Henning Bang Madsen provided constructive criticism of the submitted manuscript.

Litteratur

- Agency for Datasupply and Efficiency. Danmarks Administrative Geografiske Inddeling 1:10.000 (retrieved 8/8/2019).
- Aparicio, J.P., Corleya, J.C., & Rabinovich, J. 2013. Life history traits of *Sirex noctilio* F. (Hymenoptera: Siricidae) can explain outbreaks independently of environmental factors. *Mathematical Biosciences and Engineering* 10: 1265-79.
- ArtDatabanken. <https://artfakta.artdatabanken.se>. Retrieved 28/10/2018.
- Benson, R. B. 1946. Classification of the Cephidae (Hymenoptera Symphyta). *Transactions of the Royal entomological Society of London* 96: 89-108.
- CABI: Invasive Species Compendium, <https://www.cabi.org/isc/datasheet/50192>. Retrieved 23/10/2018.
- Chrystal, R.N., & Skinner, E.R. 1932. Studies on the biology of the woodwasp *Xiphydria prolongata* Geoffr. & its parasite *Thalessa curvipes* Grav. *Scottish Forestry Journal* 46: 36-51.
- Delaney, K.J., Weaver, D.K., & Peterson, R.K. 2010. Photosynthesis and yield reductions from wheat stem sawfly (Hymenoptera: Cephidae): interactions with wheat solidness, water stress, and phosphorus deficiency. *Journal of Economic Entomology* 103: 516-24.
- Deyrup, M.A. 1984. A Maple wood wasp, *Xiphydria maculata*, and its insect enemies (Hymenoptera: Xiphydriidae). *The Great Lakes Entomologist* 17: 17-28.
- Enghoff, H. & E.S. Nielsen, 1977. Et nyt grundkort til brug for faunistiske undersøgelser i Danmark, baseret på UTM-koordinatsystemet. *Entomologiske Meddelelser* 45: 65-74.
- Gauld, I.D. & Bolton, B. 1996. *The Hymenoptera*. Oxford University Press, Oxford, xi + 332 pp.
- Golberg, A.M. 1986. Biology of the stem sawflies *Trachelus tabidus* and *Cephus pygmaeus* in the Negev of southern Israel. *Entomologia Experimentalis et Applicata* 40: 117-121.
- Goulet, H. 2014. Revision of the African horntail genus *Afrotremex* (Hymenoptera: Siricidae). *Zootaxa* 3795: 201-254.
- Goulet, H., Boudreault, C., & Schiff, N.M. 2015. Revision of the World species of *Xeris* Costa (Hymenoptera: Siricidae). *Canadian Journal of Arthropod Identification* 28: 1-127.
- Hajek, A.E., Nielsen, C., Kepler, R.M., Long, S.J., & Castrillo, L. 2013. Fidelity among *Sirex* woodwasps and their fungal symbionts. *Microbial Ecology* 65: 753-762.
- Haris, A. 2011. Sawflies of the Börzsöny Mountains (North Hungary). (Hymenoptera: Symphyta). *Natura Somogyiensis* 19: 149-176.
- Jensen, T. S. 1988. Træhvepsen *Xeris spectrum* (Linnaeus, 1758) (Hymenoptera, Siricidae) - nye registreringer efter 100 år. *Entomologiske Meddelelser* 56: 13-15.
- Kolk A. & Starzyk J.R. 1996. *The Atlas of Forest Insect Pests*. The Polish Forest Research Institute, Multico, Warszawa, 705 pp.
- Kravchenko M.A. 1973. Biology of the willow wood wasp *Xiphydria prolongata* a pest of deciduous trees. *Biologicheskie Nauki* 16: 16-19.
- Malipatil, M. 2008. Industry biosecurity plan for the grains industry threat specific contingency plan: European wheat stem sawfly *Cephus pygmaeus*. *Plant Health Australia*. <http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/European-wheat-stem-sawfly-CP-2008.pdf>
- Midtgaard, F. 1986. *Urocera augur* (Klug, 1803) and *Sirex cyaneus* Fabricius, 1781 (Hymenoptera, Siricidae) new to the Danish fauna. *Entomologiske Meddelelser* 53: 127-129.
- Morgan, F.D. 1968. Bionomics of Siricidae. *Annual Review of Entomology* 13: 239-256.
- Muche, H. 1981. Die Cephidae der Erde (Hym., Cephidae). *Deutsche Entomologische Zeitschrift* 28: 239-295.
- Nielsen, J.C., & Henriksen, K.L. 1915. Træ- og bladhvepse. *Danmarks Fauna* 18. G.E.C Gads Forlag, Copenhagen, 1-232.
- Noyes, J.S. 2019. Universal Chalcidoidea Database. World Wide Web electronic publication. <http://www.nhm.ac.uk/chalcidoids>. Accessed 25/11/2020.
- Parkin, E.A. 1942. Symbiosis and siricid woodwasps. *Annals of applied Biology* 29: 268-274.
- Pažoutová, S. and Šrůtka, P. 2007. Symbiotic relationship between *Cerrera unicolor* and the horntail *Tremex fuscicornis* recorded in the Czech Republic. *Czech Mycology* 59: 83-90.
- Pažoutová, S., Šrůtka, P., Holuša, J., Chudíčková, M. & Kolařík, M. 2010. Diversity of xylariaceous symbionts in *Xiphydria* woodwasps: role of vector and a host tree. *Fungal Ecology* 3: 392-401.
- Quinlan, J. & Gauld, I.D. 1981. Symphyta (except Tenthredinidae). Hymenoptera. *Handbooks for the Identification of British Insects* VI 2 (a): 1-67.
- Schiff, N.M., Goulet, H., Smith, D.R., Boudreault, C., Wilson, A.D. & Scheffler, B.E. 2012. Siricidae (Hymenoptera: Symphyta: Siricoidea) of the Western Hemisphere. *Canadian Journal of Arthropod Identification* 21: 1-305.
- Shanower, Thomas G., Hoelmer, & Kim A. 2004. Biological control of wheat stem sawflies: Past and future. *Journal of Agricultural and Urban Entomology* 21: 197-221.
- Skinner, E.R. & Thomson, G.H. 1960. *The Alder woodwasp and its insect enemies*. World Educational Films, Bioquip, 25 minutes.
- Slippers, B., De Groot, P., & Wingfield, M. J. (Eds.). 2011. *The Sirex woodwasp and its fungal symbiont: Research and management of a worldwide invasive pest*. Springer Verlag, Berlin, xii + 301 pp.
- Spradbery, J.P. 1970. The immature stages of European ichneumonid parasites of siricine woodwasps. *Proceedings of the Royal Entomological Society of London. Series A, General Entomology* 45: 14-28.
- Šrůtka, P., Pažoutová, S., & Kolařík, M. 2007. *Daldinia decipiens* and *Entonaema cinnabarina* as fungal symbionts of *Xiphydria* wood wasps. *Mycological Research* 111: 224-231.
- Streams, F. A., & Coles, L. W. 1965. Wheat stem sawfly parasites, *Collyria calcitrator* and *Pediobius nigratarsis*, in eastern United States. *Journal of Economic Entomology* 58: 303-306.

- Taeger, A., Altenhofer, E., Blank, S.M., Jansen, E., Kraus, M., Pschorn-Walcher, H., & Ritzau, C. 1998. Kommentare zur Biologie, Verbreitung und Gefährdung der Pflanzenwespen Deutschlands (Hymenoptera, Symphyta). Pp. 49-135 in Taeger, A. and Blank, S.M. (eds): Pflanzenwespen Deutschlands (Hymenoptera, Symphyta). Kommentierte Bestandsaufnahme. Goecke & Evers, Keltern, 367pp. + 8 plates.
- Taeger, A., Blank, S.M. & Liston, A.D. 2010. World catalog of Symphyta (Hymenoptera). Zootaxa 2580: 1–1064.
- Thomsen, I. M., & Harding, S. 2011. Fungal symbionts of siricid woodwasps: isolation techniques and identification. Forest Pathology 41: 325-333.
- Vilhelmsen, L., & Turrisi, G. F. 2011. Per arborem ad astra: Morphological adaptations to exploiting the woody habitat in the early evolution of Hymenoptera. Arthropod Structure & Development 40: 2-20.
- Yu, D. (2012). <http://www.taxapad.com>. Retrieved 23/10/2018.