

Hoverflies (Diptera: Syrphidae) of Laivadalen, a palsa bog in northern Sweden, with notes on possible bio-indicator species

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van Steenis, J. & Zuidhoff, F.S.: Hoverflies (Diptera: Syrphidae) of Laivadalen, a palsa bog in northern Sweden, with notes on possible bio-indicator species. [**Blomflugor (Diptera: Syrphidae) i Laivadalen, en palsmyr i norra Sverige, med förslag på indikatorarter.**] – Entomologisk Tidskrift 134(4): 181-192. Uppsala, Sweden 2013. ISSN 0013-886x.

Palsa bogs are known for their unique flora and fauna and its special geomorphological features. During a PhD research on palsa growth and decay in Northern Sweden a palsa bog in Laivadalen was investigated from 1996-2001 by the second author. The first author studied the Syrphid fauna of the palsa bog. This paper deals with the geomorphology, vegetation, climate and Syrphid fauna of the investigated palsa bog. In total 33 Syrphid species have been collected, of which nine species have been depicted as possible bio-indicator species for palsa bogs. For each of these nine species a short discussion is given. Two additional species are discussed as they are mentioned from palsa bogs for the first time.

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Palsa bogs (Fig. 1) are unique geomorphological features inhabited by unique flora and fauna (Wramner 1967, Railton & Sparling 1973, Whitaker 1993, Rae et al. 1998, Koponen 2002, Hoffman 2002, Zuidhoff & Kolstrup 2005, Schröter et al. 2012). They are characterised by a mosaic of xerophilous peat mounds, named palsas, and ponds surrounded by hydrophilous *Sphagnum-Eriophorum* peat. The elevation of a palsa is due to the development of a perennially frozen core of peat, ice and mineral soil (Seppälä 1986). Palsa development (Fig. 2) is a decades to centuries long, cyclic process of growth and succeeding decay characterised by five developmental stages (Zuidhoff & Kolstrup 2005).

In the remnant stage so called themokarst ponds are formed, in which the palsa will drown. This decay (Fig. 3) can sometimes be very rapid (Zuidhoff 2002) and accounts for the high biodi-

versity observed on palsa bogs, stimulated by the various and changing micro-habitats. Palsa development is controlled by a combination of low annual temperature, low depth of snow cover, high water level in the bog, and the insulating property of the peat (Seppälä 1986). The growth and subsequent decay of the palsas is paralleled by a succession of vegetation types (Wramner 1967, Zuidhoff & Kolstrup 2005). Vegetation of embryo palsas is characterised by a wilted vegetation of sedges and dry *Sphagnum* mosses. In the young stage, that vegetation is replaced by species that can withstand the drier conditions, like *Rubus chamaemorus* and *Betula nana*. These species, together with *Empetrum hermaphroditum*, dominate the vegetation on palsas in the mature stage. This very particular dynamic of interaction between geomorphology and vegetation might give rise to a syrphid fauna as unique



Figure 1. Laivadalen with part of the palsa bog, looking East. Clearly visible are the open and the overgrown palsalakes with bordering palsa remnants. In the foreground the small stream going through the palsa bog, in the background Ammarfjället. Aerial photo by F.S. Zuidhoff.

Laivadalen med en del av palsamyren, sedd åt öster. De öppna och igenvuxna palsatjärnarna med intilliggande rester av palsar syns tydligt. I förgrunden rinner den lilla bäcken som går rakt genom området, i bakgrunden syns Ammarfjället.

as the palsa bog itself.

Warming of the climate during the 20th century in Fennoscandia is probably influencing the development of palsas at the southern limit of permafrost occurrence (Lindquist 1995, Sollid & Sørbel 1998). In Laivadalen, which is one of Sweden's southern-most palsa bogs and the bog studied in the present paper, there has been a decrease of ca. 50 % in the surface area of palsas between 1960 and 1997 and no new palsas seem to have developed during the period (Zuidhoff & Kolstrup 2000). These processes could lead to a decrease in the species inhabiting palsa bogs. In this paper the syrphid fauna of the Laivadalen palsa bog is described. Syrphid species which could be potential bio-indicators of palsa bog quality are highlighted.

Geomorphology

Laivadalen is a ca 2 km wide and 10 km long valley, located in the Vindelfjällen Nature Reserve, Southern Lapland at 66°06' N and 15°30' E (Fig. 4).

The valley has a north-south orientation and lies at an altitude of 600-620 m a.s.l. with major mountains on either side. In the west the 1078 m high Laiverte and in the east the massif of Ammarnäs, with peaks rising above 1600 m a.s.l. During Weichselian glaciation hummocky moraines and an esker were formed in Laivadalen. Today an extensive peat and palsa bog occurs, with patches of sandy, hummocky moraine protruding through it. Remnants of palsas, often surrounding palsalakes, are found throughout the bog. Only a minor part of the area still contains relatively well developed palsas. This lat-

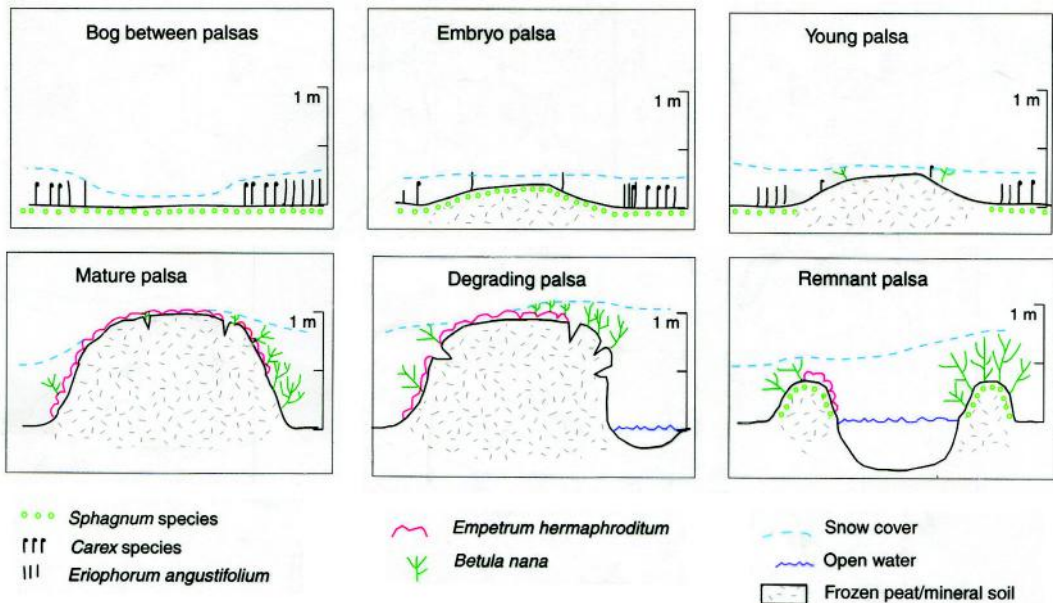


Figure 2. Cyclic development and Classification stages of palsa.

Schematisk presentation av en palsa-cykel och dess stadier.

ter part is located 3 km south of lake Laivajaur on the western bank of the river Laivajukke and measures an area of about 500 by 500 m. The mineral soil under the peat layer was often visible at the erosional edges of the palsas and consists of 70-80% silt. The peat layer of the palsa bog is 50 to 265 cm thick, with an average of 160 cm. The minimum age of 8150 ± 85 BP for the start of peat growth is in accordance with an early Holocene age (i.e. the end of the last ice-age). The palsas found here were forming palsa complexes, which consist of several dome-shaped palsas, each with a length of about 20-30 m, a width of 10-20 m and a height of 1-1.5 m. The most recent palsas were probably formed during the Little Ice Age in the cold period around 1860-1890.

Vegetation

Along the slopes of the valley the main vegetation type is birch forest-heath with mosses and the tree-line is between 670 and 720 m a.s.l. The forest is of the open, flower rich type with *Aconitum lycoctonum*, *Caltha palustris*, *Trollius eu-*

ropeus, *Ranunculus* spp., *Potentilla* spp., *Viola biflora*, *Cornus suecica*, *Angelica archangelica*, and *Taraxacum* spp. Above the treeline a heath type with *Betula nana*, dwarfed *Salix* spp. and *Juniperus communis* dominates.

In spite of its altitude, the valley floor has only little birch forest (Fig. 1). Along small streams leading through the mire *Salix* spp. shrub, with *Caltha palustris* and *Viola biflora*, are present, and on drier parts *Betula nana* scrub with *Rubus chamaemorus*. On the hummocky moraines and the esker the vegetation is sparse, with *Betula nana*, *Eriophorum hermaphroditum* and lichens. In the western part of the valley there is some Birch-forest, which is confined to the east facing slopes of the moraines. Within the palsa bog the vegetation is related to surface elevation, hydrology and drainage. During the development of a palsa the vegetation changes from one dominated by *Eriophorum angustifolium*, *Carex* spp., *Spagnum fuscum*, and *Polytrichum strictum* in the mire to drier vegetation with *Betula nana*, *Empetrum hermaphroditum*, *Rubus chamaemorus*, *Vaccinium uliginosum*,



Figure 3. Palsa decay in Laivadalen. – a) degrading palsa (July 1996), – b) the same palsa (June 2001) in the remnant stage. Note the group of birch trees and the amount of water in front of the palsa. In the background mount Linetjåkke (1006 m a.s.l.). The white pole on the palsa indicates one meter height. Photos by J. van Steenis.

En pals som kollapsar i Laivadalen. – a) en pals som börjar brytas ner (juli 1996), – b) resterna av samma pals i juni 2001. Träden i bakgrunden samt berget Linetjåkke (1006 m) utgör referenspunkter. Notera mängden vatten framför palsen efter nedbrytningen. Den vita stolpen är en meter hög.

and lichens on the palsa and more *Vaccinium* spp. colonizing on degrading palsas (Zuidhoff & Kolstrup 2005). The scientific names of the plant species are after Mossberg et al. (1995).

Climate

The air and ground temperatures are shown in Table 1. The thawed layer depth on three palsas (August 1996 and July 1997) measured between 27-55 cm, with an average of, respectively, 41, 43 and 51 cm.

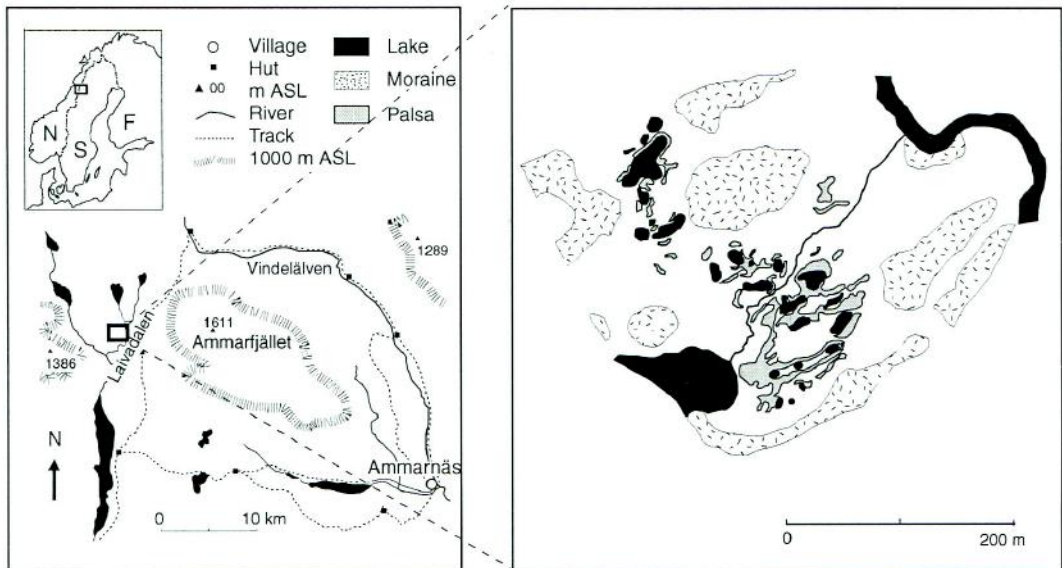


Figure 4. Location of the palsa bog within Laivadalen and Sweden. Den studerade palsmyrens läge i Laivadalen intill Ammarhäs fjället.

The snow cover, measured from mid-October till late April, had a maximum of 51 cm. In March 1998 the snow cover on the whole palsa bog was between 22–125 cm (mean 59 cm) on the bog and between 0–97 cm (mean 24) on the palsa. The soil temperature at 5 cm depth on the palsa showed large variations compared to the

soil temperatures at the same depth in the bog (Zuidhoff 2002), indicating that the snow cover on the palsa was very shallow all winter.

The distribution of palsa bogs is restricted to areas with low mean annual (< 500 mm) and winter (< 250 mm) precipitation and low mean annual temperature (< -3°C) (Luoto et al. 2004).

Table 1. Air and ground temperatures in the palsa bog. Air temperature is from a nearby climate station (Hemavan) and ground temperature is measured in the bog during 1997–2000.

Luft och marktemperaturer i palsamyren. Lufttemp är mätt på Hemavans väderstation, marktemperaturen mättes i palsamyren 1997–2000.

Annual mean	Mean summer	Max	Min
Air temperature, °C			
1961–1990	-1.9	9.6	-
1997–1998	-0.9	9.2	21
1998–1999	-1.2	8.9	22.03
1999–2000	-0.2	9.1	24
Ground temperature in palsa, °C			
10 cm	-0.4	-	12.08
50cm	-1.04	-	01.07
125 cm	-0.90	-	-0.1

Table 2. Collecting effort and the number of species and specimens collected during the field periods.

Insamlingsinsatsens storlek och tid samt antalet arter och individer som påträffades vid insamlingstillfällena.

Year	Date	Field days	Days with- out collecting	No of species	No of specimens
1996	21–29 July	2	4	9	9
1997	3–21 July	8	4	20	81
1998	14–17 Aug.	1	3	0	0
2000	1–4 Sept.	1	3	1	1
2001	25–28 June	4	0	19	90

The palsa bog in Laivadalen is at the boundary of palsa existence as the mean annual temperature is -0.8°C , winter precipitation 343 mm and the mean annual precipitation 737 mm.

Material and methods

The syrphid fauna was surveyed by hand netting, in the years 1996-1998 and 2000-2001 (Table 2). In 1997 and 1998, 10 days were spent collecting Syrphidae in Laivadalen outside the palsa bog.

Over a total of 30 field days, 181 specimens, belonging to 32 species were collected. On 14 days the weather was too cold and no Syrphidae were collected. In the years 1997 and 1998 larval traps were used. These traps consisted of 2 litre boxes filled with mashed, decaying, potatoes and carrots. The boxes were filled with water and partly submerged in the peat in order to attract females to lay eggs. Some effort was made to follow females which showed egg laying behaviour and to find larvae. The eggs and larvae which were found were brought home in order to rear them, which unfortunately failed. No larvae were obtained by the larval traps.

The species' distribution habitat preferences in Fennoscandia is based on Bartsch et al. (2009 a & b) and distribution in Europe is from Speight (2011). The environmental stratification used for categorising distribution zones in Fennoscandia and Europe is according to Metzger et al. (2005) and Metzger et al. (2012). The delimitation of the Alpine north corresponds with the area of occurrence of palsa bogs in Fennoscandia (cf Seppälä 1986, Sollid & Kristiansen 1983). Distribution of the species in Laivadalen is based on the observations of the authors.

Results and Discussion

The species caught in the palsa bog in Laivadalen are listed in Table 3, which also indicates their distribution and habitat preferences. In total 33 syrphid species were collected, of which 11 belong to the tribe Eristalinae and 22 species to the Syrphinae. Among Eristalinae, three species (*Cheilosia* spp.) have phytophagous larvae while the others (*Eristalis* (1), *Helophilus* (3), *Sericomyia* (3), and *Chrysosyrphus* (1)) have aquatic larvae. The species of the tribe Syrphinae are predacious, mostly on aphids.

Platycheirus was the most abundant genus in Laivadalen, in regard to both species (16 out of 33) and specimens (53 out of 182) collected. The larvae of this genus are mostly aphid predators on different low and tall herbs, or among leaf litter (Goeldlin de Tiefenau 1974, Rotheray & Gilbert 1989, Maibach & Goeldlin de Tiefenau 1991). The adult habitats are open wetlands or other wetland types within forested areas. Adults are most abundant either early in the morning, on clouded days or in rainy but warm weather. The genus mainly have a Boreo-Alpine distribution. Several groups are recognized within this genus (Vockeroth 1990). The monophyletic origin of these groups has not been tested, but biological preferences within each group correspond well with each other (Dušek & Láška 1970, van der Goot & Grabandt 1970, Nielsen 1972, Leereveld 1982, van der Linden 1986, Speight & Goeldlin de Tiefenau 1990). In Sweden only 5 groups (*albimanus*, *ambiguus*, *clypeatus*, *manicatus* and *peltatus*) are present, of which all except the *ambiguus* group are represented in Laivadalen. The preferences of the species of each group may be summarised as follows:

- *albimanus* group: species preferring forest or scrub and foraging on different high and low herbs in open places; always close to forest edges. Taking nectar and pollen from *Typha* spp., Ericaceae, *Salix* spp., etc. Larvae are found on low and high herbs and trees (Rojo & Marcos-Carcía (1998) and Láška & Starý (1980)).

- *clypeatus* group: species typical of wetland, found along brooks, in fens and moors in both open and forested areas; adults mainly feeding on Cyperaceae, grasses and *Plantago* spp. The larvae are found on *Carex rostrata* (Maibach & Goeldlin de Tiefenau 1991) and different low herbs (Rotheray & Dobson 1987).

- *manicatus* group: species preferring drier parts of wetlands, open meadows with scrub, and forest edges. Adults feed on different low herbs. Larvae are found on trees (Láška & Starý 1980).

- *peltatus* group: found in open places like meadows and forest edges, but also in herb-rich wet forest; adults feeding on low herbs like *Geranium* spp., *Geum* spp., and also Cyperaceae.

Table 3. Species list of Syrphidae collected in the palsa bog in Laivadalen with distributional data for Laivadalen, Fennoscandia and Europe.
 Lista på de arter som samlades i palsamyren i Laivadalen, med uppgifter om arternas habitatkrav och utbredning i olika regioner.

Species	Distribution/ biogeographical regions			
	Laivadalen	Fennoscandia	Europe	
<i>Cheilosia longula</i> aff. (Zetterstedt 1838)*	26/6-19	<i>Rubus chamaemorus</i>	Widespread and common	Alpine north and N boreal
<i>Cheilosia melanopa</i> (Zetterstedt 1843)	15/7	<i>Rubus chamaemorus</i>	Widespread and common	Alpine N and S, N boreal
<i>Cheilosia vicina</i> (Zetterstedt 1849)	26/6	-	Common in forest streams	Widespread
<i>Chrysosyrphus nasutus</i> (Zetterstedt 1838)	26/6-18/7	<i>Rubus chamaemorus</i> , <i>Cornus suecica</i>	Restricted and rare outside palsa bog	Alpine north and N boreal
<i>Dasytyrphus tricornutus</i> (Fallén 1817)	9-21/7	<i>Rubus chamaemorus</i>	Uncommon	Widespread
<i>Eristalis gomoiunovae</i> Volovitch 1977	26-28/6	-	Restricted to palsa bog	Alpine north northern boreal
<i>Helophilus groenlandicus</i> (Fabricius 1780)	17-21/7	2 ♂, 1 ♀	Restricted to palsa bog	Alpine N, N boreal atlantic N
<i>Helophilus lapponicus</i> Wahlberg 1844	26/6	1 ♂	Restricted to palsa bog	Alpine north, northern boreal
<i>Helophilus pendulus</i> (Linnaeus 1758)	27/6	1 ♂	Rare, forest stream	Widespread
<i>Melangyna arctica</i> (Zetterstedt 1838)	26/6-21/7	2 ♂, 6 ♀	Widespread, common	Alpine north and south, boreal, atlantic north
<i>Melanostoma dubium</i> (Zetterstedt 1838)	26/6-25/7	3 ♂, 8 ♀	Widespread, very common	Alpine north and southern, northern boreal atlantic north
<i>Melanostoma mellinum</i> (Linnaeus 1758)	26/6	1 ♂, 1 ♀	Widespread, common	Widespread
<i>Parasyrphus tarsatus</i> (Zetterstedt 1838)	26/6-25/7	2 ♂, 7 ♀	Widespread, very common	Alpine N and S, N boreal
<i>Platycheirus albimanus</i> (Fabricius 1781)	9-21/7	3 ♀	Widespread, very common	Widespread
<i>Platycheirus amplus</i> Curran 1927	25/7	1 ♀	Restricted and rare, forest mire	Widespread
<i>Platycheirus angustatus</i> (Zetterstedt 1843)	21/7	1 ♂	Restricted to palsa bog	Widespread
<i>Platycheirus clypeatus</i> (Meigen 1822)	21/7	1 ♂	Widespread, common	Widespread
<i>Platycheirus groenlandicus</i> Curran 1927	27/6-3/7	2 ♂, 2 ♀	Widespread, very common	Alpine north
<i>Platycheirus holarcticus</i> Vockeroth 1990	26/6-21/7	7 ♂, 12 ♀	Common in mires and palsa bog	Alpine north
<i>Platycheirus hyperboreus</i> (Staeger 1845)	26-27/6	4 ♂, 1 ♀	Rare in mires and palsa bog	Alpine north
<i>Platycheirus kittlaensis</i> Dusek & Laska 1982	26/6	2 ♂, 1 ♀	Restricted to palsa bog	Alpine north
<i>Platycheirus nielsenii</i> Vockeroth 1990	28/6	1 ♂	Restricted to palsa bog	Alpine N and S, atlantic N
<i>Platycheirus pellatus</i> (Meigen 1822)	3/7	1 ♀	Restricted to palsa bog	Widespread
<i>Platycheirus perpallidus</i> Verrall 1901	25/7	1 ♀	Restricted to palsa bog	Widespread
<i>Platycheirus podagratus</i> (Zetterstedt 1838)	25/6-21/7	2 ♂, 4 ♀	Common in mires and palsa bog	Widespread
<i>Platycheirus subordinatus</i> Becker 1915	8/7	1 ♀	Rare in mires and palsa bog	Alpine north
<i>Platycheirus varipes</i> Curran 1923	26/6	4 ♂, 2 ♀	Restricted to palsa bog	Alpine north
<i>Sericomyia jakutica</i> (Stackelberg 1927)	26/6-21/7	7 ♂, 10 ♀	Restricted to palsa bog	Alpine north
<i>Sericomyia lappona</i> (Linnaeus 1758)	26/6-21/7	6 ♂	Restricted to palsa bog	Widespread
<i>Sericomyia sibirica</i> (Harris 1776)	21/7	1 ♀	Restricted to palsa bog	Widespread
<i>Sphaerophoria borealpina</i> Goeldlin 1989	26/6-17/7	2 ♂, 3 ♀	Widespread but rare, forest, mountain, mire	Alpine north
<i>Syrphus ribesii</i> (Linnaeus 1758)	15/7	1 ♀	<i>Rubus chamaemorus</i>	Widespread
<i>Syrphus torvus</i> Osten Sacken 1875	3-25/7	1 ♂, 2 ♀	<i>Eriophorum angustifolium</i> <i>Carex</i> spp.	Widespread

*) sensu Bartsch et al. 2009

Potential bio-indicator species

The following nine species are selected from the Laivadalen list as possible bio-indicator species for palsa bogs, based on the authors' observations and the available literature on syrphid faunistics (Bartsch et al. 2009 a & b, Haarto 1995, Haarto & Kerppola 2007, Hippa et al. 1981, Nielsen 1972, 1981, 1997, 1998, 1999, Speight 2011, and van Steenis 1998).

The criteria used for the inclusion of a species as a bio-indicator (i.e. a species highly depending on palsa bogs for its survival) were: distribution data from Fennoscandinavia show that the species mainly occur within Alpine north; known adult and larval habitat preferences and food source.

For each of the selected species the known habitat preferences are given, followed by observations made in the palsa bog in Laivadalen and ending with a short discussion of its value as a bio-indicator species for palsa bogs as natural phenomena in boreal landscapes in Alpine north.

Chrysosyrphus nasutus (Zetterstedt, 1838). A rare species with scattered records. In Norway restricted to the Alpine north. In Sweden and Finland also known from the boreal zone. Found on aapa mires in open birch-pine (*Pinus sylvestris*) forests and on palsa bogs. In these wetlands the species can be very abundant on *Rubus chamaemorus*. Other flowers visited are *Dryas octopetala*, *Rhododendron tomentosum*. The flight period is from late June until late July.

Laivadalen: Very abundant on the palsas and frequently seen visiting *Rubus chamaemorus* (from June 15 until July 18). Outside the palsa bog within the birch forest seen visiting *Cornus suecica*. One female was observed while laying several eggs in moss cushions close to the water surface along a degrading palsa. The remnant was about 1 meter high with bare peat, and a palsa pond of about 10 m². The eggs were laid in singletons, with a total of more than 10 eggs being laid, on a surface of about 8 cm². Most likely the female would have laid more eggs if it was not disturbed by the observer. Efforts were made to rear the larvae but this was in vain. The species was also found in other bogs and mires within the Birch forest zone. It probably depend on open bog areas with abundant *Rubus*

chamaemorus or other white flowering plants like *Rhododendron tomentosum*. The larva seems to be aquatic, and dependent on debris in the litter zone. This species is a bio-indicator for different bogs and mires in the boreal and Alpine north zone but not exclusively for palsa bogs.

Eristalis gomojunovae Violovitsh, 1977. A very rare and local species which can be abundant in some years. It is a northern species, previously not found below 68° N. The preferred environments are freshwater wetlands, boggy margins of lakes and along drainage ditches in open boreal *Pinus sylvestris* forest and tundra, and palsa bogs. The adults usually rest on mud at the edge of pools and ditches and flies rapidly to and fro close to the water surface. It usually visit *Caltha palustris*, *Ranunculus* spp., *Salix* spp. The flight period is from mid June until mid July.

Laivadalen: Found on the palsa bog in great numbers (50 males, 2 females) and in one year (2001) only. Males were seen flying over bare peat close to the palsa ponds and settling on the peat, watching out for females and chasing other males away. Only two females were observed, flying close to the water's edge. The palsa bog seems to be a very suitable habitat for this species: peat ground warms up for mate seeking and *Rubus chamaemorus* is the food source. The peat along the palsa ponds tends to warm up more easily as the dark peat accumulates heat, which in turn probably is beneficial to the development of the larvae. This species should be regarded as a bio-indicator species of palsa bogs in Fennoscandia. Although it is found in cultivated areas in Finnmark (Norway), the natural habitat is probably palsa bogs as its larvae are most likely depending on open, shallow and nutrient rich waters which warm up easily during summer.

Helophilus lapponicus Wahlberg, 1844. A widespread but uncommon species, found in the Alpine north and the northern boreal zone. Its' main habitats are wetlands in forests and open ground like aapa mires without open water in forested regions of Finland; boreal *Picea/Pinus/Betula* forest; arctic wetlands like ponds and ditches in farmland; palsa mires. It visits flowers of *Achillea* spp., *Allium sibiricum*, *Caltha palustris*, *Matricaria* spp., *Ranunculus* spp.,

Rubus chamaemorus, *R. idaeus*, and *Sorbus aucuparia* and flies from mid June to late July (early September).

Laivadalen: Only one male was collected on June 26 2001. The palsa bog is certainly a breeding habitat of this species. It is, however, most likely not the only habitat it depends on and therefore the species is not a strong bio-indicator for palsa bogs.

Platycheirus groenlandicus Curran, 1927. A rare but widespread species in the Alpine north. Found in bogs and mires within sub-alpine *Betula* forest and dwarf *Betula/Salix* scrub and open areas in taiga and palsa bogs. It is seen flying low among dwarf shrubs and other ground vegetation, and visits flowers even in cold and cloudy weather. It visits *Ranunculus* spp., *Salix* spp., *Sedum* spp., *Rhodiola rosea*. The flight period is from late June until mid August.

Laivadalen: A few specimens were found in the palsa bog, visiting *Rubus chamaemorus* flowers edging shrub *Betula* spp., in shaded conditions. Outside the palsa bog it has been caught on *Carex* mires within birch forest, visiting *Carex* spp. and *Caltha palustris*. This species belongs to the *manicatus* group and palsa bogs are not the only mire type of the Alpine north preferred by this species. Palsa bogs are, however, a good habitat for this species in Fennoscandia, due to the combination of an abundance of the nutrient rich foodplant *Rubus chamaemorus* (probably not only for the adult but also for aphids on which the larvae can feed), plus the low *Betula nana* and higher *Betula* spp. and *Salix* spp. shrubs for shelter. *P. groenlandicus* is most likely not a very strong bio-indicator species for palsa bogs.

Platycheirus hyperboreus (Staeger, 1845). A rare species of the Alpine north, where it is found in subalpine birch forest close to streams and brooks. Most often in or near *Carex* mires within birch and pine forest. It visits flowers of *Ranunculus* spp., *Carex* spp and flies from late June to late July.

Laivadalen: It was also collected from outside the palsa bog in a *Carex* mire in open, alpine meadow habitat. Seen visiting *Parnassia palustris* and *Carex* spp. As this species belongs to the *clypeatus* group its main habitat is bogs and mires. Palsa bogs is an important habitat for

Platycheirus species of this group, as the natural cycle of palsa development leads to a succession in which favourable microhabitats from open water to dense *Carex* mires and dry palsa mounds (which compared to the surroundings are colder in winter and warmer in summer) are formed. This species could be a good bio-indicator species for Swedish palsa bogs even if it is also found abundantly on open tundra in Norway (pers com T. Nielsen).

Platycheirus kittilaensis Dusek & Láška, 1982 is an uncommon species in the Alpine north and the northern Boreal zone. It prefers open, subalpine birch forest close to streams and brooks, or subarctic *Betula* forest. It is also found in dwarf scrub (*Salix*) tundra and western taiga forest. The flowers visited are *Geranium sylvaticum*, *Caltha palustris*, *Potentilla erecta*. In other palsa bogs found on *Ranunculus* spp. and *Rubus chamaemorus*. Also known from outside palsa bogs, visiting *Viola biflora* (own observations). Flight period: late June to late July.

Laivadalen: This is a species of the *manicatus* group and only collected once in the palsa bog. Some records are from open taiga forests and tundra, which corresponds with the preferences of other species of the *manicatus* group. More data are needed before its potential as a bio-indicator species of palsa bogs can be determined.

Platycheirus subordinatus Becker, 1915 is a rather common and widespread species in the Alpine north. It prefers open ground and dwarf *Betula/Salix* scrub in alpine tundra where it has been seen visiting *Rubus chamaemorus*, *Caltha palustris*, and *Viola biflora* (own observations). It flies low through dwarf scrub and ground vegetation and rests in the sun on the foliage of broad-leaved plants (e.g. *Alchemilla*). It visit flowers of *Cerastium alpinum*, *Parnassia palustris*, *Potentilla crantzii*, *Ranunculus* spp., *Salix* spp. Flight period: late June to early August.

Laivadalen: Only collected once. Other Swedish records are from outside palsa bogs. This preference demonstrates its *manicatus* group affinities and shows that its habitat comprises a wider range of open areas than *P. groenlandicus*. Like this species *P. subordinatus* is probably not a very strong bio-indicator species for palsa bogs.

Platycheirus varipes Curran, 1923. A rare and local species in the Alpine north. Found in boreal/sub-arctic *Betula* forest and cultivated tundra meadow within pine forest. It visits flowers of *Ranunculus* spp. and flies between late June and early August.

Laivadalen: This species belongs to the *manicatus* group and, despite the occurrence in the palsa bog in Laivadalen, not restricted to palsa bogs. It is therefore not a strong bio-indicator species.

Sericomyia jakutica (Stackelberg, 1927) is a very rare species in the Alpine north. It is found in palsa bogs or aapa mires in tundra and in open, humid coniferous forest. The flight period is from late June to late July.

Laivadalen: It was very abundant on the palsa bog in 1997 and 2001, with more than 15 males and 30 females seen in total. Like all the other species of this genus it is restricted to bogs and mires. The males were seen flying low over the palsas and along the margins of the palsa ponds, or settling on bare peat. Females were seen flying around palsa ponds and over wet, bare peat at the edge of the ponds, probably seeking suitable places for egg laying. It seems to have the same demands as *Eristalis gomojunovae* and *Sericomyia arctica*, but reports on its habitat are very limited. In fact, the present habitat data could well be the first in its kind. One *Sericomyia* larva was found in the peat layer of a recent decayed palsa, rich in decomposing, fresh organic matter. Unfortunately the larva died and decayed, so it is not clear which species it belonged to. As *S. jakutica* is the most abundant *Sericomyia* in the palsa bog it could well have belonged to this species. Based on the records of adults *S. jakutica* is probably a strong palsa bio-indicator.

Boreal species reported from palsa bogs for the first time

During the Laivadalen study, *Platycheirus angustatus* (Zetterstedt, 1843) and *Platycheirus perpallidus* Verrall, 1901 were caught, with one female each. This were the first records of these species in the Alpine north of Sweden. Also in Norway both species were recently reported from the Alpine north for the first time, in a tundra bog within the western taiga forest (Nielsen 1998). This could be due to climate change, or

simply that these species are rare at the northern limit of their occurrence and have been overlooked in the past.

Acknowledgments

We wish to thank the Entomological Societies in Uppland and Stockholm for financial support. The county administrative board in Västerbottens län is acknowledged for permission to collect Syrphidae in Vindelfjällens nature reserve. We also thank Martin Speight (Dublin) for valuable comments and checking the English; Tore R. Nielsen (Sandnes) for checking the identity of some of the species and for valuable comments.

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Svensk sammanfattning

Palsar kan bildas på myrar i riktigt kalla klimatlägen. En pals består av en meterhög kulle som växer till på grund av att en islins bildas och växer till i torven. En pals finns vanligtvis i 10-100 år, eftersom den efter en tid kollapsar då islinsen smälter pga att kullen värms. Det blir ett cykliskt förlopp (se Fig. 1 & 3), vilket gör att man på palsyrrar finns oftast finner många paltar i olika stadier av cykeln. På palsyrrarna finns på grund av detta en speciell flora och fauna. I denna studie har blomflugefaunan på en palsyrr i Laivadalen i Ammarnäsfallan studerats under åren 1996-2001. Målet var att dokumentera faunan och se om det fanns speciella arter för denna typ av myrar.

Totalt hittades 182 blomflugor av 33 arter. *Platycheirus* var det vanligaste släktet, både vad gäller antalet arter (16 stycken) och individer

(53). Detta släktes arter har larver som är bladluspredatorer. Många av de andra arterna som hittades har larver som lever i vatten.

Nio arter bedömdes, baserat på fynden i denna studie och på vad som står i litteraturen, vara typiska för palsyrrar. Av dessa var *Chrysosyrphus nasutus* den art som hittades mest frekvent på myren. *Eristalis gomojunovae*, *Helophilus lapponicus*, *Platycheirus groenlandicus*, *Platycheirus hyperboreus*, *Platycheirus kittilaensis*, *Platycheirus subordinatus*, *Platycheirus varius* och *Sericomyia jakutica* var andra typiska arter. Även om de är typiska för palsyrrar så lever ingen art uteslutande på denna myrtyp.

Två arter *Platycheirus angustatus* och *Platycheirus peripallidus* hittades i denna studie för första gången i den alpina delen av Sverige. De har nyligen också rapporterats som nya för alpina Norge.

Stipendier från Entomologiska föreningen i Stockholm

Flera stipendier på tillsammans ca 50 000 kronor kan sökas av framför allt yngre entomologer men även doktorander eller motsvarande. Stipendierna är avsedda för ett självständigt arbete rörande insekter. Noggrann plan fordras rörande entomologiska undersökningen vartill medel söks. Kostnadskalkyl skall bifogas, liksom också yttrande över eleven från handledare, lärare i naturkunskap eller motsvarande. Om medel söks från annat håll skall detta anges.

Eventuella frågor kan besvaras av Bert Gustafsson, tel. 08 5195 4089, e-mail bert.gustafsson@nrm.se.

Ansökan inlämnas till föreningen senast 1 maj 2014 under adress:

Entomologiska föreningen
Naturhistoriska riksmuseet
Box 50007
104 05 Stockholm



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Eventuella frågor besvaras av Stefan Eriksson tel. 018-501559, e-post: stefaneriksson@eurofins.se

Ansökan skall vara föreningen tillhanda senast den 30 april 2014. Adress: Entomologiska föreningen i Uppland, c/o Stefan Eriksson, Järsta Lugnet 141, 743 93 Vattholma.

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