

***Psallus* Fieber, 1858 and *Parapsallus* Wagner, 1952 (Hem.-Het., Miridae) in Norway**

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This paper presents records on four species and one genus of phylinae bugs (Hemiptera, Heteroptera, Miridae, Phylinae) previously not recorded from Norway: *Psallus* (*Psallus*) *albicinctus* (Kirschbaum, 1856), *Psallus* (*Hylopsallus*) *wagneri* Ossiannilsson, 1953, *Psallus* (*Pityopsallus*) *luridus* Reuter, 1878 and *Parapsallus* *vitellinus* (Scholtz, 1847), including some new regional records for additional species of *Psallus* Fieber, 1858. Notes are given on the biology and distribution of all the 22 Nordic *Psallus* and *Parapsallus* species, of which only two have not yet been recorded. This paper discusses the importance of *Quercus* L. as a host tree for *Psallus*-species, and their spatial and temporal distribution.

Key words: Phylinae, *Psallus*, *P. albicinctus*, *P. wagneri*, *P. luridus*, *Parapsallus vitellinus*, Norway, canopy.

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Introduction

The knowledge of the heteropteran fauna in Norway is increasing due to increased mapping and attention (e.g. Hågvar 2007, 2008, 2010; Ødegaard & Endrestøl 2007; Staverløkk et al. 2008, 2009). Most of the faunistic data is obtained from species found on herbs in meadows. Due to undersampling, we assume that the knowledge of the canopy fauna of Norwegian Heteroptera still is poor. Previous investigations of canopy-arthropod communities on Scots pine *Pinus sylvestris* L. in Norway have resulted in high numbers of new species to Norway and even new to science (Thunes et al. 2004).

Since 2003, the Norwegian Institute for Nature Research (NINA) has directed the project “Arealer for rødlistearter – Kartlegging og overvåking (ARKO) [Red-listed species – Survey and Monitoring] as a part of the government-initiated “Nasjonalt program for kartlegging og

overvåking av biologisk mangfold” [National Program for Survey and Monitoring Biodiversity], where one of the main aims has been to identify important habitats (hot-spot habitats) for red listed species (Sverdrup-Thygeson et al. 2007, 2009; Kålås et al. 2010). A substantial amount of data has been recorded on rare and red listed species, including many species previously not recorded from Norway (Ødegaard et al. 2009).

One hot-spot habitat in the ARKO project is hollow oaks (*Quercus* spp.). Despite the scarce distribution of oak in Norway, it is the most important tree for insect diversity. More than 500 Norwegian species of insects are directly dependent on oak, especially mould and dead wood of old, hollow oaks. Ødegaard et al. (2009) reported 15 species new to Norway and 101 red listed species associated with oaks from the ARKO project. In this paper we report four species new to the Norwegian fauna mainly based on material collected as part of the survey of hollow oaks.

Psallus Fieber, 1858 is a diverse and species rich genus, with more than 120 Palaearctic species and 19 Norwegian species (including those published in this paper) (Coulianos 1998, Wachmann et al. 2004). It is regarded as not being monophyletic and by some authors even given the informal status “garbage genus” (Yasunaga & Vinokurov 2000). It has later been argued that virtually all species previously included in *Psallus* form three monophyletic clades; *Psallus* Fieber, 1858, *Mesopsallus* Wagner, 1970 and *Pityopsallus* Wagner, 1959, with the two latter suggested to be raised to genus level. The remaining subgenera are suggested synonymized with *Psallus* (Wyniger 2004).

Common characteristics of the *Psallus* species include that they do not exceed 6 mm in length. Colorations range from black to brown and red, but they are never green. The majority of the species are overwintering as eggs and they normally have only one generation per year. They are zoophytophagous (omnivorous) and in most cases strongly associated with their host plants. They may shift their nutrient source from plant sap to small invertebrates as they evolve from nymphs to imagines, but these strategies varies. They feed especially on aphids, and most of them can also be characterized as aphidophagous (Goßner 2008a). A large part of the group is associated with oak, and several are herbivorous oak specialists (Müller & Goßner 2007). Imagines are very active and can be found on a wide range of tree- and shrub-species, other than their host plants. Many of the species may coexist both in time and space (Gaun 1974).

Parapsallus Wagner, 1952 is closely related to *Plagiognathus* Fieber, 1858 and by some authors *Parapsallus* is considered to be a junior synonym of *Plagiognathus* (e.g. Schuh 2001, Gogala 2006). This paper follows Kerzhner & Josifov (1999), which is also consistent with Wachmann et al. (2004). The genus *Parapsallus* consists of only one Palaearctic species, *P. vitellinus*, here reported new to Norway.

Material and methods

Most of the material was collected in 2007–2009 using window traps (WT) on old, hollow oaks. A total of 50 oaks with two WTs each have been monitored along the Southeast coast of Norway since 2004 as a part of the ARKO project managed by NINA (5 in VAY, 5 in AAI, 10 in TEY, 20 in VE, 5 in AK and 5 in Ø). Oaks have been monitored each year, though not continuously on every locality each year (for details see Sverdrup-Thygeson et al. 2009 and references therein). Specimens from the collection at the Natural History Museum in Oslo (NHMO) were also considered. Some additional records of *Psallus* are also given.

Many of the *Psallus* species can only be determined by genitalia preparation (Wyniger 2004). A key to Central European species of *Psallus* based on genitalia can be found in (Wyniger 2004). Wyniger (2004) also provides detailed descriptions on the *Psallus* species' colorations, vestitures, external structures and male and female genitalia.

Below, notes are given on the biology and distribution of all the 22 Nordic *Psallus* and *Parapsallus* species (reviewed from Gaun 1974, Southwood & Leston 1959 and Wachmann et al. 2004). Norwegian regional abbreviations follow Økland (1981). * = new regional record, ** = new to Norway. WT= window trap.

The species

Psallus (Apocremnus) aethiops (Zetterstedt, 1838)

Host. On *Salix*; on undersized willows (e.g. *Salix brachypoda*).

Flight period. Mid-June to mid-August.

Length. 3.8–4.7 mm.

Distribution. European records are confined to Fennoscandia, and the southernmost records from Norway are from Dovre (ON) (Fokstua, 21.VII.1873 leg. Siebke(?); Vålåsjø, 14.VII.1953 leg. A. Bakke). Globally, it is found in North-America, East Russia and Korea.

Comments. Some records of *P. aethiops* from AK and AAI from coll. NHMO are *P. ambiguus* (Fallen, 1807) according to Coulianos (1998). *P. aethiops* was already by Reuter (1879) considered to be an arctic species.

**** *Psallus (Psallus) albicinctus* (Kirschbaum, 1856)**

Records. VE, EIS 19, Stokke: Melsomvik, Båhus, UTM 32V N6565550 E576688, WT 13.VII–11.VIII.2008, 1♀ leg. & coll. NINA; WT 14.V–16.VI.2008, 1♂ leg. & coll. NINA; VE, Larvik: Budalsås, UTM 32V N655605 E55893, WT 19.VI–13.VII.2008, 1♂ leg. & coll. NINA.

Host. On *Quercus*; lives in the sun exposed part of the canopy of *Quercus*.

Flight period. From early June to early July; end of May until early July.

Length. 3.0–3.4 mm; 2.6–3.3 mm.

Distribution. This is an European species that is found in most Central European countries, but it is apparently rare in some parts (eg. Austria, Wachmann et al. 2004). There are several records from Sweden (Wyniger 2004). It is also recorded from Denmark, but not from Finland.

Comments. *P. albicinctus* is considered to be an oak-specialist (Müller & Goßner 2007). The species is here recorded new to the Norwegian fauna. So far only found in VE in Norway.

*** *Psallus (Mesopsallus) ambiguus* (Fallen, 1807)**

Records. VE, EIS 19, Borre: Veggefjellet, WT VII.1997, 1♀ leg. L.O. Hansen, coll. NHMO; NTI, EIS 97, Mosvik: Meltingen, Kilen, WT 1-25.VII.1994, 1 ex. leg. & coll. F. Ødegaard (Tømmerås et al. 2000).

Host. On *Malus*, *Crataegus*, *Salix*, *Alnus*, *Betula*, *Quercus*. Both phytofagous and zoophagous. Nymphs probably need animal juice to grow (Morris 1965). Tunstad (1983) reported this species from a wide variety of plants; *Malus*, *Corylus*, *Salix*, *Fraxinus*, *Acer*, *Ribes* and grasses.

Flight period. Adults from mid-June until August; May until July (Jonsson 1983); 25 May

till 1 August, with the first adults appearing on 9 June (Austreng & Sømme 1980).

Length. 3.8–5 mm.

Distribution. Distributed throughout Europe. *P. ambiguus* is found in most regions in Norway north to TRI, and it is probably the most widely distributed *Psallus* species in Norway.

Comments. This species was the fifth most abundant species of Heteroptera found on *Malus* trees during a three year study in Oslo (Jonsson 1983). Records from Mosvik (NTI) given in Tømmerås et al. (2000) represent a new regional record.

*** *Psallus (Apocremnus) betuleti* (Fallen, 1826)**

Records. MRI, EIS 78, Sunndal: Litlfale, sweep net 2.VII.1994, 2 ex. leg. & coll. F. Ødegaard.

Host. Prefers *Betula*, but also found on *Salix* and *Alnus*. Phytophagous and zoophagous.

Flight period. Adults from late May to the first half of June; June until August.

Length. 4.5–6 mm. One of the largest of the Norwegian *Psallus* species.

Distribution. Widely distributed in Europe. In Norway, found in most regions from VAY to FI. Published new to North America in 1979 (Henry & Wheeler 1979) and has probably both been introduced (to Pennsylvania) and expanded naturally (to Alaska) (Henry & Wheeler 1979, Wachmann et al. 2004).

Comments. *P. betuleti* is very variable in coloration (Wachmann et al. 2004). This species is in Kerzhner & Josifov (1999) listed with two subspecies, *P. b. betuleti* (Fallen, 1826) and *P. b. montanus* (Josifov, 1973). In a recent work on *Psallus betuleti* the subspecies *P. b. montanus* was suggested raised to species rank (Rieger & Rabitsch 2006). Norwegian material of *P. betuleti* is in need of revision. Records from Mosvik (NTI) given in Tømmerås et al. (2000) are uncertain and should not be considered. *P. betuleti* is here reported new to MRI.

* *Psallus (Psallus) confusus* Rieger, 1981

Records. AK, EIS 28, Oslo: Montebello, WT 22.V–20.VI.2008, 1♂ leg. & coll. NINA; 20.VI–12.VII 2008, 1♂ leg. & coll. NINA; VE, EIS 19, Horten: Karljohansvern, WT 16.VI–13.VII.2008, leg. & coll. NINA; Stokke: Melsomvik, Båhus, UTM 32V N6565550 E576688, WT 16.VI–13.VII.2008, 4 ex. leg. & coll. NINA.

Host. On *Quercus*, *Populus*, e.g. *Quercus robur* 'Fastigiata' (Gaun 1974).

Flight period. Adults from June until August.

Length. 3.1–4.1 mm.

Distribution. Widely distributed in Europe. *P. confusus* is so far only recorded from Ø, AK and VAY in Norway (Coulianos 1998).

Comments. This species is very similar to *P. mollis* (Mulsant & Rey, 1852). In the collection at NHMO, there are seven specimens from Ås (AK). *P. confusus* is here reported new to VE.

Psallus (Psallus) falleni Reuter, 1883

Records. NTI, EIS 97, Mosvik: Meltingen, Kilen, WT 24.VI–16.VII.1996, 1 ex. leg. & coll. F. Ødegaard (Tømmerås et al. 2000).

Host. On *Betula*; *Betula platyphylla* (Yasunaga & Vinokurov 2000). Tunstad (1983) collected several specimens from AK on *Betula* (5 ex.), but even more on *Acer* (13 ex.) in addition to some on *Fraxinus* (1 ex.) and *Corylus* (2 ex.).

Flight period. From late July until September.

Length. 3.6–4.2 mm.

Distribution. Widely distributed in Europe. In Norway, *P. falleni* is found as far south as VE (Hansen & Coulianos 1998) and northwestward to TRI and TRY (Hågvar unpubl. data).

Comments. This species was one of the most abundant species of Heteroptera in light trapping (caught in 10 out of 30 years) in the UK (Southwood et al. 2003). Records from Mosvik (NTI) given in Tømmerås et al. (2000) represent a new regional record.

Psallus (Psallus) flavellus Stichel, 1933

Host. On *Fraxinus*. Tunstad (1983) collected 19 specimens in Norway, four from *Fraxinus*, one from *Corylus* and 14 from *Salix*. Tunstad (1983) remarked that the large number on *Salix* sp. was surprising.

Flight period. Adults are only found for a very short period in July until August; 1.VII–7.VIII (Tunstad 1983).

Length. 3.5–4 mm.

Distribution. Widely distributed in Central Europe. *P. flavellus* is only reported from AK by Tunstad (1983) and it is marked with “?” in Coulianos (1998) and “NR?” in Kerzhner & Josifov (1999).

Comments. None of the above mentioned specimens are present in the collection at NHMO and the whereabouts of these specimens are uncertain (E. Tunstad pers. com.). The presence of this species in Norway needs to be confirmed.

Psallus (Apocremnus) graminicola (Zetterstedt, 1828)

Host. On *Betula nana*.

Flight period. Late July to mid-August.

Length. 3.5–4.1 mm.

Distribution. Like *P. aethiops*, this species is also a northern species with its European distribution in Fennoscandia and globally found further east in Russia (Kerzhner & Josifov 1999). The southernmost records in Norway are BV and ON (Coulianos 1998).

Comments. *P. graminicola* was already by Reuter (1879) considered to be an arctic species.

* *Psallus (Psallus) haematodes* (Gmelin, 1790)

Records. HES, EIS 47, Grue: Opakersund, sweep net 9.VIII.1996, 1 ex. leg. & coll. F. Ødegaard; ON, Dovre: Storranden, WT 26.VI–3.VII.1990, 1 ex. leg. & coll. NINA; SFI, Sogndal, date ?, 1 ex. leg. T.A. Helliesen, coll. NHMO; NTI, EIS 92, Stjørdal: Skatval, sweep net 28.VII.1999, 1 ex. leg. & coll. F. Ødegaard.

Host. On *Salix*; found on small-leaved willows (*Salix caprea*, *Salix cinerea*, *Salix aurita* and *Salix repens*)(e.g. Taksdal 1965). Also found to be an important predator on eggs of the willow leaf beetle *Phratora vulgatissima* (L., 1758) (Björkman et al. 2009).

Flight period. End of July to September- early October; found in late summer from mid august to end of September.

Length. 3.0–3.8 mm.

Distribution. Widely distributed in Europe. In Norway, *P. haematodes* is found in several regions from AAY to STI (Coulianos 1998). It was recently published new to VAI (Hågvar 2010).

Comments. *P. haematodes* is here reported new to HES, ON, SFI and NTI. Record from SFI based on a specimen in the collection at NHMO.

Psallus (Pityopsallus) lapponicus Reuter, 1874

Host. On conifers (*Larix*, *Picea*, *Abies*); in Sweden found on *Picea abies*; on *Picea* and/or *Salix* (Vinokurov 1998). This contradicts Wyniger (2004) who states that “Within *Pityopsallus lapponicus* is the only species not feeding on conifers”.

Flight period. From June till August.

Length. 4.0–4.5 mm.

Distribution. *P. lapponicus* is found in Scandinavia and some Central European countries. It was published new to Norway in 1998 (Coulianos 1998) based on nine specimens from Hattfjelldalen collected by E. Strand. Additional records are only reported from NTI, Mosvik (1994), where ten individuals were caught in a window trap (Ødegaard 1998). The same locality was also sampled with window traps in 1996 and 1997, but no individuals of *P. lapponicus* were found. Even though this species can be found in Central Europe, the southernmost records in Norway are from NTI.

Comments. According to Anufriev & Emeljanov (1988), records of *P. lapponicus* from the Far East are erroneous. This species is characterized as local and rare (Wachmann et al. 2004). See also Ossianniilsson (1967).

* *Psallus (Psallus) lepidus* Fieber, 1858

Records. VE, EIS 19, Larvik: Vemannsås, WT 14.VII–12.VIII.2008, 1 ex. leg. & coll. NINA; Stokke: Melsomvik, Båhus, UTM 32V N6565550 E576688; WT 16.VI–13.VII.2008, 1 ex. leg. & coll. NINA; WT, 14.V–16.VI.2008, 1 ex. leg. & coll. NINA; TEI, EIS 18, Sauherad: Sauherad prestegård, 12.VII.1967, 3 ex. leg. G. Taksdal, coll. NHMO; RY, EIS 14, Strand: Bjørheimsbygd, 19.VII.1973, 7 ex. leg. G. Taksdal, coll. NHMO.

Host. On *Fraxinus*; associated with deciduous forests of high continuity (Hansen & Coulianos 1998). Tunstad (1983) collected this species from *Betula*.

Flight period. From mid-June until early September.

Length. 3.7–4.3 mm.

Distribution. Widely distributed in Europe (Kerzhner & Josifov 1999). From Norway, *P. lepidus* is reported from Ø, AK, VE, BØ, HOI, MRI, STI (Coulianos 1998, Hansen & Coulianos 1998, Hågvar 1999, Hågvar 2007). This species is reported new to VE by Hansen & Coulianos (1998), but this is not reflected in Coulianos (1998). According to Coulianos (1998) “very abundant on ash trees in STI: Trondheim, Domkirkegarden and Munkholmen 1981”.

Comments. A reliable determination can only be done by genitalia preparation. *P. lepidus* is here reported new to TEI and RY. These records are based on specimens in the collection at NHMO.

* *Psallus (Psallus) mollis* (Mulsant & Rey, 1852)

Records. Ø, EIS 20, Halden: Knardal, UTM 32V N6555444 E636858, WT 16.VI–12.VII.2008, 1♂ leg. & coll. NINA; AK, EIS 28, Oslo: Montebello, WT 20.VI–12.VII.2008, 3♂♂ leg. & coll. NINA; TEY, EIS 11, Kragerø: Berg Museum, UTM 32V N6527271 E522033, WT 21.VI–28.VII.2009, 3♂♂ leg. & coll. NINA; Drangedal: Steinknapp Ø, WT 18.VI–15.VII.2008, 1♂ leg. & coll. NINA; EIS 18, Siljan: Brenndalsskarven, WT 17.VI–14.VII.2008, 2♂♂ leg. & coll. NINA; VE, EIS 19, Horten: Karljohansvern, WT 16.VI–13.VII.2008, 1♂ leg. & coll. NINA; Stokke: Melsomvik, Båhus,

UTM 32V N6565550 E576688, WT 16.VI–13.VII.2008, 1♀1♂ leg. & coll. NINA

Host. On *Quercus*; herbivorous oak specialist (Müller & Gøbner 2007).

Flight period. Adults in June and July; overwintering as egg; from July to August.

Length. 3.2–3.8 mm.

Distribution. Distributed throughout Europe except a very few countries.

Comments. *P. mollis* is very similar to *P. confusus* Rieger, 1981. A total of 53 specimens from Telemarkslunden (Ø) is published in Hansen & Coulianos (1998). This publication does not state that this is the first Norwegian records of this species, and *P. mollis* is not included in Coulianos (1998). To our knowledge the records from Hansen & Coulianos (1998) represent the first Norwegian records of this species. *P. mollis* is here reported from several new regions and localities in Ø, AK, VE and TEY.

* *Psallus (Hylopsallus) perrisi* (Mulsant & Rey, 1852)

Records. Ø, EIS 20, Halden: Knardal, UTM 32V N6555444 E636858, WT 16.VI–12.VII.2008, 1♂; WT 15.V–13.VI.2007, 1♂ leg. & coll. NINA; VE, EIS 19, Horten: Karljohansvern, UTM 32V 658807 E58459, WT 14.VI–17.VII.2007, 3♂♂ leg. & coll. NINA; Larvik: Budalsås UTM 32V N655605 E55893, WT 15.V–14.VI.2007, 1♂ leg. & coll. NINA; TEY, EIS 11, Kragerø: Berg Museum, UTM32V N6527328 E522062, WT 21.VI–28.VII.2009, 1♂ leg. & coll. NINA; Jomfruland, sweep net 14.VI.2004, 5 ex. leg. & coll. F. Ødegaard; Drangedal: Steinknapp NØ, WT 19.V–16.VI.2004, 1♂ leg. & coll. NINA; RY, EIS 7, Sandnes: Ims, 5.VI.1928, 2 ex. leg. F. Jensen, coll. NHMO; Høle, VIII.1933, 1 ex. leg. F. Jensen, coll. NHMO; HOI, EIS 31, Kvam: Berge, UTM 32V N6689489 E343489, WT 7.VII–18.VIII.2005, 5 ex. leg. & coll. NINA

Host. Mainly on *Quercus* (but also e.g. *Crataegus*, *Acer*, *Tilia*). Tunstad (1983) collected this species from *Malus* and *Fraxinus*. This species also was the eight most abundant species of Heteroptera found on *Malus* trees during a three

year study in Oslo (Jonsson 1983). Jonsson (1983) only found adult specimens and it is presumed that nymphs are mainly associated with *Quercus*, and that adults can migrate to other three species (Southwood & Leston 1959).

Flight period. Adults are found from early June until August.

Length. 3.2–4.0 mm.

Distribution. Widely distributed in Scandinavia and Central Europe. In Norway, *P. perrisi* is found along the coast from Ø to HOY.

Comments. *P. perrisi* was published new to Norway by Coulianos & Ossiannilsson (1976). According to Wyniger (2004), there are no reliable characters that distinguish *P. perrisi* and *P. wagneri* on the female genitalia. The differences in the male genitalia may represent interspecific variation, and the two may be synonyms. They coexist in time and space and could therefore easily be confused (Gaun 1979). *P. perrisi* was one of the most abundant species of Heteroptera in light trapping (caught in 18 out of 30 years) in the UK (Southwood et al. 2003). *P. perrisi* is here reported with several new region records from VE, TEY, HOI, and RY. Records from RY based on specimens found in the collection at NHMO.

* *Psallus (Phylidea) quercus* (Kirschbaum, 1856)

Records. AK, EIS 28, Oslo: Bygdøy, WT 8.VI–1.VII.2004, 2♀♀ leg. & coll. NINA; VAY, EIS 2, Kristiansand: Nedre Timenes, UTM 32V N6447049 E447063, light trap VI.2009, 1 ex. leg. K. Berggren, coll. F. Ødegaard; Bråvann, UTM 32V N6441890 E437383, 1 ex. VI.2009 leg. K. Berggren, coll. F. Ødegaard.

Host. On *Quercus*; seldom on *Prunus spinosa* and *Fraxinus*.

Flight period. Adults from late June until early July.

Length. 3.5–4.6 mm.

Distribution. In Scandinavia and Central Europe. In Norway, *P. quercus* is previously only reported from VAI and RI (Coulianos 1998).

Comments. No specimens are found in the collection at NHMO. It is apparently rare in

Norway. *P. quercus* is here reported new to AK and VAY.

* *Psallus (Psallus) salicis* (Kirschbaum, 1856)

Records. HES, EIS 47, Grue: Opakersund, sweep net 9.VIII.1996, 2 ex. leg. & coll. F. Ødegaard; OS, EIS 45, Vestre Toten: Raufoss, Vestrumenga, sweep net 14.VII.2006, 1 ex. leg. & coll. F. Ødegaard; TEY, EIS 11, Drangedal: Steinknapp V, WT 16.VI–20.VII.2004, 1 ex. leg. & coll. NINA; STI, EIS 92, Trondheim: Tomset, 16.VIII.1999, 1 ex. leg. & coll. F. Ødegaard; Brundalen, 28.VII.2002, 1 ex. leg. & coll. F. Ødegaard; Stokkanhaugen, 17.IX.2003, 1 ex. leg. & coll. F. Ødegaard; Grilstad, 12.VIII–14. IX.1999, 3 ex. leg. V. Sandlund, coll. F. Ødegaard; Melhus: Udduvoll, 20.VIII.1994, 1 ex. leg. & coll. F. Ødegaard; NTI, EIS 98, Levanger: Rinnleiret, 6.VIII.1997, 1 ex. leg. & coll. F. Ødegaard.

Host. Mostly on *Alnus incana*; on *Salix* (Bryja & Kment 2002).

Flight period. Adults from end of July until September.

Length. 3.3–4.5 mm.

Distribution. Widely distributed in Europe. In Norway, *P. salicis* is reported from several regions with NTY representing the northernmost record (Hågvær 2008).

Comments. *P. salicis* was recently published new to VAI (Hågvær 2010). According to Bryja & Kment (2002) this species is rare, but widespread in Europe. *P. salicis* is here reported new to HES, OS, TEY, STI, and NTI.

Psallus (Hylopsallus) variabilis (Fallen, 1807)

Host. On *Salix* and *Populus*; on *Quercus*; but also *Crataegus*, *Tilia*, *Acer*, *Alnus*, *Corylus*, etc; reported from *Quercus* and *Ulmus* (Taksdal 1965).

Flight period. Adults from mid-June until July.

Length. 3.5–4.3 mm.

Distribution. Throughout Europe. *P. variabilis* is found scattered in Norway from VAY to STI.

Comments. A dubious record exists from FØ

(Coulianos 1998). Only two specimens from Ås (AK) are found in the the collection at NHMO and five specimens from three localities from AK (Bygdøy, Sjøstrand, Montebello) in the collection at NINA.

* *Psallus (Psallus) varians* (Herrich-Schaeffer, 1841)

Records. VE, EIS 19, Horten: Karljohansvern, UTM 32V 658807 E58459, WT 13.VI–15. VII.2005, 1 ex. leg. & coll. NINA; Østøya, 13.VI–15.VII.2005, 1 ex. leg. & coll. NINA; TEY, EIS 11, Kragerø: Berg Museum, UTM 32V N6527328 E522062, WT 21.VI–28.VII.2009, 1♂ leg. & coll. NINA; Bergland, UTM 32V N6526473 E522903, 1 ex. leg. & coll. F. Ødegaard; EIS 18, Siljan: Brenndalsskarven, UTM 32V N656704 E54898, WT 15.V–15.VI.2007, 1 ex. leg. & coll. NINA.

Host. Usually on *Quercus*; on *Quercus*, but also other deciduous trees (*Salix*, *Betula*, *Sorbus*, *Corylus*, *Alnus*, *Fraxinus*, *Fagus*); also with high numbers on conifers (Goßner 2005). The high abundance of this species on conifers remains unclear (Goßner 2005).

Flight period. From early June until September.

Length. 3.8–4.7 mm.

Distribution. Widely distributed in Europe. In Norway, *P. varians* is found mainly along the coast from Ø to RY, but also found in inland parts of southern Norway (HOI, RI, VAI).

Comments. Three subspecies of *P. varians* are given in Kerzhner & Josifov (1999). *P. v. cornutus* Wagner, 1943 (not in Scandinavia), *P. v. tunetanus* Wagner, 1962 (not in Scandinavia) and *P. v. varians* (Herrich-Schaeffer, 1841) (widely distributed in Europe). This species was one of the most abundant species of Heteroptera in light-trapping (caught in 21 out of 30 years) in the UK (Southwood et al. 2003). *P. varians* is here reported new to TEY and VE.

**** *Psallus (Hylopsallus) wagneri* Ossiannilsson, 1953**

Records. Ø, EIS 20, Halden: Knardal, UTM 32V N6555444 E636858, WT 13.VI–16.VII.2007, 1♂ leg. & coll. NINA; VE, EIS 19, Horten: Karljohansvern, UTM 32V 658807 E58459, WT 16.VI–16.VII.2008, 1♂ leg. & coll. NINA; Larvik: Budalsås, UTM 32V N655605 E55893, WT 19.VI–13.VII.2008, 1♂ leg. & coll. NINA; Vemansås, WT 16.V–20.VI.2008, 1 ex. leg. & coll. NINA; TEY, EIS 11, Kragerø: Berg Museum, UTM 32V N6527277 E522088, WT 21.VI–28.VII.2009, 1♂ leg. & coll. NINA; EIS 18, Siljan: Brenndalsskarven, UTM 32V N656704 E54898, WT 15.V–15.VI.2007, 3♂♂ leg. & coll. NINA; AAI, EIS 10, Åmli: Simonstona, UTM 32V N651942 E46722, WT 12.VI–8.VII.2006, 2♂♂ leg. & coll. NINA

Host. Found on *Quercus* and less frequently on *Crataegus*. Tunstad (1983) collected this species from *Fraxinus*.

Flight period. Adults from early June until mid-July.

Length. 3.0–4.1 mm.

Distribution. Widely distributed in Europe (Kerzhner & Josifov 1999).

Comments. This species is very similar to *P. perrisi* and *P. variabilis* (Gaun 1974, Wachmann et al. 2004). According to Wyniger (2004), *P. perrisi* and *P. wagneri* do not differ in characters on the female genitalia. The differences in the male genitalia may represent interspecific variation and the two may be synonyms. *P. wagneri* is here reported new to Norway from several localities and regions.

**** *Psallus (Pityopsallus) luridus* Reuter, 1878**

Records. RY, EIS 3, Hå: Brusand, UTM 32V N6493216 E310001, 10.VI.2008, leg. & coll. F. Ødegaard.

Host. On *Larix* (especially younger trees); also on *Picea*. On *Larix gmelinii*, *L. kajanderi*, *Picea excelsa* (Vinokurov 1998).

Flight period. Adults from mid-June until August.

Length. 3.5–4.1 mm.

Distribution. *P. luridus* is found in Scandinavia and some Central European countries.

Comment. *P. luridus* is here reported new to Norway from RY.

**** *Parapsallus vitellinus* (Scholtz, 1847)**

Records. VE, EIS 19, Larvik: Budalsås, UTM 32V N655605 E55893, WT 19.VI–13.VII.2008, 3♂♂ leg. & coll. NINA; WT 13.VII–12.VIII.2008, 1♂ leg. & coll. NINA; AAI, EIS 9, Bygland: Heddevika, 17.VII.2009, leg. K. Berggren, coll. F. Ødegaard.

Host. On conifers (especially *Picea*); *Picea*, *Pinus* and *Larix*. This species can be characterized as an early season mirid that feeds at the base of needles on new growth of spruces, larch, and Douglas fir (Henry & Wheeler 1973).

Flight period. From the beginning of July until August; “Adults were abundant only for a few weeks from about 5 June to 20 June” (Henry & Wheeler 1973).

Length. 2.7–3.4 mm; 3.26 mm (Schuh 2001).

Distribution. Widely distributed in Europe (Kerzhner & Josifov 1999).

Comment. May have been introduced to North America (Henry & Wheeler 1973). *Parapsallus vitellinus* is here reported new to Norway from VE and AAI.

Nordic species so far not recorded from Norway

***Psallus (Hylopsallus) assimilis* Stichel, 1956**

Host. Monophagous on *Acer campestre*; only on fertile individuals.

Flight period. From early June until mid-July; from late May until late July.

Length. 3.2–3.8 mm

Distribution. This species has a Central European distribution from the UK to Spain. It was reported new to Sweden by Kerzhner & Josifov (1999) and some uncontrolled specimen exists from Denmark (<http://www.allearter.dk>). It

is not reported from Finland.

Comments. *P. assimilis* is apparently rare, but could be undersampled (Aukema 1981, 2001). It could be found in the most southern parts of Norway on *Acer*.

Psallus (Pityopsallus) piceae Reuter, 1878

Host. Found on *Picea*; seldom on *Larix* or *Pinus*.

Flight period. From mid-June until end of August.

Length. 3.4–4.0 mm.

Distribution. This species is also found in Central Europe. *P. piceae* is apparently rare in Sweden. It is so far not recorded from Denmark or Finland.

Comment. Records from Jämtland (Sweden) substantiate that this species might be found in Norway (Ossiannilsson 1967).

Discussion

Oak canopies have an unique and specialized insect fauna (Müller & Goßner 2007). Wachmann et al. (2004) lists 47 species of Miridae associated with *Quercus* from Germany. It has also been demonstrated that *Quercus* has the highest diversity of specialized species of Heteroptera compared to *Fagus* and *Picea* (Goßner 2008a). Of the 20 species dealt with above, only three are found on conifers. Out of the remaining species more than half are more or less associated with *Quercus*. At least five of the species can be characterized as *Quercus*-specialists (Müller & Goßner 2007). Different groups of phytophagous insects on *Quercus* also exhibit a regular seasonal pattern. The leaf chewers appear first, following the sucking species, the leaf miners and gall formers. This pattern can be related to the condition of the leaves (Southwood et al. 2004). Seasonality is also linked to overwintering strategy and Goßner (2008a) found that species overwintering as eggs had a peak on *Quercus* in the spring, mainly as a result of a peak occurrence of *Psallus* species. Since many of the *Psallus* species have a shift in

nutrient source from sap to invertebrates towards late summer, a spring-peak in abundance would be optimal as the leaves become tougher and less nutritious during summer whilst other arthropod populations build up. Important nutrition sources for the adult *Psallus* species are aphids, which are multivoltin (Southwood et al. 2004). Still, invertebrates might also be of importance as a nymphal food source, and might increase survival and longevity (Jonsson 1983, Björkman et al. 2009). Aphidophagous Heteroptera, in general, is found in higher numbers on *Quercus* than on *Fagus* and *Picea* (Goßner 2008a). As most of the *Psallus* species are omnivorous they might act as important biological control agents, but may also cause damage to plants (Björkman et al. 2009). In addition to a temporal distribution, several of the *Psallus* species also have a local spatial distribution. Sampling in different altitudes of *Betula*-dominated forests has shown that some of the *Psallus* species (at least *P. perrisi* and *P. varians*) are significantly restricted to the canopy layer (Goßner 2009). A further spatial distribution has been found on a larger scale as climatic conditions (indirectly altitude) are a key factor for differences in the heteropteran canopy communities (Goßner 2005, Röder et al. 2010).

Both tree species composition and forest management result in distinct canopy heteropteran communities (Goßner 2005, 2008ab), and different collecting techniques are needed to reveal this (Gogala 2006). Different species of native oaks (UK; *Q. robur* and *Q. petraea*, Germany; *Q. robur*) all tend to have high diversity, exceeding that of introduced oaks (UK; *Q. ilex* and *Q. cerris*, Germany; *Q. rubra*) (Southwood et al. 2004, 2005; Goßner 2008b). Introduction of exotic tree species have been an important mean to raise timber production, as seen with *Picea sitchensis* in Norway (Stabbetorp 2009). Goßner (2008b) studied the effect of introduced exotic trees on Heteroptera fauna, and found his results to be comparable with those found after intensive harvesting. Structural differences in forest stands as a result of different management practices can thus be a key factor forming the fauna composition (Dunk & Schmidl 2008).

The findings of the above listed new species

to the Norwegian fauna and new regional records are not unexpected as the oak survey within the ARKO project has covered the above discussed features of both temporal and spatial variation in small scale (from spring-autumn/individual trees) and large scale (several years/different regions in Norway) with high continuity.

As this paper demonstrates, our knowledge on both species composition and species distribution of the arboreal Heteroptera fauna of Norway is still limited. Further investigations are needed to raise our knowledge on the arboreal Heteroptera fauna in Norway, its variations in different forest types and the faunal effects of different forest management practices.

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References

- Anufriev, G.A. & Emeljanov, A.F. 1988. Volume II: Homoptera and Heteroptera. In: P.A. Lehr (ed.). Keys to the Insects of the Far East of the USSR in Six Volumes, Transliteration of the Russian title: Opredeletel' nasekomykh Dal'nego Vostoka SSSR v shesti tomakh. Vol. 2. Ravnokrylye i poluzhestkokrylye. In: P.A. Lehr (ed.). Keys to the Insects of the Far East of the USSR in Six Volume. Nauka, Leningrad.
- Aukema, B. 1981. A survey of the Dutch species of the subgenus *Hyllopsallus* of *Psallus* (Hemiptera - Heteroptera, Miridae). *Tijdschrift voor entomologie* 124, 1–25.
- Aukema, B. 2001. Recent changes in the Dutch Heteroptera fauna (Insecta: Hemiptera). *Proceedings 13th international colloquium European Invertebrate Survey*. 39–52.
- Austreng, M.P. & Sømme, L. 1980. The fauna of predatory bugs (Heteroptera, Miridae and Anthocoridae) in Norwegian apple orchards. *Fauna Norvegica Serie B* 27, 3–8.
- Björkman, S., Maisonnasse, A. & Eklund, K. 2009. Biology and performance on different diets of an omnivorous insect predator, *Psallus haematodes* (Heteroptera: Miridae). *Entomologisk Tidskrift* 130, 145–153.
- Bryja, J. & Kment, P. 2002. New and interesting records of plant bugs (Heteroptera: Miridae) from the Czech and Slovak Republics. *Klapalekiana* 38, 1–10.
- Coulianos, C.-C. 1998. Annotated catalogue of the Hemiptera-Heteroptera of Norway. *Fauna Norvegica Serie B* 45, 11–40.
- Coulianos, C.-C. & Ossiannilsson, F. 1976. Catalogus Insectorum Sueciae. Hemiptera-Heteroptera. 2nd Ed. *Entomologisk Tidskrift* 97, 135–173.
- Dunk, K. von der & Schmidl, J. 2008. *Diptera (Brachycera) in oak forest canopies – management and stand openness gradient determine diversity and community structure*. In: Floren, A. and Schmidl, J. (eds). Canopy arthropod research in Europe, pp. 507–528, Bioform entomology, Nuremberg.
- Gaun, S. 1974. *Blomstertæger*. Danmarks Fauna 81. Dansk Naturhistorisk Forening, København. [In Danish]
- Gogala, A. 2006. Heteroptera of Slovenia, III: Miridae. *Annals for Istrian and Mediterranean Studies, Series historia naturalis* 16, 77–112.
- Goßner, M. 2005. The importance of Silver fir (*Abies alba* MILL.) in comparison to spruce (*Picea abies* (L.)KARST.) and oak (*Quercus petraea* (MATT.) LIEBL.) for arboreal Heteroptera communities in Bavarian forests. *Waldökologie online* 2, 90–105.
- Goßner, M. 2008a. *Heteroptera (Insecta: Hemiptera) communities in tree crowns of beech, oak and spruce in managed forests: Diversity, seasonality, guild structure, and tree specificity*. In: Floren, A. and Schmidl, J. (eds). Canopy arthropod research in Europe, pp. 119–143. Bioform entomology, Nuremberg.
- Goßner, M. 2008b. *Introduced tree species as an anthropogenic disturbance of arthropod communities in tree crowns of managed forests - a case study of native Heteroptera communities on introduced red oak (Quercus rubra L.)*. In: Floren, A. and Schmidl, J. (eds). Canopy arthropod research in Europe, pp. 409–425, Bioform entomology, Nuremberg.
- Goßner, M.M. 2009. Light intensity affects spatial distribution of Heteroptera in deciduous forests. *European Journal of Entomology* 106, 241–252.
- Hansen, L.O. & Coulianos, C.-C. 1998. Noteworthy records of Heteroptera (Hemiptera) from the middle Oslofjord, SE Norway. *Fauna Norvegica Serie B* 45, 69–76.
- Henry, T.J. & Wheeler, Jr. A.G. 1973. *Plagiognathus vitellinus* (Scholtz), a conifer-feeding mirid new to

- North America (Hemiptera: Miridae). *Proceedings of the Entomological Society of Washington* 75, 479–485.
- Henry, T.J. & Wheeler, Jr. A.G. 1979. Palearctic Miridae in North America: Records of newly discovered and little-known species (Hemiptera: Heteroptera). *Proceedings of the Entomological Society of Washington* 81, 257–268.
- Hågvar, S. 1999. New data on the distribution of Norwegian Hemiptera Heteroptera. *Norwegian Journal of Entomology* 46, 61–65.
- Hågvar, S. 2007. Nye fylkesfunn av teger IV. *Insekt-Nytt* 32, 9–12. [In Norwegian]
- Hågvar, S. 2008. Nye fylkesfunn av teger V. *Insekt-Nytt* 33, 45–48. [In Norwegian]
- Hågvar, S. 2010. Nye fylkesfunn av teger VI. *Insekt-Nytt* 35, 21–26. [In Norwegian]
- Jonsson, N. 1983. The bug fauna (Hem., Heteroptera) on apple trees in south-eastern Norway. *Fauna Norvegica Serie B* 30, 9–13.
- Kerzhner, I.M. & Josifov, M. 1999. *Miridae*. In: Aukema, B. & Rieger, C. (eds.). Catalogue of the Heteroptera of the Palaearctic Region. Volume 3. Cimicomorpha II. Netherlands Entomological Society. Ponsen & Looijen, Wageningen. Amsterdam, 350 pp.
- Kålås, J.A., Viken, Å., Henriksen, S. and Skjelseth, S. (eds.). 2010. *The 2010 Norwegian Red List for Species*. Norwegian Biodiversity Information Centre, Norway.
- Morris, M.G. 1965. Some aspects of the biology of *Psallus ambiguus* (Fall.) (Heteroptera: Miridae) on apple trees in Kent. I. Life cycle. *Entomologist* 98, 14–31.
- Müller, J. & Goßner, M. 2007. Single host trees in a closed forest canopy matrix: a highly fragmented landscape? *Journal of Applied Entomology* 131, 613–620.
- Ødegaard, F. & Endrestøl, A. 2007. Establishment and range expansion of some new Heteroptera (Hemiptera) in Norway. *Norwegian Journal of Entomology* 54, 117–124.
- Ødegaard, F. 1998. Faunistic notes on Heteroptera (Hemiptera) in Norway. *Fauna Norvegica Serie B* 45, 93–99.
- Ødegaard, F., Sverdrup-Thygeson, A., Hansen, L. O., Hanssen, O. & Öberg, S. 2009. Survey of invertebrates in five hot-spot habitat types. Red-listed species and new species for Norway. 2004–2008. *NINA Report* 500. 102 pp. [In Norwegian]
- Økland, K.A. 1981. Inndeling av Norge til bruk ved biogeografiske oppgaver – et revidert Strand system. [Division of Norway for use in biogeographic work – a revision of the Strand-system]. *Fauna (Oslo)* 34, 167–178. [In Norwegian]
- Ossiannilsson, F. 1967. On the lectotypes of *Psallus lapponicus* Reuter and *Psallus piceae* Reuter (Hem., Heteropt.). *Entomologisk Tidsskrift* 88, 87–88.
- Rieger, C. & Rabitsch, W. 2006. Taxonomy and distribution of *Psallus betuleti* (Fallén) and *P. montanus* Josifov stat. nov. (Heteroptera, Miridae). *Tijdschrift voor Entomologie* 149, 161–166.
- Reuter, O.M. 1879. Till en djurgeografisk fråga, ett litet bidrag. *Öfversikt af Finska Vetenskaps-Societetens Förhandlingar* XI, 64–82.
- Röder, J., Bässler, C., Brandl, R., Dvorak, L., Floren, A., Goßner, M.M., Gruppe, A., Jarzabek-Müller, A., Vojtech, O., Wagner, C. & Müller, J. 2010. Arthropod species richness in the Norway Spruce canopy along an elevation gradient. *Forest Ecology and Management* 259, 1513–1521.
- Schuh R.T. 2001. Revision of New World *Plagiognathus* Fieber, with comments on the Palearctic fauna and the description of a new genus (Heteroptera: Miridae: Phylinae). *Bulletin of the American Museum of Natural History* 266, 1–26.
- Southwood, T.R.E. & Leston, D. 1959. *Land and Water Bugs of the British Isles*. Frederick Warne & Co. Ltd.
- Southwood, T.R.E., Henderson, P.A., & Woiwod, I.P. 2003. Stability and change over 67 years – the community of Heteroptera as caught in a light-trap at Rothamsted, UK. *European Journal of Entomology* 100, 557–561.
- Southwood, T.R.E., Wint, G.R.W., Kennedy, C.E.J., & Greenwood, S.R. 2004. Seasonality, abundance, species richness and specificity of the phytophagous guild of insects on oak (*Quercus*) canopies. *European Journal of Entomology* 101: 43–50.
- Southwood, T.R.E., Wint, G.R.W., Kennedy, C.E.J., & Greenwood, S.R. 2005. The composition of the arthropod fauna of the canopies of some species of oak (*Quercus*). *European Journal of Entomology* 102, 65–72.
- Staverløkk, A., Johansen, N.S. & Coulianos, C.-C. 2009. *Atractotomus parvulus* Reuter, 1878 (Hemiptera, Miridae) a plant bug new to Norway. *Norwegian Journal of Entomology* 56, 13–14.
- Staverløkk, A., Johansen, N.S. & Coulianos, C.-C. 2008. Nye fylkesfunn av teger. *Insekt-Nytt* 33, 49–53. [In Norwegian]
- Sverdrup-Thygeson, A., Bakkestuen, V., Bjureke, K., Blom, H., Brandrud, T.E., Bratli, H., Endrestøl, A., Framstad, E., Jordal, J.B., Skarpaas, O., Stabbetorp,

- O.E., Wollan, A.K. & Ødegaard, F. 2009. Survey and monitoring of red-listed species. Progress report 2009. *NINA Report* 528. 76 pp. [In Norwegian]
- Sverdrup-Thygeson, A., Blom, H.H., Brandrud, T.E., Bratli, H., Skarpaas, O. & Ødegaard, F. 2007. Survey and monitoring of red-listed species. Sub-project II: Red -listed species – survey and monitoring. Progress report 2006. *NINA report* 238. 86 pp. [In Norwegian]
- Stabbetorp, O. 2009. Sitkagran *Picea sitchensis*. Artsdatabanken faktaark nr. 105. [In Norwegian]
- Taksdal, G. 1965. Hemiptera (Heteroptera) collected on ornamental trees and shrubs at the Agricultural College of Norway, Ås. *Norwegian Journal of Entomology* 13: 5–10.
- Thunes, K.H., Skartveit, J., Gjerde, I., Starý, J., Solhøy, T., Fjellberg, A., Kobro, S., Nakahara, S., zur Strassen, R., Vierbergen, G., Szadziewski, R., Hagan, D.V., Grogan Jr, W.L., Jonassen, T., Aakra, K., Anonby, J., Greve, L., Aukema, B., Heller, K., Michelsen, V., Haenni, J.-P., Emeljanov, A.F., Douwes, P., Berggren, K., Franzen, J., Disney, R.H.L., Prescher, S., Johanson, K.A., Mamaev, B., Podenas, S., Andersen, S., Gaimari, S.D., Nartshuk, E., Søli, G.E.E., Papp, L., Midtgaard, F., Andersen, A., von Tschirnhaus, M., Bächli, G., Olsen, K.M., Olsvik, H., Földvári, M., Raastad, J.E., Hansen, L.O. & Djursvoll, P. 2004. The arthropod community of Scots pine (*Pinus sylvestris* L.) canopies in Norway. *Entomologica Fennica* 15, 65–90.
- Tunstad, E. 1983. *Tegefaunaen i en usprøytet eplehage, og i dens viktigste omgivende vegetasjon*. Cand. Scient. Oppgave i Entomologi, Zoologisk Institutt, Universitetet i Oslo. [In Norwegian]
- Tømmerås, B.Å., Willmann, B., Ødegaard, F., Gjershaug, J.O., Breistein, J., Abildsnes, J., Prestø, T., Aakra, K. & Krokstad, S. 2000. Effects of fragmentation on biodiversity in spruce forest. *NINA Report* 40. 89 pp. [In Norwegian]
- Vinokurov, N.N. 1998. Asian plant bugs of the subgenus *Pityopsallus* E. Wagn., genus *Psallus* Fieb. (Heteroptera: Miridae). *Zoosystematica Rossica* 7, 285–296.
- Wachmann, E., Melber, A. & Deckert, J. 2004. *Wanzen Band 2. Die Tierwelt Deutschlands* 75. Goecke & Evers, Keltern, 288 pp. [In German]
- Wyniger, D. 2004. *Taxonomy and phylogeny of the Central European bug genus Psallus (Hemiptera, Miridae) and faunistics of the terrestrial Heteroptera of Basel and surroundings (Hemiptera)*. PhD-thesis, Basel.
- Yasunaga, T. & Vinokurov, N.N. 2000. The Phylinae Plant Bug Genus *Psallus* Fieber in Japan (Heteroptera: Miridae: Phylinae). *Entomological Science* 3, 653–668.

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