

# The hoverfly (Diptera: Syrphidae) fauna of the nature reserve Hågadalen-Nåsten, Uppsala, Sweden

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The syrphid fauna of the nature reserve Hågadalen-Nåsten is described. The following red-listed species are recorded: *Ceriana conopsoides* (NT), *Doros profuges* (NT), *Pocota personata* (NT), *Temnostoma sericomylaeformis* (NT) and *Xylota abiens* (NT), together with other bioindicator or potential red-list species: *Brachyopa obscura*, *Brachypalpus laphriformis*, *Cheilosia angustigenis*, *C. luteicornis*, *C. morio*, *C. nebulosa*, *C. sootryeni*, *Cryptopipiza notabila*, *Dasysyrphus pauxillus*, *Epistrophe diaphana*, *Eristalis cryptarum*, *Melangyna barbifrons*, *Melanogaster aerea*, *M. parumplicata*, *Heringia (Neocnemodon) larusi*, *Orthonevra stackelbergi*, *Parasyrphus proximus*, *Platycheirus discimanus*, *P. jaerensis*, *P. perpallidus*, *Sphaerophoria chongjini*, *Spilomyia diophthalma*, *S. manicata*, *Syrphus admirandus* and *Temnostoma sericomylaeformis*. Special attention is paid to the role of the different habitats within the nature reserve. Based on the species collected, recommendations are made for management to maximise maintenance of biodiversity in various parts of the nature reserve, particularly “Hågadalen forest meadow”. This latter area is prone to regrowth of shrubs and trees and management is needed to preserve its open character and the fauna associated with it.

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Nature is influenced by humans in a rapidly expanding way, even in a less densely populated country like Sweden (Höjer 2009). Nature close to cities is most affected by humans due to pollution from cars and industries and also by the increased recreational pressure. (Borgström et al. 2010, Borgström 2011). Establishing nature reserves to preserve nature is a step in the right direction. Usually some kind of management is needed to maintain existing natural resources or restore them to previous levels (Speight 1989, Dieterich & van der Straaten 2004, Reemer 2005, Haslett 2007, Krauss & Krumm 2013). Establishment of the nature reserve Hågadalen-Nåsten on the SE border of the town Uppsala in 1998 (Kommunstyrelsen 1998a) was a big step towards the permanent conservation of some im-

portant forest and wetland habitats. The intensive use of some parts of this nature reserve diminished subsequently, letting nature take its course. Other parts are still as intensively used as before and without management, these valuable habitats will be lost, together with the rich fauna depending on them. However several open areas tend to regrow with trees and lose their natural value. The meadow in the Norby forest, from now on called “Hågadalen forest meadow” (Fig. 10 & 11), is such a place. This area has been used by the military and after that walking trails and a lighted skiing track were made in this meadow. A combination of nature, with sufficient protection management, and recreation, could be beneficial to its existence, as highlighted for other nature reserves by Stenseke (2012).



Figure 1. The east part of Hågadalen-Nåsten nature reserve is close to Uppsala and consists of a valley with the creek Hågaån. It is dominated by grazed meadows and arable fields (= "Hågaån meadows"). It was formerly a military training area.

De östra delarna Hågadalen-Nåstens naturreservat ligger precis i Uppsalas utkant och utgörs av Hågadalen, där Hågaån flyter fram genom naturbetesmarker och åkrar. Tidigare var området militärt övningsfält.

This paper details the syrphid fauna of the nature reserve Hågadalen, with special attention to the Hågadalen forest meadow. Syrphids are often used as indicators on nature conservation values as their larvae breed in a wide variety of habitats. The adults on the other hand depend on flowers, where they feed. Syrphids were collected by hand net during the course of several visits to this area over a period of 6 years, and scattered records are available from another 5 years. Hågadalen forest meadow, together with other hotspots within the nature reserve, are discussed from a nature conservation point of view, leading to recommendations for management, aimed at maximising maintenance of biodiversity, particularly in the Hågadalen forest meadow.

### Material and methods

The syrphid fauna was surveyed by hand netting during the years 1996-2001, 2008 and 2012. In addition to the hand netting yellow traps and a Malaise trap have been used from 21 until 31-May-1996 and from 29-June until 25-July-1997 respectively.

During the period 1996-2001 an investigation of the Syrphidae of Uppland was carried out by the author. In 2008 and 2012 the area was visited once. Additional data have been extracted from Artportalen (Artdatabanken 2014), the Zoological Museum in Uppsala and some pri-

vate collections. These additional data are from 1966-1985 (15 records, including 1 additional species) and 2004-2014 (13 records also including 1 additional species). Other nature reserves like Lunsen, Kungshamn-Morga, Fyrisån, Florarna etc. were visited by the author during these years too. These data together with additional data from literature and from Landskapskatalog Blomflugor (Artdatabanken 2014) are used in the discussion of each species. The plant names are from Mossberg et al. (1995).

### Area description

Hågadalen-Nåstens nature reserve covers more than seventeen square kilometres and stretches along Uppsala's western boundary, from Enköpingsvägen in the north to Stabby in the Uppsala-Näs valley in the south (Fig. 2), with the corners at approximately 59°50'N 17°35'E and 59°48' N 17°33'E. The reserve includes both agricultural landscape with fields, pastures and groves and a larger wooded area with coniferous forest, rocky areas, bogs, mires, fens and different types of forest meadows. The rivers "Hågaån" and "Stabbybäcken" run through the nature reserve. The river valleys consist of pastures, calcareous meadows and forest edges. Near the village of Håga the Hågaån flows through a grove ravine of about 10 metres depth (near Kvarnbo), with deciduous forest bordering

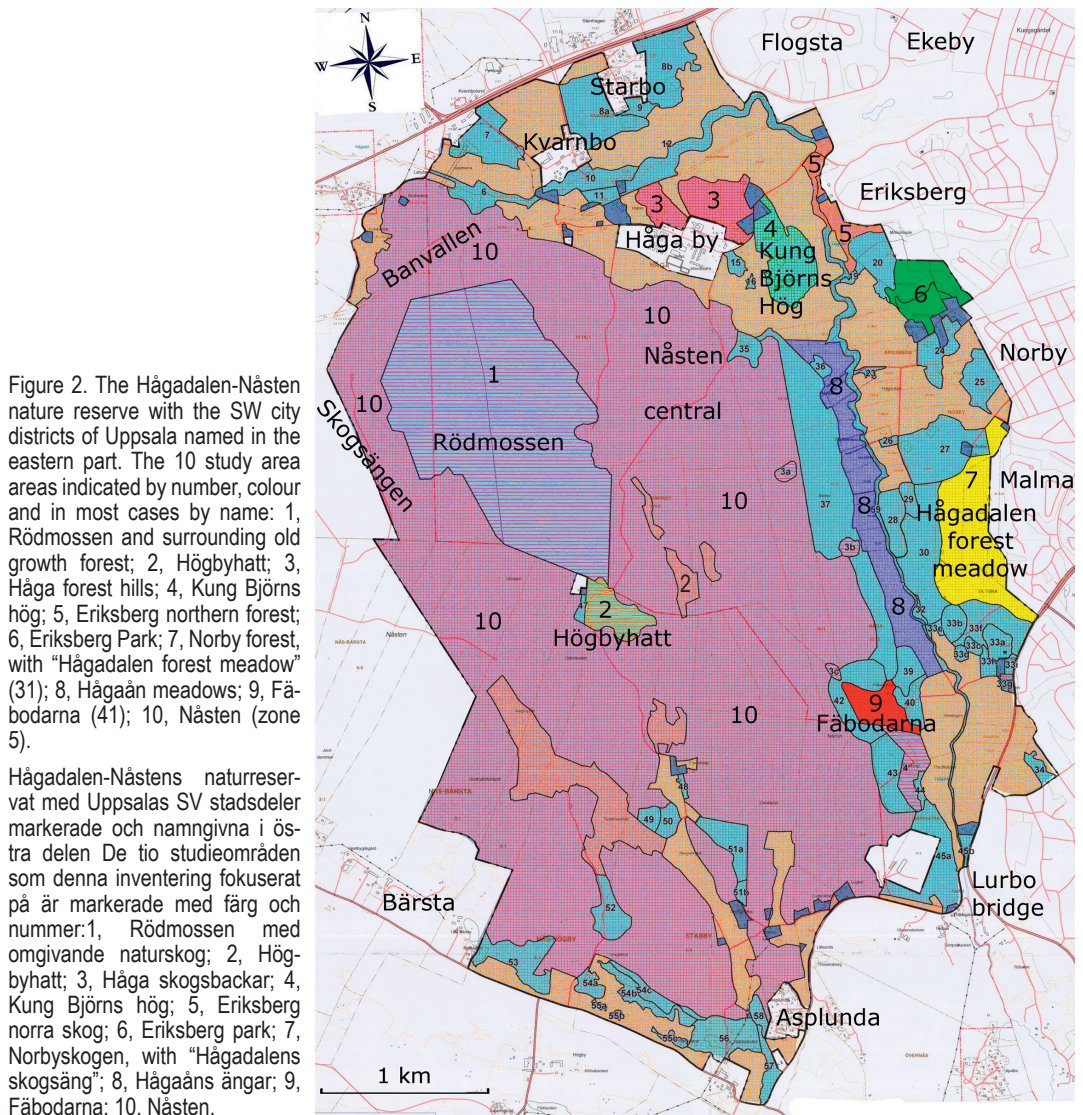


Figure 2. The Hågadalen-Nåsten nature reserve with the SW city districts of Uppsala named in the eastern part. The 10 study area areas indicated by number, colour and in most cases by name: 1, Rödmosse and surrounding old growth forest; 2, Högbyhatt; 3, Håga forest hills; 4, Kung Björns hög; 5, Eriksberg northern forest; 6, Eriksberg Park; 7, Norby forest, with "Hågadalen forest meadow" (31); 8, Hågaån meadows; 9, Fäbodarna (41); 10, Nåsten (zone 5).

Hågadalen-Nåstens naturreservat med Uppsalas SV stadsdeler markerade och namngivna i östra delen. De tio studieområden som denna inventering fokuserat på är markerade med färg och nummer: 1, Rödmosse med omgivande naturskog; 2, Högbyhatt; 3, Håga skogsbackar; 4, Kung Björns hög; 5, Eriksberg norra skog; 6, Eriksberg park; 7, Norbyskogen, with "Hågadalens skogsäng"; 8, Hågaåns ångar; 9, Fäbodarna; 10, Nåsten.

the river. The central and western part, consisting of coniferous forest, is called Nåsten, the part along the northern and eastern boundary where the Hågaån flows is called Hågadalen.

Calcareous dry slopes are found along Hågadalen at Stabby, Håga, Norbylund and western Eriksberg. Old pasture land is found along the southern parts of Hågaån and south-west of Kung Björns hög. Along the Hågaån on the higher ground deciduous forest is found, with herb-rich forest meadows at Norbylund, Fä-

bodarna, Predikstolen and "Hågadalens forest meadow".

The investigations were focused on ten areas in the Hågadalen-Nåsten reserve (Kommunstyrelsen 1998a, b) and they are marked in Fig. 2, with numbers given as for the maintenance areas (Skötselområde) defined by Kommunstyrelsen (1998c). They are described below using information from Kommunstyrelsen (1998a, b) and Salomonsson (2009), supplemented by observations made by the author.



Figure 3. *Hepatica nobilis* is one of the earliest flowers in the spring which attracts many hoverflies.

Blåsippan är en av de tidigaste blommorna som attraherar blomflugor.



Figure 4. *Rhododendron tomentosum* is an important nectar source for adult hoverflies in peat bogs.

Skvattram är en viktigt nektarresurs för blomflugor i mossarna i Nästen.

1: Nature forest area at Rödmosse (153.5 hectare Fig. 5). This is a coniferous forest on rocky moraine with undergrowth of lichens and low herbs like *Vaccinium* spp., *Pyrola* spp. and *Empetrum*. Dominating tree species are *Pinus* spp. and *Picea* spp.

Predominant nectar sources are *Anemone nemorosa*, *Hepatica nobilis* (Fig. 3) and in the wetter parts *Geum rivale*, *Potentilla* spp., *Caltha palustris*, *Rhododendron tomentosum* (Fig. 4), *Cicuta virosa* and *Salix* spp. In the central part lays "Rödmosse", a large peat bog with hummocks with ant nests (*Myrmica* spp.). The bog itself consists predominantly of Lycopodiaceae, *Carex* spp., *Vaccinium* spp., *Rubus chamaemorus* and scattered and low growing coniferous trees. In this area no management is permitted, except for the clearance of trees which have fallen on trails.

2: Högbyhatt (8.7 ha). The main area consists of a large eutrophic fen, bordered by mixed forest. Some 100 meters east of the area there are some moist unimproved meadows, which are included in the area in this study. The main nectar sources are *Salix* spp., *Taraxacum* spp., *Carex* spp., *Caltha palustris*, *Ranunculus* spp. and diverse Asteraceae. Trees found here are *Pinus* spp., *Picea* spp., *Betula* spp. and *Populus* spp.

Maintenance of undisturbed fens is a priority. The forest is unmanaged, which may develop to an old mixed forest.

3: Håga forest hills (4.7 + 11 ha). This is a pine-dominated forest with a lot of other tree species mixed in (*Picea* sp., *Quercus* spp., *Populus* spp.). The more open NE part is extensively grazed by horses. Predominant nectar sources are *Prunus spinosa*, *Salix* spp., *Crataegus* spp., *Sorbus aucuparia*, *Prunus padus* and diverse low growing herbs from the families of Asteraceae, Ranunculaceae and Apiaceae.

4: Kung Björns hög (14.4 ha). This area consists mainly of intensively grazed open pastures. On the south-facing chalky slopes an unusual range of dry slope flora, including *Artemisia campestris*, *Helianthemum nummularium* and *Phleum phleoides*, is found. In the dry pastures a diverse ant fauna is present. Preservation and improvement of species rich herb- and fungal flora and reduction of soil erosion on the top of Kung Björns hög is pursued. In order to achieve this the sheep that graze the area are fenced out from the ancient monument Kung Björns hög. It is stated that mowing in late summer will be



Figure 5. Rödmosse in August 2016. The formerly open mire is more and more overgrown with pine and birch saplings. Management by clearing the saplings and increasing the water level could probably stop the development towards forest.

Rödmosse i augusti 2016. Den förut helt öppna myren blir mer och mer igenväxt av unga träd. Det vore önskvärt att den fortsatt får vara öppen, men det kräver skötselåtgärder där man röjer de uppväxande träden och/eller höjer vattennivån.

initiated if needed as a supplement to the grazing (but it has probably never been done). Scattered shrubs of *Prunus spinosa* and *Rosa rugosa* are spared outside the ancient monuments. The old pine stands in the eastern section should be allowed to continue to develop. The path down towards Hågaån (towards the hanging bridge) is maintained with gravel.

The main nectar sources are *Salix* spp., *Prunus spinosa*, *Crataegus* spp. and diverse Rosaceae and Asteraceae.

5: *Eriksberg northern forest* (0.4 and 4.4 ha). This is the forest strip and field south-west of western Eriksberg. In essence forest meadows of varying character, in the richer parts enclosed groves with a well-developed shrub layer, formerly used for cattle grazing and wood production. The northern part consists of meadows and moderate fields on the banks of the Hågaån. The

area should serve as leisure parkland with good but unpaved paths and park benches.

Nectar sources are *Carex* spp., *Pastinaca sativa*, *Ranunculus* spp., *Filipendula ulmaria*, *Salix* spp., *Prunus* spp., *Sorbus aucuparia* and *Taraxacum* spp.

6: *Eriksberg Park* (8.3 ha). The area provides an attractive woodland walk with the character of coniferous forest with some admixture of deciduous trees and good accessibility. It has the same history as the previous area. *Filipendula ulmaria* and *Daucus carota* are the main nectar sources in this area.

7: *Hågadalen forest* (31.7 ha) with *Hågadalen forest meadow* (ca 0.9 ha). The area between South Norby Farm and Djurgården, its eastern part with open and varied coniferous-deciduous mixed forest, and until the 1980's strongly affected by military use. Part of a young stand in



Figure 6. Spring in Hågdalen, with ongoing collection of hover flies on *Salix* spp. In the background the farm N. Norby.

Vår i Hågdalen, där blomflugor kan hittas på sälg och vide. I bakgrunden ligger N. Norby gård.

the north was thinned some years ago and has since then been grazed mainly by sheep and has become an open tree-rich meadow. The older forest parts are protected and broadleaved trees are favoured. Many of the high stumps, wind fallen trees and tree trunks are left.

Nectar sources are *Anemone nemorosa*, *Ranunculus ficaria*, *Salix* spp. and *Pastinaca sativa*.

8: *Hågaån meadows* (15.3 and 16 ha, Figs. 1 & 6). The fields between Nåstens forest edge and Hågaån, from the former Northern shooting range to Fäbodarna, comprises unfertilized permanent pasture and hay meadow. It is grazed by cattle and mowed for hay to ensure its open character. Invasion by shrubs and trees is avoided by the grazing and mowing.

Main nectar sources are *Salix* spp., *Prunus* spp., *Daucus carota*, *Filipendula ulmaria*, *Anthriscus sylvestris*, *Taraxacum* spp., *Sorbus aucuparia* and *Ranunculus* spp.

9: *Fäbodarna* (7.5 ha). In the southern part of the Håga valley, remain the foundations of “the crofts” (Fäbodarna). The different natural habitats around the remnants of the cottages mirror the past cultivation and grazing. In the marshy meadows you will find the official flower of the province of Uppland, *Fritillaria meleagris*. A number of rare fungi have been found in the surrounding groves. The open parts consist of open “friskäng av tuvtätelyp”. The other parts in-

clude wooded pastures, forest edges and mixed coniferous and broadleaved forest. Management consists of continued grazing by cattle or sheep throughout the area; cleaning and thinning of shrubs and thickets when necessary. If the opportunity exists, mowing in some parts of the open pastures around the old house-remnants needs to be done.

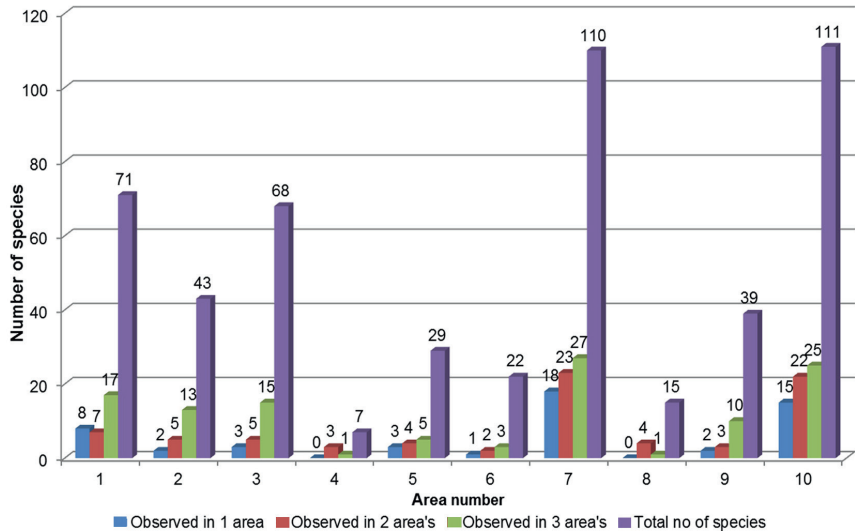
Main nectar source are *Prunus padus*, *Crataegus* spp., *Salix* spp., *Ranunculus* spp. and *Taraxacum* spp.

10: *Nåsten* (ca 750 ha). This is the largest area of the reserve. The area consists mainly of coniferous and mixed forests which can be maintained by normal management practices, with the exception of the regulations stated below. During harvest of suitable trees attention should be paid to increasing the amount of dead wood, old trees, snags etc. so that conditions improve for the long term preservation of the endangered species of plants, lichens, fungi and animals that occur within the reserve. Old ditches that have long stopped working, so that a new state of nature has developed, should not be cleaned. New logging roads should not be constructed within the area.

Collecting mainly took place in the meadow (“Skogsängen”) in the north-west, along a cycle path on an old railway track (“banvallen”), along the northern border and in the central part of the coniferous forest. The meadow Skogsän-

Figure 7. The number of species observed in the ten study areas (cf. Fig. 2). Short bars indicate uniqueness, as number of species observed in one, two or three of the study areas. Tall bar is the total number of species.

Antalet arter som observerades i de tio delområdena (jfr Fig. 2). Korta staplar visar antalet arter som bara hittades i en, två eller tre delområden; den långa stapeln anger totalt artantal.



gen consists of open, dry to wet, species-rich, grasslands with several ditches running through them and bordering the forest at the eastern side of the meadow. Along the “banvallen” there are small openings in the forest, fens and peat bogs bordered by broadleaved trees like *Populus tremula* and *Betula* spp. surrounded by coniferous forest.

Main nectar sources are *Anemone nemorosa*, *Anthriscus sylvestris*, *Salix* spp., *Taraxacum* spp., *Ranunculus* spp., *Caltha palustris* and *Cirsium* spp.

## Results

In total 188 species have been recorded in Hågadalen-Nåsten, of which 5 species are redlisted (Westling 2015): *Ceriana conopsoides* (found in area 7), *Doros profuges* (area 10), *Pocota personata* (7 and 10), *Temnostoma sericomylaeformis* (area 1) and *Xylota abiens* (area 7).

The highest species numbers were found in area 7 and 10 with 110 and 111 species collected on 22 and 28 field days respectively (Table 1). The highest number of species per field day have been found in areas 1, 3, 6 and 9 (Table 1). However, the areas 6 and 9 have only been visited 1 and 4 times respectively, rendering a higher number per field day. On the basis of these results the areas 1, 3, 7 and 10 were the most species rich.

Another way of expressing the value of a site is the uniqueness, i.e. how many species per site that were observed in only one, two or three of the areas. The number of species unique to each area varied between 0 to 15 (Fig. 7). The areas with less than 6 field days (area 4, 6 and 9) are, however, not that relevant to included in comparisons of uniqueness. The highest proportion of unique species is found in Hågadalen forest meadow (area 7) with 16.4% of the species only observed in this area, 20.1 % of the species observed in one other area and 24.5 % of species observed in two other areas. Nåsten forest (area 10) is the second area in uniqueness with respective percentages as 13.5%, 19.8% and 22.5%. The least unique area is Hågåån meadows (area 8) with a low total number of species and no unique species. The two most unique areas after areas 7 and 10 are Röd mossen (area 1) and Eriksberg ”Norra” forest (area 5) with respective percentages of unique species of 11.3% and 10.3%.

## Interesting records

In this section I comment on records of redlisted and rare species for either the Hågadalen-Nåsten nature reserve or the whole province of Uppland. For each species the area where it is collected and dates of collection are given. Each time a species has been observed in an area on 1 day

Table 1. Number of species and field days for each area (Fig. 2).

Antal arter och antal fältdagar för de tio delområdena (se Fig. 2).

Area Delområde	No of species Antal arter	No of field days Antal fältdgr.	Species/ field day Arter/fältdag
1 Rödmosse	71	7	10.1
2 Högbyhatt	43	9	4.8
3 Hågaby	68	7	9.7
4 Kung Björns hög	7	2	3.5
5 Eriksberg "N." forest	29	6	4.8
6 Eriksbergs park	22	1	22
7 Hågad. forest mead.	110	22	5.0
8 Hågadalen	15	6	2.5
9 Fäbodarna	39	4	9.8
10 Nästen forest	111	28	4.0
Total amount	188	71	2.6

is 1 record, the number of specimens seen is not taken into account. The total number of records is 880. Frequency of occurrence in the nature reserve is given and expressed in 6 grades: very rare, rare, not so rare, uncommon, common, very common. Frequency of occurrence in the area is followed by an overview of records elsewhere in the vicinity, in which the rarity classification is based on the number of records from Artdatabanken (2014). A short discussion is given concerning the rarity and habitat preferences of the species based on the literature and the author's observations. The main literature used is Haarto & Kerppola (2007), Bartsch et al. (2009a and b) and Karlsson & Johansson (2010). Additional literature is mentioned for particular species, as necessary. Species that indicate a high conservation value of the Hågadalen meadow and its surrounding forest are called "indicator species for the Hågadalen-forest meadow" and they are highlighted.

*Anasimyia interpuncta* (Harris, 1776)

Area 1; date 20-May-1997, 1 ♀ on *Carex* spp.

Very rare within the area, in the vicinity collected along the Fyrisån (Nedre Föret) and Mälaren (Sunnersta viken). In Uppland uncommon. This species is dependent on fens, lakes and slow flowing rivers with abundant, living and decaying vegetation, like *Typha latifolia* and *Phragmites australis*, as larval habitat.

*Baccha* sp.

Area 6; date 8-August-1996, 1 ♂ on *Filipendula ulmaria*.

No other records are available as Bartsch et al. (2009a) consider this species to be a synonym of *B. elongata*. This specimen is clearly different from the specimens here named *B. elongata* and therefore it is mentioned here. It could be that the type of *B. obscuripennis* is conspecific.

*Blera fallax* (Linnaeus, 1758) (Fig. 8)

Area 7; date 19-June-2002, 1 ♂ and area 10; date 10-June-1997, 1 ♂.

Rare in the area, with nearby records from Lunsen, Flottsund and Gottsunda. In Uppland rare as well. The larvae live in rotten tree stumps of Pine trees, but possibly more tree species are used (Nilsson et al. 2012) Controlled felling of mature Pine trees will favour the occurrence of this species (Rotheray & Rotheray 2012). Adults are found flying through dense thickets of low growing shrubs with *Rosa* spp. A widespread species and depending on large and old growth coniferous forests. Its' presence indicate high conservational values in and around Hågadalen meadow.

*Brachyopa obscura* Thompson & Torp, 1982

Area 9; date 10-May-2002, 12 ♂, 1 ♀ on *Prunus padus*.

Very rare, but collected in good number at this collecting site, so probably there is a large population here. Most nearby records are from Kungshamn-Morga and Fiby urskog (van Steenis 1998). In Uppland rare. In Sweden widespread but rare. It can be collected in great numbers and the larval habitat could be damaged or died standing Aspen trees (Nilsson et al 2012).

*Brachyopa pilosa* Collin, 1939

Area 9; date 10-May-2002, 9 ♂, 1 ♀ and area 10; dates 4-May-1999, 1 ♂ and 22-May-2001, 1 ♀ on *Prunus padus* and *Anemone nemorosa*.

Not so rare in the area, but without records in the vicinity. In Uppland it is a rare species. It is here recorded about one month earlier than the earliest known date in Sweden (Bartsch et al. 2009b). The larvae live in decaying sap in recently fallen tree trunks, especially Aspen. The adults are found visiting flowers or hovering around trees.

*Brachyopa testacea* (Fallén, 1817)

Area 5; date 22-May-2001, 1 ♂ and area 8; date, 2-June-1999, 1 ♀.

Rare in the area and no records in the vicinity. In



Figure 8. *Blera fallax* male. A rare species, depending on dead wood in old growth forests, and by that an indicator for high conservation values in and around the Hågadalen forest meadow.

Röd stubblomfluga, hane. En ovanlig art vars larver utvecklas i död ved. I och med det är den en indikator på höga naturvärden i och omkring Hågadalens skogsäng i Norbyskogen.



Uppland a rare species too, depending on coniferous forests as the larvae live in accumulations of sap under the bark of recently fallen trunks or stumps.

*Brachypalpus lentus* (Meigen, 1822)

Area 1; date 24-June-1997, 1 ♂, area 7; dates 19-June-1997, 1 ♀ and 23-June-1998, 1 ♀ and area 10; dates, 25-June-1998, 1 ♂ and 19-June-2002, 2 ♂

A common species in the area and also collected nearby at Uppsala-Näs and Fiby urskog. In Uppland a rare species. A species of old growth deciduous forests with the northern most localities in Gästrikland. Larvae have been found in rot-pockets close to the ground on deciduous trees. Probably the quantity of old deciduous trees in Hågadalen-Nåsten is, compared to the other forests in Uppland, rather high, which explains the difference in rarity.

*Brachypalpus laphriformis* (Fallén, 1817)

Area 7; date 8-June-2011, 1 ♂.

Very rare in the area, with nearby records from Ultuna, Krusenbergs and Morga hage. In Uppland it is a rare species. The larvae live in rot-holes, preferably in old deciduous trees like *Quercus*, but it is also collected in rot-holes in Pine trees (Reemer et al 2009). Indicator species for Hågadalen meadow.

*Ceriana conopsoides* (Linnaeus, 1758)

Area 7; date 20-July-1998, 1 ♀ on *Pastinaca sativa*. Very rare in the area, in the vicinity known from Ultuna and Uppsala-Näs. In Uppland rare. A species of old growth deciduous forests and found throughout Sweden. In several provinces not re-

cently recorded and listed as near threatened in Westling (2015). The larvae live in sap-runs of preferably deciduous trees like Oak and Aspen. Indicator species for Hågadalen meadow.

*Cheilosia angustigenis* Becker, 1894

Area 7; date 9-May-1998, 1 ♀ and area 10; dates 4-May-1999, 3 ♂ and 15-May-1998, 2 ♀ on *Anemone nemorosa*, *Salix* spp.

Not so rare in the area, without nearby records available. In Uppland rare and known from Fiby urskog (van Steenis 1998). Probably a local species of wet meadows in old coniferous forests. Relatively rare and local in the central part of Sweden. Indicator species for Hågadalen meadow.

*Cheilosia cynocephala* Loew 1840

Area 5; date 5-June-2001, 1 ♀.

Very rare in the area and the only record in Uppland (van Steenis 2011). Found at the outermost boundary of the nature reserve in the meadows along the eastern shore of the Hågaån. Prefers open calcareous wet meadows. Larvae are found in *Carduus* spp., and *Cirsium* spp. A very rare species in Sweden with few and scattered records in the southern part. A possible candidate for the Swedish redlist.

*Cheilosia gigantea* (Zetterstedt, 1838)

Area 10; date 12-June-2001, 1 ♂ 2 ♀.

A very rare species in the area, with nearby records from Ultuna and Kungshamn-Morga. In Uppland not so rare. A very widespread species in Sweden and sometimes common too. Unclear why it is so rare in Hågadalen-Nåsten.

*Cheilosia illustrata* (Harris, 1780)

Area 7; dates 9-July-1999, 1 ♂, 26-July-1998, 8 ♂, 2 ♀, 27-July-2001, 5 ♂, 3 ♀ and 8-August-1996, 3 ♀ on *Pastinaca sativa*.

Uncommon in the area, very restricted, only known from Hågadalen forest meadow. No nearby record. In Uppland not so rare. This species prefers ruderal meadows with abundant *Pastinaca sativa* or *Heracleum sphondylium* as adult and larval food source. In Sweden it is confined to the southern part and relatively rare throughout. Indicator species for Hågadalen meadow.

*Cheilosia impressa* Loew, 1857

Area 7; dates 20-July-1998, 1 ♂, 28-July-2002, 1 ♂, 31-July-2002, 1 ♂, 2 ♀ and 8-august-1996, 1 ♀ and area 8; date 8-August-1996, 1 ♂ on *Pasinaca sativa* and *Daucus carota*.

A common species with restricted occurrence in the area. No nearby records and in Uppland very rare. Habitat warm and dry open meadows with Apiaceae as adult food source and *Arctium lappa* as larval habitat. In Sweden relatively rare and confined to the southern part. Hågadalen is probably a key biotope for this species in Uppland and the open character of the meadows along the Hågaån account for the occurrence in Hågadalen-Nåsten. Indicator species for Hågadalen meadow.

*Cheilosia latifrons* (Zetterstedt, 1843)

Area 10; date 22-May-2001, 1 ♀.

Very rare in the area, without nearby records. In Uppland rare. This is a species from open calcareous meadows, in which the larvae could live in *Leontodon autumnalis*. In Sweden widespread but relatively rare.

*Cheilosia luteicornis* Zetterstedt, 1838

Area 7; date 9-May-1998, 1 ♂ and area 10; date 9-May-2002, 1 ♂, 1 ♀ on *Salix* spp.

Rare in the area, recorded from the following nearby localities (as *C. morio* B) Dalkarlskärret, Kodöden and Sävja-Vreten (van Steenis 2011). The status of this species in Sweden needs to be clarified as well as the status of *C. morio* (Nilsson et al 2015). Known from 2 other localities in Uppland (van Steenis 2011). Found in sheltered places with forests nearby, more widespread than *C. morio*. Indicator species for Hågadalen meadow.

*Cheilosia morio* (Zetterstedt, 1838)

Area 2; date 31-May-1996, 1 ♂ and area 10; dates

4-May-1999, 1 ♂, 9-May-2002, 1 ♂, 12-May-2002, 1 ♀ and 15-May-1998, 1 ♀ on *Salix* spp. and *Taraxacum* spp. Common species in the area, with a nearby record from Kungshamn-Morga. In Uppland rare. A species from coniferous forests, in which the larvae live in tunnels in Pine trees, caused by tunnelling beetle larvae. This species is *Cheilosia morio* A sensu Bartsch et al. (2009b) Karlsson & Johansson (2010), and van Steenis (2011). Prefers more open habitats than *C. luteicornis* and seems more restricted.

*Cheilosia mutabilis* (Fallén, 1817)

Area 3; date 24-June-1997, 1 ♂.

Very rare in the area and no nearby records. In Uppland rare. Prefers open sun-exposed meadows within different types of forests. In southern parts much more common.

*Cheilosia nebulosa* Verrall, 1871

Area 10; date 26-April-1999, 1 ♀ on *Salix* spp.

Very rare in the area without nearby records and also very rare in Uppland. Habitat open wet meadows with abundant *Salix* spp as adult food source. Larvae probably in *Centaurea* spp. (Doczkal 1996).

*Cheilosia proxima* (Zetterstedt, 1843)

Area 1; date 28-July-2001, 1 ♀.

Very rare in the area without nearby records and also very rare in Uppland. Occurs in open wet meadows close to forests, often along the coast. The larvae live in roots of *Cirsium palustre*.

*Cheilosia velutina* Loew, 1840

Area 3; date 26-July-1997, 1 ♂ and area 7; dates 9-July-1999, 1 ♀, 26-July-1998, 1 ♂, 1 ♀ and 8-august-1996, 1 ♀ on *Daucus carota*, *Pastinaca sativa*.

Uncommon in the area without nearby records. Rare in Uppland. Habitat dry thermophilous meadows with Apiaceae as adult food source and *Cirsium palustre* as larval food source.

*Cheilosia vicina* (Zetterstedt, 1894)

Area 4; date 10-June-1999, 1 ♂ and area 10; date 12-June-2001, 1 ♂.

Rare in the area and only known from Kungshamn-Morga. Rare in Uppland too. Habitat small thermophilous meadows within forests.

*Chrysogaster coemiteriorum* (Linnaeus, 1758)

Area 7; dates 9-July-1999, 2 ♂, 26-July-2012, 1 ♀, 31-July-2002, 1 ♀ and 8-August-1996, 1 ♂ on *Pastinaca sativa*.

An uncommon, very restricted species in the area with the only nearby record from the

Fyrisån (Ulleråker). In Uppland not so rare. Adults preferring flower-rich, dry thermophilous meadows. Indicator species for Hågadalen meadow.

*Criorhina ranunculi* (Panzer, 1805)

Area 7; date 8-June-2011, 2 ♂ and area 10; date 9-May-2002, 5 ♂ on *Salix* spp.

Rare in the area with records from nearby localities Kungshamn-Morga (van Steenis 1998), Berthåga, and Dalby Hammarskog. In Uppland rare. Found in open flower rich meadows within old growth deciduous forest, visiting *Prunus* spp. and *Crataegus* spp. Larvae in decaying wood of living deciduous trees. Indicator species for Hågadalen meadow.

*Cryptopipiza notabila* (Violovitsh, 1985)

Area 10; date 8-June-1999, 1 ♀.

Very rare in the area with the only other record in Uppland from Fiby urskog (van Steenis 2011). Very rare in Sweden, but maybe misidentified as *Pipiza* species like *P. lugubris* or *P. bimaculata* (Bartsch 2009, Karlsson & Johansson 2010) and more common than currently thought.

*Dasysyrphus pauxillus* (Williston, 1887)

Area 2; date 16-May-1999, 2 ♂ and area 10; date 4-May-1999, 1 ♂ on *Anemone nemorosa*, *Salix* spp.

Rare in the area with nearby records from Fyrisån and Uppsala-Näs. In Uppland rare too. An early flying *Dasysyrphus*.

*Doros profuges* (Harris, 1780)

Area 10; dates 29-June/25-July-1997, 1 ♀.

Very rare in the area and no nearby records known. In Uppland also very rare. Calcareous pastures and forest edges. A very rare species throughout Sweden which has seemingly disappeared from many former localities and now included in the Swedish red list (Westling 2015) as near threatened.

*Epistrophe diaphana* (Zetterstedt, 1843)

Area 7; date 9-July, 2 ♂ on *Pastinaca sativa*.

Very rare in the area, without nearby records. Rare in Uppland. Thermophilous species found in open and dry meadows. Very rare and restricted in Sweden with many old records. Indicator species for Hågadalen meadow.

*Epistrophe flava* Doczkal & Schmid, 1994

Area 3; date 15-June-1997, 1 ♀ and 24-6-2001, 1 ♀, area 7; date 19-June-1997, 1 ♀ and area 10; date 12-June-2001, 2 ♀.

Uncommon in the area, with nearby records from Vipången and Bäcklösa. In Uppland rare.

*Eristalis anthophorina* (Fallén, 1817)

Area 9; date 20-July-1998, 2 ♂.

Very rare in the area and without nearby records. In Uppland not so rare. Adults prefer open, wet meadows or floating vegetation in rivers and lakes. In Sweden rather uncommon.

*Eristalis cryptarum* (Fabricius, 1794)

Area 1; dates 15-May-1998, 1 ♂, 15-June-1997, 3 ♂ and 25-June-1997, 1 ♂, 2 ♀, area 9; date 20-July-1998, 1 ♀ and area 10; date 29-June / 25-july-1997, 1 ♂, 3 ♀.

A common species in the area, confined to fens and peatbogs in the coniferous forests, without any nearby record. In Uppland very rare. Habitat oligotrophic bogs and fens, with widespread records and more common in central and northern Sweden.

*Eristalis rupium* Fabricius, 1805

Area 7; dates 27-July-1997, 1 ♀ and 28-July-2008, 1 ♀ on *Pastinaca sativa*.

Rare in the area and only recorded on the Hågadal forest meadow, without any nearby records. In Uppland very rare. Found mainly in marshland habitats.

*Eumerus funeralis* Meigen, 1822

Area 8; dates 4-June-2002, 7 ♂, 2 ♀ and 5-June-2001, 1 ♂.

Rare in the area, only found on the ruderal meadows along the Hågaån in Ekebydalen. No nearby records, but not so rare in Uppland. Found in or near gardens and parks.

*Eupeodes lapponicus* (Zetterstedt, 1838)

Area 10; dates 26-April-1999, 1 ♀, 1-May-1996, 1 ♂, 1 ♀ and 15-May-1998, 1 ♀ on *Salix* spp.

Not so rare in the area without nearby records. In Uppland very rare. Prefers open meadows within pine dominated forests. More common in the northern half of Sweden.

*Eupeodes luniger* (Meigen, 1822)

Area 1; date 20-May-1997, 1 ♀.

A very rare species in the area, with the only nearby record from Flottsund. In Uppland rare.

*Leucozona (Ischyrosyrphus) laternarius* (Müller, 1776)

Area 7; date 28-July-2002, 2 ♀ and area 10; date 30-June-2002, 1 ♀ on *Anthriscus sylvestris*.

A rare species both in the area and in Uppland. No records nearby. Found on open meadows often close to lakes and rivers within different types of forests. Widespread but uncommon in Sweden. Indicator species for Hågadalen meadow.

*Leucozona (Leucozona) lucorum* (Linnaeus, 1758)

Area 3; date 15-June-1997, 1 ♀.

Very rare in the area without nearby records. In Uppland rare. A forest species found along forest edges and in small meadows in deciduous forests. Relatively common in Sweden.

*Melangyna barbifrons* (Fallén, 1817)

Area 2; date 31-May-1996, 1 ♀ on *Salix* spp.

Very rare both in the area and in Uppland and with one nearby record from Kungshamn-Morga (RN 6629-1603, 17-5-1998, 1 ♀, leg & coll JvS). This is a very early flying species.

*Melangyna compositarum* (Verrall, 1873)

Area 6; date 8-August-1996, 1 ♀ and area 7; dates 9-July-1999, 1 ♂, 27-July-1997, 1 ♂, 28-July-2002, 1 ♀, 31-July-2002, 1 ♂ and 8-August-1996, 1 ♂ on *Pastinaca sativa*.

Common in the area, with nearby record from Kungshamn-Morga (RN 6627-1603, 24-8-1996, 1 ♀, on *Hieracium* spp., leg & coll JvS) and Flottsund. In Uppland very rare. Occurs on meadows and glades in mixed forest. Rather common in Sweden.

*Melangyna lucifera* Nielsen, 1980

Area 5; date 22-May-2001, 1 ♀ and area 7; date 14-May-1997, 1 ♂ on *Salix* spp.

A rare species in the area with nearby records from, Botaniska trädgården (van Steenis 1998), Stadsskogen (Hedström 1990), Ultuna, Flottsund, Bäcklösa and Kungshamn-Morga. In Uppland not so rare.

*Meligramma guttata* (Fallén, 1817)

Area 7; dates 9-July-1999, 1 ♀, 27-July-1997, 1 ♀, 28-July-2002, 1 ♀ and 31-July-2002, 1 ♀ on *Pastinaca sativa*.

Uncommon in the area and very restricted, without any nearby record. In Uppland very rare. Thermophilous species with preference for large Apiaceae like *Pastinaca sativa* and *Heraclium sphondylium*. Widespread but uncommon in Sweden. Indicator species for Hågadalen meadow.

*Melanogaster aerea* (Loew, 1843)

Area 10; dates 8-June-1999, 1 ♂, 12-June-2001, 1 ♂ and 25-June-1998, 2 ♂.

Not so rare in the area, but very restricted and only found on the "skogsängen". Nearby records from Ulleråker and Fyrisån. In Uppland very rare.

*Melanogaster parumplicata* (Loew, 1840)

Area 10; dates 12-June-2001, 1 ♂, 1 ♀ and 25-June-1998, 1 ♂, 5 ♀.

Rare in the area with nearby records from Ultuna, Sunnersta, Bäcklösa and Dalkarlskärret. In Uppland uncommon.

*Microdon analis* (Macquart, 1842)

Area 4; date 10-June-1999, 1 ♂ and area 7; date 23-June-1998, 1 ♀.

Rare in the area without nearby records. In Uppland rare too. Found on dry meadows with *Lasius* ants.

*Microdon spec aff lateus* Violovitsh, 1976

Area 1; date 24-June-1997, 1 ♂.

Very rare in the area. The only record from Uppland is from Järlåsa (Hedström 1990, as *M. species A*). Based on area and ant (*Myrmica*) hummocks in peat bog this seems to differ from *M. analis* and *M. major* as indicated in Hedström (1990). This would be a species to be included in the Swedish red-list.

*Microdon miki* Doczkal & Schmidt, 1999

Area 4; date 10-June-1999, 1 ♂ and area 10; dates 12-June-1969, 1 ♂ and 12-June-2001, 2 ♂.

Rather rare in the area, without nearby records. In Uppland very rare. A species of open meadows within coniferous forests, larvae found in mount building ants (*Formica* sp.). This is a candidate for the Swedish red-list.

*Microdon myrmicae* Schönrogge, Barr, Wardlaw, Napper, Gardner, Breen, Elmes & Thomas, 2002

Area 1; date 24-June-1997, 3 ♂, 5 ♀ and area 10; date 25-June-1998, 1 ♂, 1 ♀.

Rare in the area. Due to confusion with *M. mutabilis* nothing can be said about the presence of this species in Uppland. The smaller size, greyish pile (not brown) and collecting site (peat mire and wet forest with *Myrmica* nests) indicates these specimens are *M. myrmicae* and not *M. mutabilis*.

*Neoscia podagrica* (Fabricius, 1775)

Area 5; date 27-July-2001.

Very rare in the area, with one nearby record from Kungshamn-Morga (Lövängen, RN 6627.9-1604.0, larva in artificial breeding box, 1-4/1-9-1997 2 ♂, 2 ♀, leg & coll JvS). In Uppland very rare too.

*Heringia (Neocnemon) larusi* (Vujić, 1999)

Area 1; date 21 / 31-May-1996, 1 ♀ and area 7; date

23-June-1998, 1 ♂.

Rare in the area without nearby records or records from Uppland. In Sweden only scattered records throughout the country, only recently described and probably more common.

*Orthonevra nobilis* (Fallén, 1817)

Area 7; date 9-July-1999, 1 ♀ and area 10; date 8-June-1999, 2 ♂ on *Pastinaca sativa*.

Rare species in the area without nearby records and very rare in Uppland. Habitat damp forest edges, meadows and other wet habitats within different types of forests. In Sweden widespread but local. Indicator species for Hågadalen meadow.

*Orthonevra stackelbergi* Thompson & Torp, 1982

Area 7; dates 28-July-2008, 1 ♀ and 31-July-2002, 1 ♀.

Rare in the area with records from Bäcklösa, Kungshamn-Morga and Nedre föret. In Uppland also rare, but widespread (Hedström, 1991, van Steenis 2011). Habitat thermophilous meadows and edges of humid forests. In Sweden rare and local. Indicator species for Hågadalen meadow.

*Parasyrphus macularis* (Zetterstedt, 1843)

Area 10; date 8-June-1999, 1 ♂.

Very rare in the area without nearby records. In Uppland rare, probably under-recorded on Artportalen, from where there are several records in the author's collection.

*Parasyrphus nigritarsis* (Zetterstedt, 1843)

Area 10; date 9-May-2002, 1 ♀.

Very rare both in the area as in Uppland, with nearby record from Kungshamn-Morga (Morga hage RN 6627-1602, 23-June-2001, 2 ♀, leg & coll JvS). Larvae prey on Chrysomelidae larvae on *Alnus* spp. Adult habitat damp meadows and forest edges. In Sweden local and rare.

*Parasyrphus proximus* Mutin, 1990

Area 10; date 15-May-1998, 1 ♂ on *Salix* spp.

Very rare in the area and only known from one nearby record Lunsen (van Steenis, 2011). In Uppland very rare. This is a possible candidate for the Swedish redlist.

*Parhelophilus consimilis* (Malm, 1863)

Area 8; date 2-June-1999, 1 ♂ and area 10; date 25-June-1998, 1 ♀.

A rare species in the area, with one record in the vicinity from Dalkarlskärret. Very rare in Uppland. Found in fens with *Typha latifolia* as larval food source.

*Parhelophilus frutetorum* (Fabricius, 1775)

Area 7; date 27-July-1997, 1 ♂.

Very rare in the area, with nearby records from Flottsund, Nedre Föret and Ultuna. In Uppland not so rare. Wet habitats with decaying vegetation and open meadows. Larvae are found in *Typha latifolia*.

*Parhelophilus versicolor* (Fabricius, 1794)

Area 7; date 19-June-2002, 1 ♀.

Very rare in the area with nearby records from Dalkarlskärret, Övre Föret and Ultuna. In Uppland not so rare. Larvae are found in *Typha latifolia*.

*Pelecocera (Chamaesyphus) scaevoides* (Fallén, 1817)

Area 10; dates 8-August-1978, 1 ♀ and 9-September-1976, 2 ♀.

Rare in the area with nearby records from Sävsjå-Vreten (van Steenis, 1998), Stadsskogen and Botaniska trädgården. In Uppland very rare, but probably overlooked, since there are several Uppland records in the authors' collection.

*Pipiza austriaca* Meigen, 1822

Area 3; date 15-June-1997, 1 ♀ and 24-June-1997, 1 ♀ and area 10; date 10-June-1996, 1 ♂.

Not so rare in the area, without any nearby record. In Uppland rare, several records in the author's collection (Up, Uppsala, Kungshamn-Morga, Morga hage, RN 6627-1602, 23-June-2001 1 ♂; Up, Uppsala, Stadsskogen, RN 6636-1602, 4-June-1996 1 ♀; Up, Uppsala, Fiby urskog, RN 6641-1586, 23-June-1997 1 ♂, 1 ♀; Up, Österbybruk, Florarna, RN 6688-1612, 15-June-1996). It is a rare but widespread species in Sweden and only found in low numbers.

*Platycheirus angustatus* (Zetterstedt, 1843)

Area 1; dates 20-May-1997, 1 ♂ and 24-June-1997, 1 ♀ and area 10; dates 20-5, 12-June-2001, 1 ♀.

Not so rare in the area, with nearby records from Krusenberget and Övre föret. In Uppland rare.

*Platycheirus discimanus* Loew, 1871 (Fig. 9)

Area 2; date 16-May-1999, 1 ♀ on *Salix* spp.

Very rare in the area and Uppland, without nearby records. Early flying species mostly collected on early flowering *Salix* spp.

*Platycheirus europeus* Goeldlin de Tiefenau, Maibach & Speight, 1990

Area 10; dates 8-June-1999, 1 ♂ and 10-June-1996, 1 ♂.

Rare in the area, with nearby record from Dalkarlskärret. Very rare in Uppland. A wetland



Figure 9. *Platycheirus discimanus* female feeding on *Salix* spp. A very rare spring species with one record from Högby hatt.

Tidig fotblomfluga, hona, som äter på blommor av viden. En mycket ovanlig art som hittades i en individ vid Högby hatt.

species often found together with *P. clypeatus* and *P. occultus*.

*Platycheirus fulviventris* (Macquart, 1829)

Area 3; date 7-August-1996, 1 ♀.

Very rare in the area, with nearby records from Krusenberget and Nedre Föret. In Uppland uncommon. Larvae feed on Aphidae on *Phragmites australis*.

*Platycheirus jaerensis* Nielsen, 1971

Area 1; date 24-June-1997, 2 ♀.

A very rare species both in the area as in Uppland, without any nearby record. Found in peat bogs. Could be a species for the Swedish redlist.

*Platycheirus nielsenii* Vockeroth, 1990

Area 3; date 24-June-1997, 1 ♂.

Very rare in the area, not known from outside the area. Habitat bogs, fens and wet flower-rich meadows. In Sweden common in the northern part and only very few records from the southern part.

*Platycheirus occultus* Goeldlin de Tiefenau, Maibach & Speight, 1990

Area 1; date 24-June-1997, 1 ♀.

Very rare both in the area as in Uppland, and

without nearby records. A wetland species of more open situations than *P. europeus*.

*Platycheirus perpallidus* Verrall, 1901

Area 5; date 10-June-1996, 1 ♀ on *Carex* sp.

Very rare in the area, without any other record from Uppland. Adults are found close to or even flying over water in bogs, fens and other wet habitats with abundant *Carex* spp. It is widespread in Sweden, but local and rare.

*Platycheirus podagratus* (Zetterstedt, 1838)

Area 1; date 24-June-1997, 1 ♂, 3 ♀.

Very rare in the area, without any other record from Uppland. Adults prefer bogs and other wetlands in open alpine birch forests. In the north-western part common, outside this area local and in the southern part rare.

*Platycheirus (Pyrophæna) rosarum* (Fabricius, 1787)

Area 1; date 24-June-1997, 1 ♂, 1 ♀, area 2; date 7-August-1996, 4 ♂, 3 ♀ and area 3; date 7-August-1996, 2 ♀.

Not so rare in the area, with nearby records from Sunnersta åsen (RN 6631-1604, 6-8-1996 1 ♀), Damkärret (RN 6645-1606, 12-8-1996, 1 ♂), both leg & coll JvS and Dalkarlskärret. In Uppland very rare.

*Pocota personata* (Harris, 1780)

Area 7; date 22-May-2001, 1 ♂.

Very rare in the area with two nearby records from Kungshamn-Morga (van Steenis 1998) and Uppsala-Näs. Very rare in Uppland. Adults in open forests and forest meadows, feeding on *Crataegus* spp or resting on sunlit leaves or tree trunks. Larvae found in rot holes in old deciduous trees like *Populus* spp., *Fagus* spp. and *Quercus* spp. Indicator species for Hågådalen meadow.

*Sericomyia nigra* Portschinsky, 1873

Area 1; date 15-June-1997, 1 ♀, area 7; date 27-July-1997, 1 ♀ and area 9; date 20-July-1998, 2 ♀.

A not so rare species, without nearby records. Very rare in Uppland. Adults in peat bogs and more common in northern parts.

*Sphaerophoria chongjini* Bankowska, 1964

Area 7; date 9-July-1999, 1 ♂ on *Pastinaca sativa*.

Very rare in the area and Uppland, without nearby records. Occurs in forest meadows. A very rare species with scattered records. Indicator species for Hågådalen meadow.

*Sphaerophoria virgata* Goeldlin de Tiefenau, 1974

Area 1; dates 24-June-1997, 1 ♂ and 28-July-2001, 1 ♂ and area 10; dates 12-June-2001, 2 ♂, 1 ♀ and 8-August-1978, 2 ♂.

Uncommon in the area, without nearby records. In Uppland rare.

*Sphegina clunipes* (Fallén, 1817)

Area 10; dates 8-June-1999, 1 ♂, 2 ♀ and 29-June/25-July-1997, 1 ♂.

Rare in the area without nearby records. Very rare in Uppland. Larvae in tree trunks in wet conditions, often in water. Adults fly in shaded parts along forest edges or along streams.

*Sphegina sibirica* Stackelberg, 1953

Area 7; date 10-June-2011, 1 ♂ and area 10; dates 8-June-1999, 2 ♀ and 30-June-2002, 1 ♂.

Not so rare with nearby record from Kungshamn Morga (Turelund parking, RN 6627-1603, 23-VI-2001 1 ♂, 1 ♀, leg & coll JSA). In Uppland very rare! Found in coniferous forests and forest meadows bordering wet coniferous forests. Rather rare in the southern part of Sweden, but probably extending its range, as it was common in southern Sweden (Nilsson et al 2012).

*Spilomyia diophthalma* (Linnaeus, 1758)

Area 1; date 28-July-2001, 4 ♂, 2 ♀ and area 7; dates 26-July-2012, 1 ♂, 1 ♀, 27-July-1997, 2 ♂, 1 ♀, 27-July-2001, 2 ♂, 28-July-2002, 1 ♂, 1 ♀ and 8-August-1996, 2 ♂ on *Pastinaca sativa*.

Common in the area with nearby records from Nedre Föret, (van Steenis 1998) and Bäcklösa. In Uppland rare. Adults on large meadows and bogs with abundant flowering Apiaceae close to old growth deciduous and mixed forests. Widespread in Sweden but more rare in the southern part. Indicator species for Hågadalen meadow.

*Spilomyia manicata* (Rondani, 1865)

Area 7; dates 26-July-1998, 1 ♂ and 28-July-2008, 1 ♂ on *Pastinaca sativa*.

Rare in the area, only collected on the Hågadalens forest meadow. In Uppland very rare. Restricted species indicative of old deciduous or mixed forest with abundant old trees and sufficient adult food plants like Apiaceae. In southern Sweden very rare too (Karlsson & Johansson 2010) and it is a candidate for inclusion in the Swedish redlist. Indicator species for Hågadalen meadow.

*Syrphus admirandus* Goeldlin de Tiefenau, 1996

Area 2; date 16-May-1999, 1 ♂, area 7; dates 9-July-1999, 1 ♀ and 28-July-2008, 1 ♂ and area 10; date 9-May-2002, 1 ♀ on *Pastinaca sativa*.

Uncommon in the area. Very rare in Uppland, but known from Fiby urskog and Häverö (van Steenis 1998).

*Temnostoma sericomylaeformis* (Portschinsky, 1887)

Area 1; date 24-June-1997, 1 ♂.

Very rare species throughout. Recently split from *T. vespiforme*. Larvae tunnel in *Betula* spp. logs.

*Trichopsomyia flavitarsis* (Meigen, 1822)

Area 9; date 20-July-1998, 1 ♂ and area 10; date 29-June/25-July-1997, 1 ♀.

A rare species in the area, with only one other record from Uppsala-Näs (van Steenis 1998).

*Xylota abiens* Meigen, 1822

Area 7; date 19-June-1997, 1 ♂.

This is the only record from Uppland (van Steenis, 1998). Adults in old growth, mixed forests, on logs and leaves in sunlit glades and forest edges. In Sweden very rare and besides this record and one record from Småland only known from Skåne which makes it a candidate for the Swedish redlist. Indicator species for Hågadalen meadow.

*Xylota sylvarum* (Linnaeus, 1758)

Area 3; date 7-August-1996, 1 ♂ and area 7; date 26-July-2012, 2 ♂.

Rare in the area with only one nearby record from Bäcklösa. In Uppland rare.

## Discussion

The area Hågadalen-Nåsten has a relatively rich Syrphidae fauna with about 45% of the entire Scandinavian fauna (Bartsch et al. 2009a and b). This high number of species is comparable with other special habitats investigated in Sweden (Nilsson et al. 2012) and indicates the natural richness of this area. The maintenance of these species rich areas is of high priority as they could serve as refugia for rare species when surrounding areas are threatened by negative human impacts. To maintain the species richness of the Hågadalen-Nåsten nature reserve the following management recommendations should be taken into account.



Figure 10. Hågdalen forest meadow (photo taken in 2016) with an accelerating overgrowth of shrubs and trees, most strongly expanding in from the edges, here the northern forest edge, with "the northern triangle" (cf Fig. 11) to the left.

Hågdalens skogsång (foto från augusti 2016) som allt snabbare växer igen, speciellt av unga träd som expanderar in från kanterna. Häravbildas det nordliga brynet med "the northern triangle" i Fig. 11 till vänster i bild.

### Management recommendations

Overall the management in the Hågdalen-Nåsten nature reserve has been to let nature take its course which is in several cases a good way to maintain natural resources. However several open areas are regrowing due to the extensive management and lack of large grazers to keep meadows open. Another problem is possibly the water management in the area which should be aimed at keeping high groundwater levels during spring and summer, especially applicable for Rödmosse, Högbyhatt and several peat bogs in Nåsten.

*1 Rödmosse:* Syrphidae collected on *Vaccinium* spp., *Carex* spp, *Cicuta virosa* and *Rhododendron tomentosum*. The larvae of the most unique species are aquatic, saproxylic in tree stumps of broadleaved trees, predatory in ant nests (*Myrmica* spp.) and predating on aphids on sedges. Adults were also caught while flying through the vegetation or on ant (*Myrmica* spp.) hills in the bog. This area has a very high biodiversity and should be protected as it is. Man-

agement should focus on keeping water level as high as possible without influx of eutrophic surface water from the nearby fields. Filling in the drainage ditch from the area and felling pine saplings in the bog are useful measures too.

*2 Högbyhatt:* The Syrphidae occur on *Carex* spp., *Caltha palustris*, *Taraxacum* spp. and *Salix* spp., and are found hovering at 1-2 metres above the ground. Larvae of the most unique species are found as aquatic larvae, or predating aphids on sedges and high shrubs or trees, as wood borers in coniferous trees or saproxylic in tree stumps of coniferous trees. Here the pastures east of Högby hatt should be grazed, preferably by cattle. Leaving water levels high, especially during spring and fall time is of great importance in the big open fen, Clearing of tree and shrub encroachment around fens is recommended.

*3 Håga forest hills:* Syrphidae are found on *Prunus spinosa*, *Filipendula ulmaria* and *Salix* spp. Species consisted predominantly of predators on aphids on sedges, low shrubs and diverse



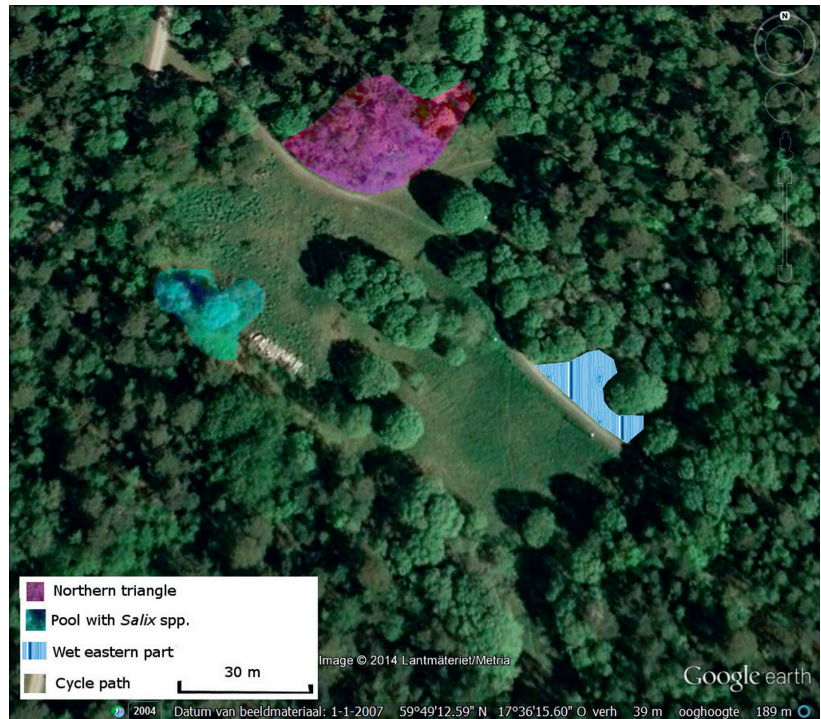


Figure 11. Hågadalen forest meadow.

Hågadalen skogsäng med några oartier som kommenteras i texten markerade.

trees. Conservation management should continue as proposed.

**4 Kung Björns hög:** Syrphidae on *Salix* spp. and *Prunus spinosa*. The larvae of the unique species live in ant nests. Conservation management should be aimed at ending the erosion mostly due to the sheep grazing. This has been accomplished already by fencing the old hill.

**5 Eriksberg northern forest:** Syrphidae on *Carex* spp., *Salix* spp. and *Filipendula ulmaria*. Conservation management should continue as proposed.

**6 Eriksberg park:** Syrphidae on *Filipendula ulmaria*. Conservation management should continue as proposed.

**7 Norby forest, with "Hågadalen forest meadow"** (Fig. 10 & 11). Syrphidae on *Salix* spp., *Ranunculus vicaria*, *Anemone nemorosa*, and *Pastinaca sativa*. Larval habitats include rotholes in coniferous and deciduous trees, tree trunks and sap runs of deciduous trees, roots of *Pastinaca sativa* and *Arctium lappa*, stem borers of coniferous trees, aquatic in decaying organic matter and aphidophagous on a diversity

of herbs, shrubs and trees. Forest management should be aimed at leaving old and dead trees as they are, making *Quercus* spp., *Betula* spp., *Acer* spp. and *Populus tremula* the dominating trees by felling all *Picea* spp. and some of the *Pinus* spp.

Meadow management is aimed at preserving the open character and creating transition zones between dry and wet parts. Clearing of shrub and tree encroachment is highly recommended for most of the area. Felling of other large trees in the central part should be done sparsely and aimed at creating larval habitat for saproxylic species, by creating snags or stumps (Jonsell & Weslien 2003, Lindhe & Lindelöw 2004, Fayt et al. 2006). Along the western and southern forest edges good forest border should be maintained with at the dryer parts *Prunus spinosa*, *Rosa* spp. and *Rubus fruticosus* as dominating shrub layer species. In the wet eastern triangle maintenance of high groundwater levels, by filling in drainage ditches, is essential for the continued growth of *Alnus* spp. and *Betula* spp. forest with an undergrowth of *Caltha palustris*, *Filipendula*

*ulmaria* and *Salix* spp. In the north part (named Northern triangle in Fig. 11) large trees should be felled and replaced by some *Prunus padus* and *Crataegus* spp. The shrub layer along the northern forest edge should be restored with *Prunus spinosa*, and *Rubus fruticosus*. The pool in the western corner should be restored to promote the growth of *Caltha palustris*, *Carex* spp. and low growing *Salix* spp. (*Salix repens*) along its margins.

The best way to keep the meadow open is by clearing trees and shrub. In order to maintain the amount of *Pastinaca sativa*, the main food source for Syrphidae in this meadow, extensive grazing in early spring (preferably by cattle) and by mowing in autumn (Baskin & Baskin 1979, Kennay & Fell 1990, Hendrix & Trapp 1992) is recommended. Minimalisation of grazing, however, seems to be best for syrphid abundance (Sjödén 2007). The maintenance of the surrounding forest should be aimed at the promotion of the deciduous tree population, as described for *Populus tremula* by Salomonsson (2009).

8 *Hågaån meadows*: Syrphidae on *Caltha palustre*, *Ranunculus* spp., *Daucus carota*, *Salix* spp. and *Prunus padus*. The open character of this area is of great value as well as the river banks and forest edges. The scrub should be left to grow as a natural border between pasture and forest, allowing *Salix* spp., *Crataegus* spp., *Prunus padus* and *Prunus spinosa* to establish. Other management should be as proposed earlier.

9 *Fäbodarna*: Syrphidae on *Prunus padus*, *Salix* spp. and *Taraxacum* spp. The larval habitat exploited by the unique species were sap runs on deciduous trees. The open areas should be protected and the shrub layer along the forest edges should be strengthened too. Maintenance should be as proposed earlier.

10 *Nåsten*: Syrphidae on *Anemone nemorosa*, *Salix* spp., *Taraxacum* spp., *Caltha palustris*, *Carex* spp. and *Anthriscus sylvestris*. The larval habitat for the unique species were stems of coniferous trees, aquatic in decaying matter and aphidophagous on diverse herbs, shrubs and trees. Forest management should be as proposed. The small peat bogs should be protected by felling trees and shrubs and maintaining high groundwater levels. Skogängens meadow in the north-western part should be extensively grazed

by cattle or horses and kept shrub and trees free. The wet meadows could be protected by filling in the drainage ditches to allow the growth of *Ranunculus* spp., *Caltha palustris*, *Geum rivale*, *Cirsium palustre*, *Centaurea* sp. and *Salix* spp. The forest edges should be reinforced with shrubs like *Salix* spp., *Crataegus* spp., *Prunus spinosa* and *Prunus padus*.

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