

Bees (Hymenoptera: Apiformes) in the Narew National Park

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ABSTRACT. In wetlands and adjacent habitats in the Narew National Park (northeastern Poland), 125 species of Apiformes were recorded. The bee diversity of the area was distinguished by very high contributions of Andrenidae (particularly of *Andrena* s. str.) and Apidae, but relatively low contributions of Megachilidae and Anthophoridae. Characteristic species include *Bombus jonellus*, while *Andrena fulva* has its easternmost locality there.

KEY WORDS: wild bees, Apoidea, Apiformes, Narew National Park, wetlands.

INTRODUCTION

The Narew National Park comprises the valley of the middle section of the river Narew in northeastern Poland (about 50 km northwest of the Białowieża Forest). This is one of the largest and best-preserved areas of wetlands in Poland. The wetlands cover over 95% of the bottom of the Narew valley.

The Narew NP includes a 35-km-long section of the river, between Suraż town in the south and the village of Rzędziany in the north (Fig. 1). This section of the river has numerous anastomosing distributaries, i.e. streams that leave and link up again with the main river, forming an irregular, complicated network. The Narew valley within the Park is flat and waterlogged, and its width ranges from 2 to 4 km (Banaszuk 2000, Gradziński 2001). Such conditions are favourable for emergent vegetation, so it is flourishing there. The dominant type of vegetation in that area are sedge communities (particularly *Caricetum elatae*), which occupy about 32% of the area. Reed communities and other plant associations of the alliance *Phragmition* cover over 16.5%. Grassy wetland communities and grass-sedge communities account for about 14%, while alluvial thickets and forests for nearly 15% of the area. Edges of the valley are colonized by willow thickets (*Salicetum*

pentandro-cinereae, *Salicetum triandro-viminalis*, etc). Among forest communities in the study area, the most common are alder carrs (*Carici elongatae-Alnetum*), while oak-linden forests (*Tilio-Carpinetum*) are found on mineral (sandy) islands surrounded by wetlands (Bartoszuk 1996).

The Podlasie region, i.e. the eastern belt of Central Poland including the Narew NP, was poorly studied before with respect to bees and other insects. The creation of the Park 10 years ago (in 1996) stimulated more intensive scientific investigations in that area (Banaszuk 2004).

The objectives of this study were: (1) to assess the taxonomic composition and abundance of bees within the borders of the Narew NP; (2) to analyse the seasonal activity and dominance of the bees; and (3) to make a zoogeographic analysis of the bee fauna of the study area. Because of the habitat specificity of the Narew NP, this report is in Poland the first publication characterizing wetlands with respect to pollinating insects.

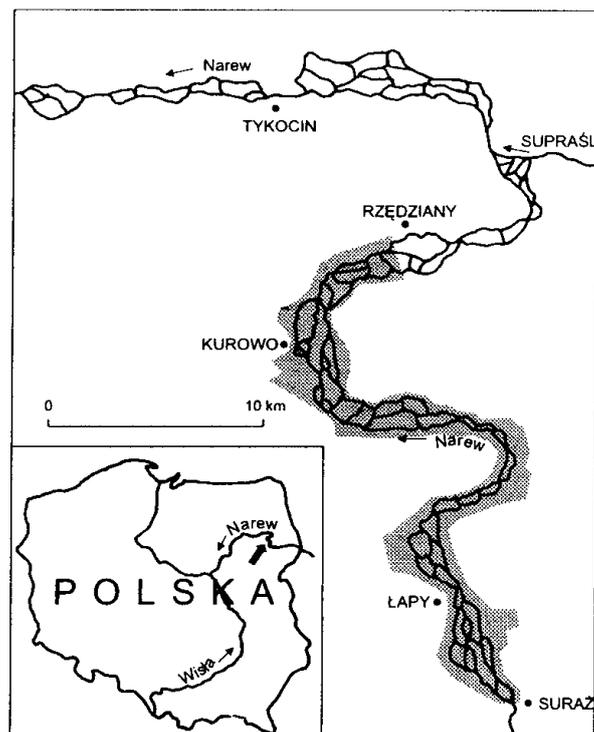


Fig. 1. The river Narew, anastomosing in the shaded area of the Narew National Park (after Gradziński 2001).

MATERIALS, METHODS, AND STUDY SITES

Investigations were carried out within the borders of the Narew NP, during the growing season in 2001 and 2002. Material was collected by use of Moericke traps and direct catching in the field. Additionally, species of flowering plants visited by bees were recorded. Bees were regularly collected in Kurowo and Waniewo, which are located on the left bank of the Narew. In those villages, white Moericke traps were placed directly of the ground or on poles at the height of 0.5 m, three traps per site: Kurowo – in the park near the manor house, in the nearby willow thickets and emergent vegetation, and on a meadow; Waniewo – on a meadow and in adjacent thickets (near the Narew). The traps were white plastic bowls of 20 cm in diameter, filled to 2/3 of their volume with a mixture of water (95%), glycol (4.8%) and a detergent (0.2%).

KUROWO – a small village on the left bank of the Narew, with a manor house being the headquarters of the Narew NP and the adjacent park sloping gradually to the Kurówka, which is a branch of the Narew. Research plots:

P a r k i n K u r o w o (Fig. 2) – covers an area of 10 ha. Many of the trees growing along lanes and alleys indicate that the park was created in the late 19th century and was replenished till the 2nd World War. The oldest tree (*Ulmus laevis*) is about 250 years old, but it can be of natural origin. The vegetation of the park is composed of 35 tree species (*Betula* spp., *Quercus* spp., *Carpinus betulus*, *Abies concolor*, *Tilia cordata*, *Acer* spp., *Picea* spp., *Populus* spp., *Salix* spp., etc.), 29 shrub species (*Ribes* spp., *Rosa* spp., *Symphoricarpos* spp., *Chaenomeles × japonica*, *Cornus* sp., *Berberis* sp., *Frangula alnus*, *Salix cinerea*, etc.), and many herbaceous taxa, including 12 ornamentals. Herbaceous bee forage plants are represented there by *Gagea lutea*, *Lamium album*, *L. purpureum*, *Taraxacum officinale*.

In the park, 3 traps were located, but bees were also caught directly with a sweep net.

W i l l o w t h i c k e t s (Fig. 3) – with adjacent emergent vegetation. The shrub community *Salicetum pentandro-cinereae* is accompanied there by a relatively dry *Caricetum elatae* with a large contribution of *Cirsium arvense*. Bees were collected with the use of a sweep net and 3 traps. Emergent vegetation and adjacent thickets (near a pier) included numerous herbs that attracted bees: abundant specimens of the above-mentioned *Cirsium arvense*, but also *Symphytum officinale*, *Epilobium hirsutum*, *Lythrum salicaria*, *Stachys palustris*, *Lysimachia vulgaris*, *Solanum dulcamara*, *Sparganium erectum*, *Senecio fuchsii*.

M e a d o w – mowed regularly, of the order *Molinietalia caeruleae* (Fig. 4).

WANIEWO – a village on the left bank of the Narew. Research plots: meadow, as in Kurowo, of the order *Molinietalia caeruleae*, and similarly willow thickets *Salicetum pentandro-cinereae*, dominated by *Salix cinerea*.

In both years the traps were used from early April till mid-September. Insects were removed from the traps every week.

Additionally, in both villages mentioned above and in several localities listed below, bees were also collected occasionally with a sweep net.



Fig. 2. A fragment of a former manor park in Kurowo (Narew National Park).



Fig. 3. A belt of emergent vegetation and sallow thickets in Kurowo (Narew National Park).



Fig. 4. A belt of meadows and sallow thickets in Kurowo (Narew National Park).



Fig. 5. Suraż town, slopes of an early medieval barrow – nesting site of *Andrena* species, including *A. fulva*.

B A B I N O – village in the northern part of the buffer zone of the Narew NP. On 29 July 2001, in an old sand pit and xerothermic grassland (mainly on *Cichorium intybus*), 26 bees were collected. Other plants attracting bees: *Lotus corniculatus*, *Trifolium pratense*, *Melilotus album*, *Cirsium arvense*.

B A C I U T Y – meadows on the right (eastern) bank of the Narew: 9 bees were caught on *Taraxacum officinale* on 30 April 2002.

R Z Ę D Z I A N Y – village in the northern part of the buffer zone of the Narew NP. On meadows along the Narew, where *Taraxacum officinale* was flowering abundantly, 24 bees were collected on 24 April 2002.

S U R A Ź – town near the southern border of the Narew NP. On slopes of an early medieval barrow and in the nearby thickets along the Narew (Fig. 5), 92 bees were caught on 28 April 2002.

T O P I L E C K O L O N I A – meadows on the eastern bank of the Narew, with a high contribution of *Taraxacum officinale*: 39 bees were caught on 28 April 2002.

U H O W O – field adjacent to meadows, on the right (eastern) bank of the Narew: 19 bees were caught on 30 April 2002.

Outside the Narew NP, bees were caught only once in 2 localities:

T Y K O C I N – town located 8 km north of the Narew NP. In the town centre and along the Narew, 15 bees were caught on 28 July 2001.

T A T A R Y – village near the northern borders of Tykocin: several dozen bees were caught on an inland dune on 5 April 2001.

RESULTS

Species diversity and dominance structure

This work is based on 3962 collected specimens of wild bees (Apiformes). They belong to 124 species, which account for 26.5% of the Polish bee fauna. Honeybees are common throughout the study area, but they were not taken into account in this paper. List of collected species is shown in Table 1.

Results of a comparison of contributions of bee families to the bee fauna in the study area and in Poland are interesting (Fig. 6). Andrenids account for as many as 27.3% of the fauna in the Narew NP, compared to 20.9% generally in Poland. It is noteworthy that nearly all species of the genus *Andrena* s.str. (10 species) were recorded in the study area. Only *Andrena mitis* was absent, but that sub-Mediterranean species is found exclusively in the southern part of the country.

Some andrenids belong to the group of dominant species (Fig. 7). This applies mainly to *Andrena vaga*, which contributed 15.6% of the total catch, beside *A. haemorrhhoa* (13.3%). Subdominants included *Andrena praecox* (8.2%), whereas smaller but still substantial contributions were made by *A. cineraria* (4.8%) and *A. dorsata* (3.2%). Another

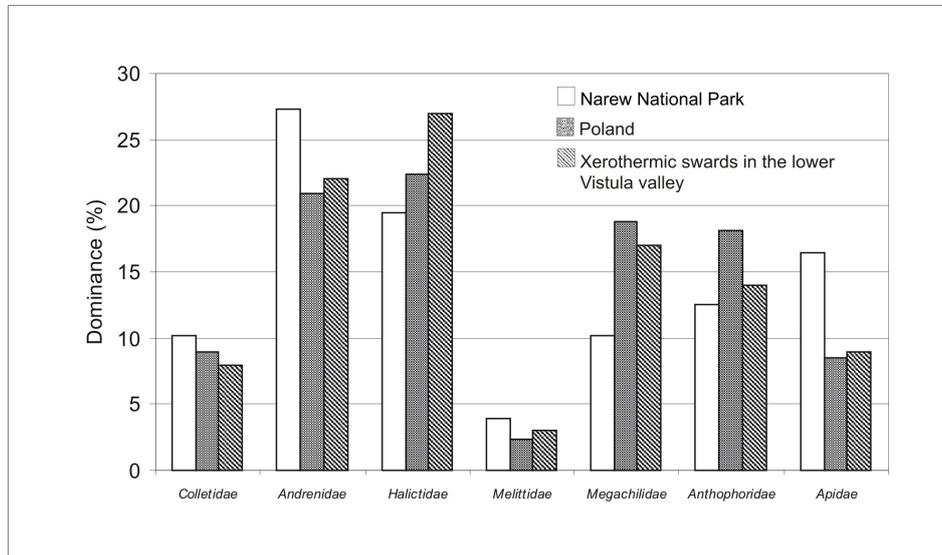


Fig. 6. Comparison of contributions of bee families to the total number of species of bees (Apiformes) in the Narew National Park and in Poland.

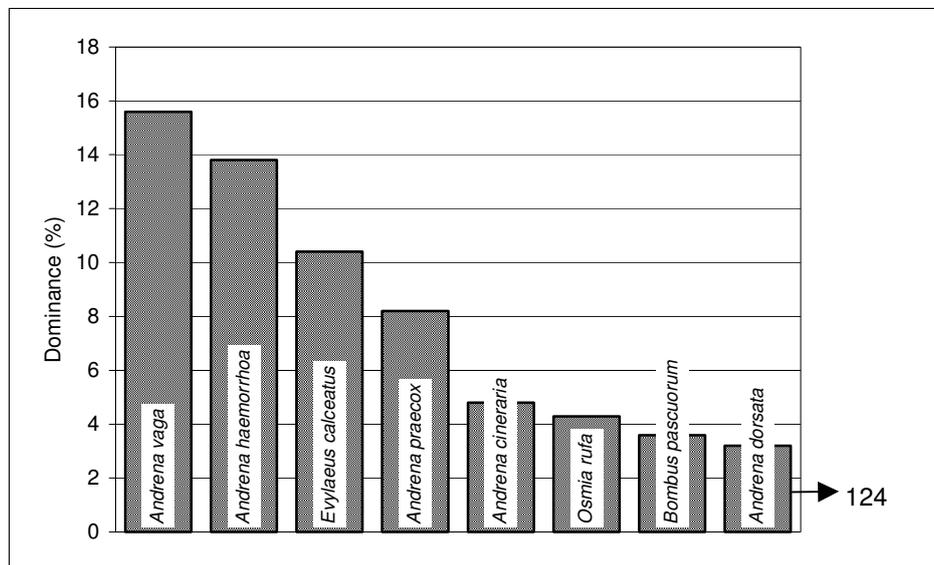


Fig. 7. Dominance structure of bees (Apiformes) in the Narew National Park.

subdominant was the halictid *Lasioglossum calceatum* (10.4%), which is widespread in Poland.

It must be emphasized that the contribution of halictids to the total number of species is lower in the Narew NP (19.5%) than generally in Poland (22.4%). Unusually low in the study area was also the contribution of Megachilidae (10.2% versus 18.8%), and Anthophoridae (12.5% versus 18.1%, respectively). By contrast, the contribution of Apidae (bumblebees, cuckoo bees) reached as many as 16.8%, while generally in Poland it accounts for only 8.5% of the bee fauna. Thus the wetlands and adjacent habitats in the Narew NP are characterized by an unusually high species diversity of Andrenidae and Apidae, and a relatively low diversity of Megachilidae and Anthophoridae.

Among the bees collected in the Narew NP, 40 species (32.3% of the total) were represented by 1-3 individuals each. Some of them are generally rare in Poland, but some are more frequent in other parts of the country. It is noteworthy that out of the 12 *Hylaeus* species recorded in the study area, as many as 10 were represented by only 1-6 individuals. Only *Hylaeus communis* and *H. confusus* were more numerous. Also the low numbers of nest parasites of bumblebees is surprising, because the latter are abundant in the Narew NP. The species that are very rare in the study area and in Poland are listed below, with detailed data on location and date of collection.

Hylaeus gredleri – Waniewo, willow thickets, 13.07.2001, 1♂; meadow, 13.07.2001, 1♂; Kurowo, willow thickets, 28.06.2001, 1♂. Earlier found in Poland only in the Kraków-Częstochowa Upland and in Łódź and its environs.

Hylaeus moricei luteifrons – species with little-studied distribution, known earlier only from Inowrocław in the Kujawy region (Pawlikowski 1993); in the study area 6 individuals were caught: Kurowo, willow thickets, 18-27.06.2001, 1♀, 3♂♂; 12.07.2001, 1♀; Waniewo, willow thickets, 21.06.2002, 1♂.

Andrena lapponica – Waniewo, meadow, 17.05.2001, 1♂. Species associated with forests, more precisely with *Vaccinium* spp., so it is rare in the Narew NP.

Andrena synadelpha – Kurowo, park, 25.06.2001, 1♀. Species distributed mainly in western Europe; in the east reaching to Poland and Turkey, recorded also in the Czech Republic and Germany, but rare (Dylewska 2000, Osytshnjuk et al. 2005). In Poland recorded near Łódź, the lower Vistula valley, and Opole.

Dufourea minuta – Kurowo, park, 28.07.2001, 1♀. This Western Palaearctic species is widespread in Europe, but in Poland it is found in single locations in the west and south. It was not reported from the northwestern part of the country before.

Epeoloides coecutiens – Kurowo, emergent vegetation, 28.07.2001, 1♂; 1-2.07.2002, meadow, 1♀, 2♂.

Nomada sheppardana – Kurowo, park, 8-18.06.2001, 3♀♀; 12.07.2001, 1♀.

Andrena sericata – Waniewo, thickets, 8.05.2001, 8♂♂; meadow, 27.05.2001, 1♂. Distributed in southern and locally also in central Europe. In Poland known from Upper Silesia (Dylewska 2000).

The use of Moericke traps enabled catching large numbers of dominant species, which provided additional information on their biology, e.g. on seasonal dynamics and sex ratio:

Andrena vaga - total 620, including 317♂♂ and 303♀♀ (sex ratio 1:1). The species was recorded for over one month, from 12 April till 16 May, with an abundance peak in late April (143♂♂ and 111♀♀ were caught then).

Andrena haemorrhoa – total 548, including 475♂♂ and 74♀♀ (sex ratio 7:1, so it is quite different from that of *A. vaga*). The species was recorded for nearly two months, from 22 April till 19 June. The majority of males were caught in late April.

Andrena praecox – total 335, including 203♂♂ and 132♀♀ (sex ratio 1.5:1). The species was recorded for nearly two months, from 12 April till 25 June.

Andrena cineraria – total 191, including 191♂♂ and only 2♀♀ (sic!). It must be emphasized that all the individuals were trapped in white bowls in two localities and in both they were nearly equally numerous: Kurowo 95♂♂ and 1♀, Waniewo 94♂♂ and 1♀. The extremely low, seemingly accidental contribution of females is difficult to explain. Perhaps the white Moericke traps did not attract females as efficiently as males. Males were recorded from 29 April till 17 May. The two females were collected on 30 April and 16 May.

Andrena nitida – unlike in *A. cineraria*, sex ratio favours females. Total 106, including 18♂♂ and 88♀♀ (sex ratio 1:5). Recorded from late April (first collected from the traps on 29 April) till 19 June.

Evylaeus calceatus – total 412, including 8♂♂ and 404♀♀ (sex ratio 1:50). Females were recorded from 28 April till 13 August, while males from 1 July till 12 September. Primitively eusocial species (Pesenko et al. 2000), which is confirmed by the above data on the flight season of females and males.

Osmia rufa – total 170, including 140♂♂ and 30♀♀ (sex ratio 4.5:1). The species was recorded for nearly two months, from 22 April till 26 June (males from 22 April till 23 May, females from 30 April till 26 June).

A comparison of the trap data on sex ratio of the most abundant species brought interesting results. The ratio of males to females was extremely varied:

	males	females
<i>Andrena cineraria</i>	95.5	1
<i>Andrena dorsata</i>	8	1
<i>Andrena haemorrhoa</i>	7	1
<i>Osmia rufa</i>	4.5	1
<i>Andrena praecox</i>	1.5	1
<i>Andrena vaga</i>	1	1
<i>Andrena nitida</i>	1	5

The question is whether trap materials are reliable for assessing the true sex ratio of the population. An extremely high proportion of males in traps and a simultaneous low proportion of females can be explained by their biology, i.e. protandry. Perhaps the males are caught in the traps while waiting for emergence of females and penetrating the area during courtship flights.

Phenological issues

Seasonal changes in species diversity of bees (Apiformes) observed in wetlands in the Narew NP are presented in Fig. 8. During the first three trapping sessions in April, 20-30 species were caught, but in late April their number increased rapidly to 66. Throughout May, June and most of July, about 40-50 species per trapping session were recorded. In late July, many new species appeared, but from early August the number of bee species declined quickly.

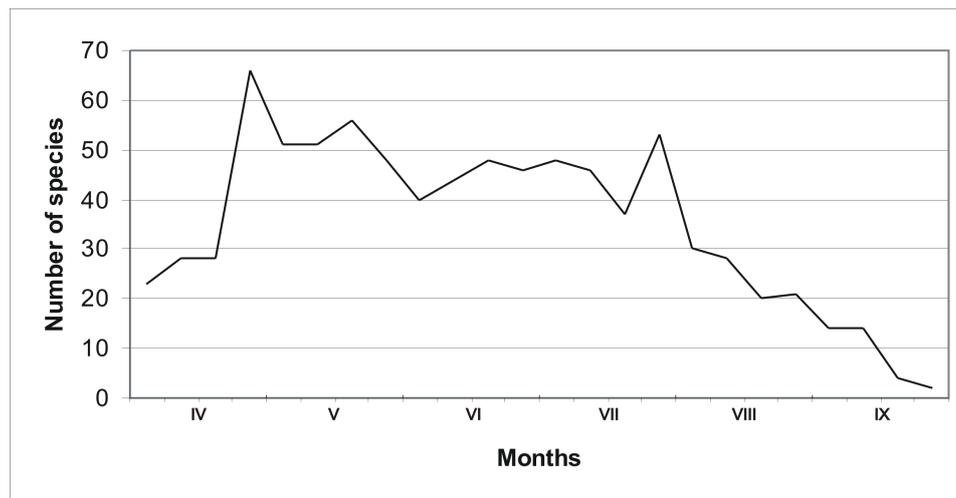


Fig. 8. Changes in number of species of bees (Apiformes) in wetlands in the Narew National Park.

Table 2 shows the species composition of Apiformes in successive phenological seasons. Early spring (April) and spring (May) were dominated mainly by *Andrena* spp. and the parasitic *Nomada* spp. In both months also female bumblebees were observed. Characteristic bees of this period included also *Colletes cunicularis*, *Osmia rufa* and *Anthophora plumipes*. In late April, the majority of Halictidae started their flight season. Also the more abundant species of *Andrena* must be mentioned here: *A. vaga*, *A. clarcella*, *A. haemorrhoea*, *A. praecox* and *A. rosae*, *A. ovatula*, as well as *Evylaeus calceatus* and *E.*

laticeps. In June the number of bee species decreased. This was due to the termination of flight seasons of early spring species in late May, although *Hylaeus* spp. appeared then, while all bumblebee workers and mainly halictids were also present. In July, typical summer species appeared, e.g. the summer generation of *Andrena*, Melittidae, Megachilidae, and there were still Halictidae, *Hylaeus* spp. and bumblebees with their parasites. In the latest part of the growing season (September-October), the recorded bees included mainly *Lasioglossum* and *Evylaeus* spp., especially *E. calceatus*, *E. paxilles*, *E. sexstrigatus* and bumblebees.

Generally, in relation to the group of spring and summer bees, the lowest diversity of bees in the study area (40-45 species) was observed in June, as a transitional period. A similar decrease in bee diversity in this month is observed throughout the Polish Lowland (Banaszak 1989).

Zoogeographic analysis

Among the 125 recorded species, 14 zoogeographic elements were distinguished.

The extensive wetlands in the Narew NP are colonized mainly by widely distributed species: Palaearctic (31.2%) and Western Palaearctic (21.6%), which jointly with Holarctic, Eurasian and Euro-Siberian elements account for nearly 72%. Less widespread species – European, Euro-Caucasian, and those limited to a part of Europe – constitute jointly 18.4%.

Also two West-European species are noteworthy: *Andrena synadelpha* (see section Species diversity ...) and *A. fulva*. Results of this study have revealed that the range of *A. fulva* reaches much further east than reported before. For a long time in Poland, the eastern limit of this species was supposed to be the line of the Vistula (Banaszak 1982). Earlier information on occurrence of *A. fulva* east of the Vistula was found only in Alfken's (1913) report on East Prussia, who claimed that C. Steiner found the bee near Metgethen. Later on, the same information was repeated by Möscher (1938) in his publication on bees of East Prussia, with particular reference to the Courland Spit. Interestingly, that record of *A. fulva* cannot be found in previous detailed lists of bees compiled by C. G. Brischke from West Prussia. Similarly, this species was not included by Monsevicius (1995) in his recent list of bees from Lithuania. In the Narew NP this species was found in several localities: Kurowo 8-23.05.2001, 2♀♀; 22-29.04.2002, 1♂, 2♀♀; Waniewo 8.05.2001, 1♀; 30.04.2002 1♂; Suraż, barrow slopes, 28.04.2004, 1♀. A preliminary report on the discovery of *A. fulva* in the Narew NP has already been published (Banaszak 2003). Recently this species has also been recorded in Skepe near Lipno (May 2006, leg. J. Banaszak), near Olsztyn (May 2003, leg. A. Oleksa), in the Masuria in Krutynia (2003) and Szczytno (2004), and in the Białowieża NP (2006) (leg. J. Banaszak, unpubl. data). These records may indicate that this western species has recently started an eastward expansion of its distribution range.

Special attention should be paid also to boreal-alpine species found in the Narew NP: *Hylaeus annulatus*, *Bombus jonellus*, and *B. semenoviellus*. *Bombus semenoviellus* was not known in Poland till the mid-1990s. This taiga species, reported earlier from Lithuania, is also expansive, broadening its geographic range westwards in recent years. Since its first

record near Warsaw in 1995 (Plewka 1995), this bumblebee has been quickly spreading its range westwards. Today it is known from several hundred locations in Poland and Germany (Smissen, Rasmont 1999, Mauss, oral comm.). In the study area, 10 females, worker bees and males of this species were recorded from May till July 2002 in Waniewo and Kurowo. In contrast, *Bombus jonellus* is an example of species typical of the wetland, cold habitats that prevail in the Narew NP. It was recorded in the study area frequently and in many localities, from early April till mid-September. It is reported from many locations in Poland, where it prefers humid habitats.

A characteristic feature of the Narew NP is the very low (8%) contribution of southern species: sub-Ponto-Mediterranean, Pontic, and sub-Mediterranean. These include 10 species:

Hylaeus styriacus – sub-Ponto-Mediterranean species, found nearly throughout Poland. In the study area represented by only one female caught in Waniewo, on 6 August 2001.

Andrena flavipes – sub-Ponto-Mediterranean species, recorded on warm sites recorded nearly throughout Poland; in the study area quite frequent, but only as the first generation (April-May).

Andrena sericata – sub-Pontic species, in Poland reported only from Lower Silesia. The species is treated as extinct in the Red Data Book of Polish fauna (Banaszak 1992). Within the Narew NP, 9 males were collected in Waniewo on 8 and 27 May 2001.

Lasioglossum lativentre – sub-Pontic species, scattered throughout Poland, but rare. In the study area, over the two years, 17 females and 3 males were found in Waniewo and Kurowo, between 26 June and 28 August.

Lasioglossum majus – sub-Mediterranean species, rather rare in Poland. Recorded in many parts of the country, except the northeast. In the study area, over the two years, 7 individuals were found in Kurowo and Waniewo, between 30 April and 23 August.

Evylaeus pauxillus – sub-Ponto-Mediterranean species, relatively frequent, mainly on dry meadows, roadsides and forest edges. In the study area, over the two years, 8 females were found in various locations between late April and late July.

Heriades crenulatus – sub-Ponto-Mediterranean species, in Poland reported from the Wielkopolska-Kujawy Lowland, Sandomierz Lowland, Małopolska Upland, and Lublin Upland, infrequent. During this study, one male was found in Tykocin on 28 July 2001.

Osmia bicolor – sub-Pontic species, distributed nearly throughout Poland, but rather rare. In the study area represented by only one male caught in Kurowo, in willow thickets, on 30 April 2001.

Nomada sheppardana – sub-Mediterranean species, in Poland known earlier only from two localities near Kraków (Celary, Wiśniowski 2001) and from the vicinity of Ząbkowice Śląskie and Poznań (J. Banaszak, unpubl. data), not recorded in northern and eastern Poland before. In the study area, 4 females were collected in the park in Kurowo on 8 and 18 June and 17 July 2001.

Nomada zonata – sub-Ponto-Mediterranean species, known mainly from southern and western Poland, not recorded in northern and eastern part of the country before. In the

Narew NP, a total of 17 males were caught in Kurowo between 4 April and 2 May in 2001 and 2002.

DISCUSSION

Before this study, Podlasie was the least-studied part of Poland in respect of the bee fauna. Only the Białowieża Forest was in the past investigated in this respect by Bischoff (1925). More recently, Sowa et al. (1990) investigated bumblebees on red clover plantations in that region. Thus the Narew NP was a gap in the knowledge of wild bees, but it must be added that this interesting area is still the least-studied among Polish national parks also with regard to other insects (Banaszak et al. 2004).

This paper presents information on occurrence of 125 bee species in the Narew NP and its vicinity. This is a much higher number than that reported from the nearby Białowieża NP, where 98 species of Apiformes have been recorded to date (Bischoff 1925, Malher 2001). However, the two Parks are very different in terms of flora and land relief. Besides, in the whole Białowieża Forest, 121 bee species have been recorded, including 98 in the Polish part and 63 in the Belorussian part (Malher 2001). Considering the area of both Parks, a total of 163 species of Apiformes have been found in Podlasie. This is a very low number, in comparison to other regions of Poland, but it attests only to the insufficient knowledge of the bee fauna of this region. For example, 265 species have been recorded in the neighbouring Mazovian Lowland (Banaszak, Plewka 1981, Szczepko et al. 2002).

In the study area, bees were collected mainly in the predominant plant communities, i.e. waterside bush communities, willow thickets, emergent vegetation, and the adjacent wet meadows. The present paper provides an apidological description of this area. Willow thickets are a rich source of bee forage in spring, which is reflected in the highest number of early spring species, i.e. in late April. In that period the majority of species are associated with flowering shrubs and trees, mostly willows. Thus early spring is dominated by *Andrena* spp. Also *Colletes cunicularius* is closely connected with the flowering period of willows.

A very high contribution (15.6%) of *Andrena vaga* to the total catch can be explained by its preference for flowers of willows, which are abundant in the study area. It has been proved that 99% of its visits to flowers were observed on various willow species (Hallmen et al. 1991). This species nests on sandy, often small sites at higher elevations among meadows, as confirmed in the planned reserve "Folusz" near Bydgoszcz (Banaszak et al. 2004).

The prevalence of wetlands in the Narew NP is reflected in the unusually high dominance of andrenids, particularly of *Andrena* s.str. (nearly all *Andrena* species found in Poland belong to this subgenus). From the conservational standpoint, the Narew NP should be considered as a refuge of diversity of the genus *Andrena*, particularly of the subgenus

Andrena s.str. Among species of this genus, *A. fulva* is particularly noteworthy, because it has its easternmost locality within the Narew NP.

Some comments must be added about the flight season of *Andrena cineraria* and *A. nitida*.

Andrena cineraria, according to Dylewska (2000), occurs in Poland in two generations: from mid-April till early June, and from July till August. However, in materials from the Narew NP, no summer individuals were found. This seems strange, considering the abundance of this species. An explanation can be the very low numbers of females. On the other hand, Warncke (1967) regards *Andrena barbarae* Panzer, 1805 as the second generation of *A. cineraria*, but the latter was not recorded in the Narew NP.

Andrena nitida, according to Dylewska (2000), appears in Poland in April and May. Also Kocourek (1966) in the former Czechoslovakia reported that its flight season lasts from April till mid-May. In the Narew NP, among 106 individuals (88♀♀ and 18♂♂), 5♀♀ were collected in June (1, 8, 18 and 19 June). Thus data from the Narew NP correspond with Osytshnjuk's (1977) findings that in Ukraine the flight season of *A. nitida* lasts from April till August (two generations!). It is possible that the individuals caught in June in the Narew NP represent the second generation.

It must be emphasized that this work fills a gap in current knowledge of bee ecology, because wetlands and alluvial forests in Poland were not subject to detailed apidological research before. The only exception was a study by Krzysztofiak (1994), concerning the reserve "Suche Bagno" in the Wigry NP, where that author found 60 bee species, with the highest contribution of bumblebees (dominants: *Bombus lucorum*, *B. cryptarum* and *Andrena fucata*). The different group of dominants in the present study probably results from the prevalence of open habitats in the Narew NP and of wooded habitats in the Wigry NP.

Willow flowers are the first source of forage for mother bumblebees and honeybees. Thus the Narew valley is a rich source of bee forage (first willow, later dandelions), which makes apicultural development possible there. It is also important that Podlasie and the Białystok region are characterized by a very low level of environmental pollution, which is of major significance for production of health food, including honey. Unfortunately, Podlasie is currently (contrary to its traditions) a region with a low number of apiaries, as there is only one bee family per 1 km² (Stajniak 2001). This is due to many factors, e.g. the economic situation during the social and political transformations in the last two decades.

Major results and conclusions

In wetlands and adjacent habitats in the Narew NP, 125 bee species were recorded. The bee diversity of the study area is distinguished by very high contributions of Andrenidae and Apidae, and relatively low contributions of Megachilidae and Anthophoridae. Dominant species include *Andrena vaga* (15.6 % of total catch) and *A. haemorrhoa*. Another frequent species is *Bombus jonellus*, characteristic of wetlands and other colder habitats.

In the study area, some species that are very rare in Poland were recorded: *Hylaeus gredleri*, *H. moricei luteifrens*, *A. lapponica*, *Nomada sheppardana*, and *A. sericata*. Consequently, this study has broadened the current knowledge of their distribution.

The majority of bee species recorded in the Narew NP have wide ranges of distribution. The contribution of southern species was low there. Southern species (sub-Ponto-Mediterranean, Pontic, and sub-Mediterranean) accounted for only 8% of the bee fauna.

Interestingly, the West European *Andrena fulva* and *A. synadelpha* were recorded in the study area. This study showed that the geographic range of *A. fulva* reaches much further east. Perhaps this reflects its eastward expansion over the last decade, as in the case of the westward expansion of the range of *Bombus semenoviellus*.

From the conservational standpoint, in light of results of this study, the Narew NP should be considered as a refuge of bees of *Andrena* spp., especially of the subgenus *Andrena* s.str.

Acknowledgements

I was encouraged to start research on bees in the Narew NP by the former Director of the Park, Eng. Bogusław Deptuła, who offered his help in controlling Moericke traps and provided free accommodation during my visits to the study area. Thus I would like to express here my sincere gratitude for his help and warm-heartedness. I also thank Ms. Iwona Laskowska, who is employed in the Narew NP, for technical assistance.

Table 1. List of species and number of individuals of Apiformes found at studied sites in the Narew National Park (*, locations outside the borders of the Park).

No.	Species	Number of		Investigation sites										
		females	total	Kurowo	Waniewo	Babino	Baciny	Rzędziany	Suraż	Tatary *	Topielec Kol.	Tykocin *	Uhowo	
				1	2	3	4	5	6	7	8	9	10	
1	<i>Colletes cunicularius</i> (Linnaeus, 1761)	3	8	2	1			1			3			1
2	<i>Hylaeus annulatus</i> (Linnaeus, 1758)	1	1	1										
3	<i>Hylaeus bisinuatus</i> Förster, 1871		1									1		
4	<i>Hylaeus brevicornis</i> Nylander, 1852	2	2	2										
5	<i>Hylaeus communis</i> Nylander, 1852	3	39	5	34									
6	<i>Hylaeus confusus</i> Nylander, 1852	6	14	8	6									
7	<i>Hylaeus gibbus</i> Saunders, 1850	1	2	1	1									
8	<i>Hylaeus gredleri</i> Förster, 1871		3	2	1									
9	<i>Hylaeus hyalinatus</i> Smith, 1842	3	3											
10	<i>Hylaeus moricei luteifrons</i> (Strand, 1909)	2	6	5	1									
11	<i>Hylaeus pectoralis</i> Förster, 1871	6	6	3	3									
12	<i>Hylaeus sinuatus</i> (Schenck, 1853)	1	3		3									
13	<i>Hylaeus styriacus</i> Förster, 1871	1	1		1									
14	<i>Andrena apicata</i> Smith, 1847	5	16	4	2					10				

				1	2	3	4	5	6	7	8	9	10
67	<i>Sphecodes gibbus</i> (Linnaeus, 1758)	2	2						1		1		
68	<i>Sphecodes longulus</i> Hagens, 1882		1									1	
69	<i>Sphecodes monilicornis</i> (Kirby, 1802)	1	1	1									
70	<i>Sphecodes pellucidus</i> Smith, 1845	2	2						2				
71	<i>Melitta leporina</i> (Panzer, 1799)	2	5			5							
72	<i>Melitta nigricans</i> Alfken, 1905	2	25	23	1	1							
73	<i>Macropis europaea</i> Warncke, 1973	15	29	25	4								
74	<i>Macropis fulvipes</i> (Fabricius, 1804)	1	1	1									
75	<i>Dasydoda altercatoi</i> (Harris, 1776)	7	8	2	1	5							
76	<i>Stelis phaeoptera</i> (Kirby, 1802)		1		1								
77	<i>Heriades crenulatus</i> Nylander, 1856		1									1	
78	<i>Heriades truncorum</i> (Linnaeus, 1758)	9	13	1								12	
79	<i>Chelostoma florisomne</i> (Linnaeus, 1758)	8	14	4	10								
80	<i>Osmia bicolor</i> (Schrank, 1781)		1	1									
81	<i>Osmia rufa</i> (Linnaeus, 1758)	30	170	30	138				2				
82	<i>Megachile alpicola</i> Alfken, 1924	1	1	1									
83	<i>Megachile centuncularis</i> (Linnaeus, 1758)	9	19	16	3								
84	<i>Megachile ligniseca</i> (Kirby, 1802)	15	32	28	4								
85	<i>Megachile versicolor</i> Smith, 1844	1	7	6		1							
86	<i>Coelioxys elongata</i> Lepeletier, 1841		1		1								
87	<i>Coelioxys mandibularis</i> Nylander, 1848	1	1	1									
88	<i>Coelioxys rufescens</i> Lepeletier, 1825	3	4	2	2								
89	<i>Nomada fabriciana</i> (Linnaeus, 1767)	1	4	4									
90	<i>Nomada ferruginata</i> (Linnaeus, 1767)	12	12	12									
91	<i>Nomada flava</i> Panzer, 1798		6	2	3					1			
92	<i>Nomada flavopicta</i> (Kirby, 1802)	1	2	1		1							

Table 2. Emergence time of species of Apiformes in growing seasons of 2001–2002 in the Narew National Park (+, recorded occurrence; ○, doubtful occurrence).

No	Month Week Species	IV				V				VI				VII				VIII				IX			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.	<i>Colletes cunicularius</i> (Linnaeus, 1761)	+	○	○	+																				
2.	<i>Hylaeus annulatus</i> (Linnaeus, 1758)														+										
3.	<i>Hylaeus bisinuatus</i> Förster, 1871																+								
4.	<i>Hylaeus brevicornis</i> Nylander, 1852																+	○	+						
5.	<i>Hylaeus communis</i> Nylander, 1852								+	○	+	+	+	○	+	+	○	○	○	+					
6.	<i>Hylaeus confusus</i> Nylander, 1852								+	+	+	+	+	+	+	○	○	○	○	+					
7.	<i>Hylaeus gibbus</i> Saunders, 1850												+	○	+										
8.	<i>Hylaeus gredleri</i> Förster, 1871												+	○	○	○	+								
9.	<i>Hylaeus hyalinatus</i> Smith, 1842												+	○	○	○	○	○	+	+					
10.	<i>Hylaeus moricei luteifrons</i> (Strand 1909)														+	+	○	+							
11.	<i>Hylaeus pectoralis</i> Förster, 1871														+	○	+	+	○	○	○	○	○	+	
12.	<i>Hylaeus sinuatus</i> (Schenck, 1853)																+	+							
13.	<i>Hylaeus styriacus</i> Förster, 1871																				+				
14.	<i>Andrena apicata</i> Smith, 1847	+	+	○	+	+																			
15.	<i>Andrena barbilabris</i> (Kirby, 1802)				+																				
16.	<i>Andrena bicolor</i> Fabricius, 1775				+															+					
17.	<i>Andrena chrysoceles</i> (Kirby, 1802)		+	○	+	+	○	+																	

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Received: November 11, 2006

Accepted: December 3, 2006