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RESULTS FROM POLLINATOR MONITORING IN KIVACH 1997–1999

R. LEINONEN ¹, G. SÖDERMAN ² AND N. KUTENKOVA ³

¹ Kainuu Regional Environment Center, Kajaani, Finland

² Finnish Environment Institute, Helsinki, Finland

³ State Nature Reserve «Kivach», Karelia, Russia

Pollinator insects: bumblebees, bees, wasps (Hymenoptera, Aculeata) and hoverflies (Diptera, Syrphidae) of the Nature Reserve «Kivach» from Russian Karelia were inspected in years 1997–1999 by yellow color-traps. 34 species of Hymenoptera and 35 species of Diptera were found in the study period. New for Kivach were following 38 species. Insects 21.8% of the species were captured for all 3 years, 27.5% – for 2 years and 50.7% – for 1 year. Kivach show a high diversity and strong populations even when scoping on the whole Northern Europe. The species number of bumble-bee was 14 which is a high number. Also the captured number of bumble-bee individuals was quite high. But many species of hoverflies were not numerous. Some observed species are threatened and also include in Red Data Books: of Russia (*Bombus schrencki* and *B. sporadicus*), of Karelia (*Vespa crabro*, *Anistrocerus antilope*, *Temnostoma vespiforme*), of East Fennoscandia (*A. antilope*).

Р. ЛЕЙНОНЕН, Г. СЁДЕРМАН, Н. КУТЕНКОВА. РЕЗУЛЬТАТЫ МОНИТОРИНГА НАСЕКОМЫХ-ОПЫЛИТЕЛЕЙ В ЗАПОВЕДНИКЕ «КИВАЧ» В 1997–1999 гг.

В заповеднике «Кивач» было проведено исследование фауны насекомых-опылителей: шмелей, пчел, ос (Hymenoptera, Aculeata) и мух-журчалок (Diptera, Syrphidae) с помощью желтых световых ловушек в 1997–1999 гг. За этот период было учтено 34 вида Hymenoptera и 35 видов Diptera. Новыми для Кивача оказались 38 видов. Насекомые 21,8% видов попадались в ловушки ежегодно, 27,5% – в течение двух лет и 50,7% – только один год. Заповедник «Кивач» обладает высоким разнообразием и сильными популяциями насекомых-опылителей во всей Северной Европе. Здесь было отмечено 14 видов шмелей, их обилие также высоко. Многие виды мух-журчалок имели низкую численность, возможно, это было связано с тем, что этот тип ловушек мало привлекателен для мух. Шмели *Bombus schrencki* и *B. sporadicus* занесены в Красную книгу Российской Федерации; осы *Vespa crabro*, *Anistrocerus antilope*, журчалка *Temnostoma vespiforme* – в Красную книгу Карелии; *A. antilope* – в Красную книгу Восточной Фенноскандии.

Key words: Pollinator insects (bumblebees, bees, wasps, hoverflies), abundance.
Ключевые слова: насекомые-опылители (шмели, пчелы, осы, журчалки), обилие.

Preface

Pollinator insects comprise a taxonomically heterogenic group. These insects play a key role in the propagation of many flowering plants. They also have a central function in pollinating important

cultivated flowering species like clover, fruit trees and wild berries (Söderman et al., 1997). The most important pollinators in northern Europe are bumblebees, bees, wasps (Hymenoptera, Aculeata) and flies (Diptera), especially hoverflies (Syrphidae). The highest species numbers of

bumblebees are found in the Nemoral and Boreal regions (Pekkarinen, Teräs, 1977).

The number of threatened species in these groups is relatively high compared to other groups of the same insects' orders. This is due to the fact, that both intensive and extensive changes in the land use have taken place during the last five decades. The natural feeding and breeding grounds have become rare at the same time that traffic (and insects killed by cars) has grown. The amount of threatened species is still higher further south in Europe, e.g. in Denmark, Britain and Germany. Some recent researches have also shown that the populations of a part of our bumblebees and several wild bees have declined even if they are not classified as threatened yet.

The abundance of apids depends on foraging and breeding factors. A high density of flowers producing honey is not enough, but also suitable nesting habitats are required. If the species lives in meadows, grazing must not be intensive as not to loose flowering plants. Marginal agricultural habitats are often important foraging areas.

Suitable nesting habitats are i.e. open sandy soils and to some extent old, partly decomposed wood. Thus meadows with old standing trees can support larger populations than treeless meadows, because many aculeate wasps nest in holes in wood and some saproxylic hoverflies may develop in soft, decomposed parts.

Goals and methods of the study

This research is a part of the East-Fennoscandian and Baltic pollinator monitoring in 1997–1999. The numbers of sites for this monitoring were in Finland 81, in Western Russia 12, and in Estonia, Latvia and Lithuania 8 per country. The aim of the research has been to test the method of yellow-traps as a technique for long-term monitoring and to collect basic inventory data of species distribution and abundance.

The study material was collected with yellow-traps (type Russell, pheromone traps). The traps were installed in clusters of three in several places within the study area. In the Nature Reserve «Kivach» (provinciae Karelia onegensis) the chose study place was a dry meadow (6216:3430, Lat-Long-coordinates). The main aspect of the plant cover creates by *Ranunculus acris*, *Alchemilla* spp., *Geranium sylvaticum*, *Hypericum maculatum*, *Leucanthemum vulgare*, *Festuca* spp., *Poa* spp., *Phleum pratense*, *Centaurea phrygia*, *Anthriscus sylvestris*, *Prunella vulgaris*, *Hieracium* spp., *Galium* spp., *Angelica sylvestris* and other.

The study period was 1997–99. The yellow-traps were hung on branches at 1–1.5 meters above the ground (which was regarded optimal for bumblebees) and 3–5 meters apart along forest margin. DDVP-strips were used to kill the insects that entered the traps. The samples were collected once a week during weeks 18–42. The collected samples were then intermittently stored in cold

before sending them for identification to Guy Söderman (Finnish Environment Institute).

Weather conditions during the study period

The research period had coincidence with a thermally favorable period in northern Europe during which many species showed signs of expansion. The monthly means of temperature and precipitation sums in 1997–1999 and during the previous period 1970–1996 are shown in table 1.

Table 1. Weather statistics for the study period in w. Kivach

	May	June	July	Aug.	Sept.
Mean 1970–1996					
Temperature, t °C	+8.2	+13.6	+16.0	+13.6	+8.2
Precipitation, mm.	36.9	62.6	68.8	81.0	66.4
1997					
Temperature, t °C	+6.8	+14.7	+16.8	+15.4	+8.0
Precipitation, mm.	39.9	73.1	54.8	27.2	64.1
Number days with a rain.	13	14	12	12	24
1998					
Temperature, t °C	+8.5	+14.2	+16.6	+12.5	+9.2
Precipitation, mm.	47.5	120.4	112.8	78.9	38.7
Number days with a rain.	17	20	20	20	15
1999					
Temperature, t °C	+4.4	+18.6	+17.3	+13.0	10.1
Precipitation, mm.	28.8	37.7	30.6	19.8	32.2
Number days with a rain.	8	15	14	14	16

In the first year, 1997, the weather conditions were quite close to normal, whereas 1998 was particularly rainy and 1999 started very cold but got hotter and drier towards the end. In 1998 the many rainy days may have inhibited active flight of pollinators and in 1999 some juvenile stages of hoverflies may have dried out.

Results and discussion

The area of Kivach lying on the transitory border of southern and middle Boreal forest region. The climate is rather continental although the area situates close to Lake Onega. The vegetation is luxurious and diverse, giving good foraging conditions in the meadows. The pollinator fauna of North Western Russia is very variable. The sites in Karelia (Kostamus, Kivach) show a high diversity and strong populations even the scope on the whole Northern Europe.

The yellow color-traps caught 2376 individuals of the 69 species of the pollinators insects (34 species of Hymenoptera and 35 species of Diptera) in the study period (table 2). These are the highest numbers in trap sites in Northwestern Russia. At the same time have obtained a lot of new information from species of Kivachu area, because many species had been captured first time from Kivach. There were 12 species of Hymenoptera (35% from captures color-traps)

Table 2. Captures in the study period (3 traps)

	1997	1998	1999	Total
Bumblebees & Cuckoo bees				
species	15	15	11	17
individuals	1025	774	227	2026
Bees				
species	4	2	1	6
individuals	5	3	1	9
Wasp				
species	5	8	3	11
individuals	63	21	11	95
Hoverflies				
species	18	23	13	35
individuals	61	141	44	246
Total: species	42	48	28	69
individuals	1154	939	283	2376

and 26 species of Diptera (74%) (Хумала, 1997; Полевой, 1997). Despite of intensive investigations of fauna of insects in Karelia during last 20 years (Yakovlev et al., 2003), this fact shows insufficiency of information about the pollinator insects.

The structure of the fauna of the pollinator insects had the different composition for three years. Near one of fifth part of all species (21.8%) were captured for all years (table 3). Many species (50.7%) were captured for one year only. Bumblebees & Cuckoo bees had the species composition unsteady less than the insects of the other groups. The yellow-traps recorded 14 bumblebee species in Kivach, which is a high number. Also the captured number of bumblebee individuals was quite high. However, individual numbers varied much from year to year (table 4), which apparently is normal in higher latitudes. Five species: *Bombus consobrinus*, *B. distinguendus*, *B. muscorum*, and *Psithyrus campestris*, *P. norvegicus* were absent in yellow traps, but these species were captured in the different forest habitats in Kivach early (Хумала, 1997). Total number of bumblebee is 17 now.

Table 3. Number of years of capture of pollinator insects in the study period

	1 year	2 years	3 years
Bumblebees & Cuckoo bees			
species (17 sp.)	1	8	8
%	6.0	47.0	47.0
Bees			
species (6 sp.)	5	1	0
%	83.3	16.7	
Wasp			
species (11 sp.)	7	3	1
%	63.6	27.3	9.1
Hoverflies			
species (35 sp.)	22	7	6
%	62.9	20.0	17.1
Total			
species (69 sp.)	35	19	15
%	50.7	27.5	21.8

Many species of hoverflies were not numerous. This results show that hoverflies are not particularly well attracted to yellow-traps in high numbers

(except for some migratory species), very little can be concluded about the change of their distribution and abundance.

The dominant species for this period were: bumblebees *Bombus hypnorum*, *B. lucorum*, *B. pascuorum*, *B. pratorum*, *B. sporadicus*, cuckoobee *Psithyrus bohemicus*, wasp *Vespula vulgaris* and hoverflies *Episyrphus balteatus*, *Syrphus ribesii*, *S. torvus*, *Parasyrphus lineolus*. These species bumblebees were usual in the different forest habitats at the nature reserve (Хумала, 1997). They use meadows for the forage. The flowering plants *Centaurea phrygia* and *Angelica sylvestris* are attractive the more that other plants for pollinator insects at the height of summer.

Apparently, these species bumblebees are dominant at the all study area of Karelia: Vepsian Volost (Полевой, Хумала, 2005), Central Karelia (Яковлев и др., 2001), in Zaonezhski peninsula and Kizhski archipelago (Яковлев и др., 2000; Полевой и др., 2005), at Karelian shore and islands of the White Sea (Хумала, Полевой, 1999; Полевой, Хумала, 2003) and Paanajarvi National Park (Yakovlev et al., 2000).

Some observed species are threatened and also include in Red Data Books:

Bombus schrencki and *Bombus sporadicus* – Red Data Book of Russian Federation (2001) and regional Red Books of Archangelsk region (1995). Both this forests species have a strong populations from air to east White Sea of Archangelsk region (Болотов, Семьшин, 2003). In Karelia *B. sporadicus* was found out at Paanajarvi. Big wasp *Vespa crabro* include in Red Data Book of Karelia (1995) was the rare species in during many years, but the quantity of this species in 2000 year was very much. Other wasp *Anistrocerus antilope* include in Red Data Book of Karelia (1995) and Red Data Book of East Fennoscandia (1998), was captured in southern regions of Karelia and Zaonezhski peninsula (Полевой и др., 2005; Yakovlev et al., 2003). This species have low level of abundance in all points. Hoverflies *Temnostoma vespiforme* (Красная книга Карелии, 1995) spread by the whole area of Karelia (Yakovlev et al., 2003). The interesting species is other hoverflies *Sphocomyia vespiformis*, was captured also at Paanajarvi Park (Yakovlev et al., 2000).

The comparison the fauna of pollinator insects for Kivach and fauna of pollinator insects the next territory for Finland (Söderman et al., 1997), it has no remarkably differences between those areas.

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Table 4. Check-list of the pollinator insects in Kivach (3 colour-traps)

Species	Weeks	1997	1998	1999	Total
HYMENOPTERA					
Apidae					
Colletinae					
<i>Colletes cunicularius</i>	20–20	1		1	2
Andreninae					
<i>Andrena clarkella</i> *	20–20	1			1
<i>Andrena praecox</i> *	19–19	2			2
<i>Andrena ruficrus</i> *	20–20		2		2
Halictinae					
<i>Lasioglossum rufitarse</i> *	22–22	1			1
Megachilinae					
<i>Osmia uncinata</i> *	30–30		1		1
Apinae					
<i>Bombus cryptarum</i> *	20–36	1	49	20	70
<i>Bombus hortorum</i>	22–23	2		2	4
<i>Bombus hypnorum</i>	19–35	113	161	10	284
<i>Bombus jonellus</i>	19–35	27	15		42
<i>Bombus lapidarius</i>	20–22	3	1		4
<i>Bombus lucorum</i>	19–38	359	38	60	457
<i>Bombus magnus</i> *	19–34	6	9		15
<i>Bombus pascuorum</i>	19–35	127	85	12	224
<i>Bombus pratorum</i>	19–37	122	207	15	344
<i>Bombus ruderarius</i> *	25–25		1		1
<i>Bombus schrencki</i> *	22–35	37	21	3	61
<i>Bombus soroeensis</i>	22–35		16	1	17
<i>Bombus sporadicus</i>	20–38	74	82	67	223
<i>Bombus veteranus</i>	20–22	8	4		12
<i>Psithyrus bohemicus</i>	20–37	104	75		179
<i>Psithyrus flavidus</i>	32–35	7		2	9
<i>Psithyrus sylvestris</i>	21–36	35	10	35	80
Vespidae					
<i>Vespula rufa</i>	21–30		2		2
<i>Vespula vulgaris</i>	35–39	50		1	51
<i>Vespa crabro</i> *	36–36	1		8	9
<i>Dolichovespula media</i>	31–37	5			5
<i>Dolichovespula norwegica</i>	20–39	6	9	2	17
Eumenidae					
<i>Anistrocerus antilope</i>	29–29		1		1
<i>Anistrocerus parietinus</i>	35–35		1		1
<i>Anistrocerus trifasciatus</i>	34–37		3		3
<i>Symmorphus allobrogus</i> *	26–36		3		3
Sphecidae					
<i>Crossocerus barbipes</i>	37–38	1	1		2
<i>Lindenius albilabris</i> *	33–33		1		1
DIPTERA					
Syrphidae					
<i>Lapposyrphus lapponicus</i> *	19–19	1			1
<i>Scaeva selenitica</i> *	38–38	1			1
<i>Dasysyrphus pinastri</i> *	21–22		2		2
<i>Dasysyrphus venustus</i> *	22–27	2	1	2	5
<i>Meliscaeva cinctella</i> *	34–38	1	2	2	5
<i>Sphaerophoria scripta</i>	38–39	2			2
<i>Sphaerophoria taeniata</i> *	33–33		1	1	2
<i>Melanostoma mellinum</i>	26–35	1	1		2
<i>Platycheirus peltatus</i>	34–34		1		1
<i>Melangyna compositarum</i> *	27–36	1	12	4	17
<i>Melangyna lasiophthalma</i> *	18–18	1			1
<i>Orthonevra intermedia</i> *	29–29		1		1
<i>Episyrphus balteatus</i> *	30–42	27	3	15	45
<i>Syrphus ribesii</i> *	24–39	5	27		32
<i>Syrphus torvus</i> *	31–38		40	2	42
<i>Syrphus vitripennis</i> *	34–39	1	8	6	15
<i>Eupeodes corollae</i> *	41–41	1			1
<i>Parasyrphus annulatus</i> *	?			4	4
<i>Parasyrphus lineolus</i> *	32–38	9	25		34
<i>Rhingia campestris</i>	26–26	1			1
<i>Volucella pellucens</i> *	29–35	1	3		4
<i>Eristalis cryptarum</i> *	34–34	1			1
<i>Eristalis interrupta</i> *	30–30		1		1
<i>Eristalis tenax</i> *	?			1	1

Table 4

Species	Weeks	1997	1998	1999	Total
<i>Helophilus affinis</i>	?			2	2
<i>Helophilus pendulus</i>	34–36		5		5
<i>Sphecomomyia vespiformis</i> *	37–37		1		1
<i>Temnostoma vespiforme</i>	28–28		1		1
<i>Syrirta pipiens</i> *	35–38	1	2		3
<i>Xylota jakutorum</i> *	30–30		1		1
<i>Chalcosyrphus nemorum</i>	29–29	4	1	1	6
<i>Didea fasciata</i> *	31–31		1		1
<i>Didea intermedia</i> *	38–38		1		1
<i>Sericomyia silentis</i>	?			3	3
<i>Eriozona erraticus</i> *	?			1	1
DIVERSITY PARAMETERS					
Species number		42	48	28	69
Specimens number		1154	939	283	2376

Note: symbol * – this species absent for the check-list of Hymenoptera (Хумала, 1997) and for the check-list of Diptera (Полевой, 1997) from nature reserve «Kivach».

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