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Apiformes (Hymenoptera, Apoidea) of the Łysogóry Mountains and adjacent area

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Abstract. In the Łysogóry Mts and adjacent area 126 species of Apiformes were found. Mid-forest meadows in the Łysogóry Mts are populated mostly by Bombini (20 species). Apart from widely distributed species, the representatives of the following zoogeographical elements were collected in this area: one xerothermic montane species (*Bombus mesomelas),* several boreo-montane species (*Andrena lapponica, Andrena tarsata, Osmia parietina, Bombus jonellus)* and subpontic, submediterranean and subponto-mediterranean species (*Colletes succinctus, Andrena decipiens, Lasioglossum subfasciatum, Chalicodoma ericetorum, Osmia aurulenta, Ceratina cyanea, Anthophora pubescens*). In the years 50-ies and 60-ies the number of Apiformes in the Łysogóry Mts reached 150 individuals per 100 m^2; in the 80-ies the number of individuals was significantly lower. This condition was confirmed by a relatively low number of parasitic species (9) and by at least decuple decrease in number of Bombini.

Key words: Apiformes, Hymenoptera, Apoidea*,* fauna, Łysogóry Mountains, Poland.

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I. INTRODUCTION

The first data on bees (Apiformes) of the Świętokrzyskie Mountains were presented in the work of DROGOSZEWSKI (1932) who reported three species from the Łysogóry Mountains: *Macropis europea, Bombus pratorum* and *Bombus subterraneus*. Since 1950 Apiformes were collected in the Łysogóry Mts by KOŃCZYK (1965), DYLEWSKA & ZABŁOCKI (1972) and ČMAK & SZCZYPCIAK-BĄK (1987). In addition, the composition and quantity of Bombini were investigated in some national parks in southern Poland, including the Łysogóry Mountains (DYLEWSKA et al. 1998). These studies revealed that the quantity expressed in percentages depends on blooming plants. The mentioned authors reported from the Łysogóry Mountains the total number of 20 spe-

*Previously used name: SZCZYPCIAK-BĄK

cies of Bombini. Additionally, LIANA (2000) reported *Halictus niger, Andrena lapponica* and *Andrena tarsata.*

The purpose of this paper is to present the faunistic, ecological and zoogeographical analyses of Apiformes of the Łysogóry Mountains on the basis of all hitherto collected materials.

II. STUDY AREA

The Świętokrzyskie Mountains are the oldest and the highest part of the Little Poland Upland. Their main mountain range – Łysogóry Mts stretches along 15 km from the north-west to the east--west. This area and its surrounding is protected as the Świętokrzyski National Park. The map (Fig. 1) shows borders of the national park and its protection zone. The highest peak of the Łysogóry Mountains is Łysica Mt. (612 m asl) and Łysa Mt., previously called Łysiec, and nowadays called Święty Krzyż Mt. (595 m asl). The major part of slopes and tops of the Łysogóry Mts is covered with upland fir-tree forest *Abietum polonicum* (in different variants). The plant associations have undergone significant changes: the dominating fir-tree is dying-out and is replaced by the beech forest. The areas of the upland fir-tree forest are mixed with mosaic and vast complexes of the Carpathian beech forest *Dentario glandulosae-Fagetum*. This association is the most common in Jastrzębi Dół, Święty Krzyż Mt., Łysa Góra Mt. and to north-west from Wola Szczygiełkowa. The fir-tree and beech forests neighbour in lower part of the mountains with mid-Poland mixed forest *Pino-Quercetum.* This association is also common in Chełmowa Góra, Serwis-Dąbrowa, Mokry Bór, Czarny Las, Góra Miejska and Gawroniec. The association of *Tilio-Carpinetum* is very rare in the area of the Świętokrzyski National Park. Some larger areas covered with this community are in Chełmowa Góra Mt., Czarny Las and Serwis-Dąbrowa. In these dense forest complexes, meadows with blooming plants are very rare. These meadows are: Święty Krzyż Mt., Bielnik meadow, meadows in the vicinity of Wola Szczygiełkowa, Mokry Bór and Święta Katarzyna. A meadow in the northern part of the Święty Krzyż existed till 1970. Since then it has been managed in a different way. A southern part of it was previously covered with papilionaceous plants, now it is covered with grass, which is regularly cut. The Bielnik meadow is located in the vicinity of Święty Krzyż Mt. The meadow is partially used as a football playground. The rest of this area holds such plant species as: *Knautia arvensis, Veronica chamaedrys, Centaurea, Campanula* and *Heracleum sphondylium*.

In the vicinity of Święta Katarzyna, on mineral-glia soils, colourful *Cirsietum rivularis* meadows with a dominating species *Cirsium rivulare* are located. There are also some cultivated meadows in this area. Meadows near Wola Szczygiełkowa hold blooming species: *Cirsium palustre, Heracleum sphondylium, Ranunculus, Lotus corniculatus, Lysimachia* and others, in the vicinity of Mokry Bór *Gladiolus paluster* occurs. Edges of these clearances and meadows are covered with blooming shrubs – *Rubus, Crataegus, Salix and Prunus*. Road edges in fir-tree forests, stony clearances on Łysica Mt. and foothills of Święty Krzyż Mt. are covered with scarce blooming vegetation. Along streams and rivers in the Wilkowska Valley vast complexes of meadows are developing. These are: *Arrhenatheretum medioeuropaeum, Cirsietum rivularis* and cultivated meadows. Around forested areas, the Łysogóry Mountains have gentle slopes with southern elevation and more folded slopes with nothern elevation. These areas are used as arable fields with association *Vicietum tetraspermae* and dominating species *Cirsium arvense, Vicia hirsute, Vicia angustifolia, Trifolium pratense, Lamium purpureum* and others. In this area, the clumps of trees and shrubs are very seldom. The plant communities and associations in the Łysogóry Mts were presented after GŁAZEK & WOLAK (1991).

III. CLIMATE OF THE ŁYSOGÓRY MTS

The climate of the Łysogóry Mts has many features typical for the mountainous clime. Thermal conditions depend here on elevation and exposition of slopes. A mean yearly temperature in top

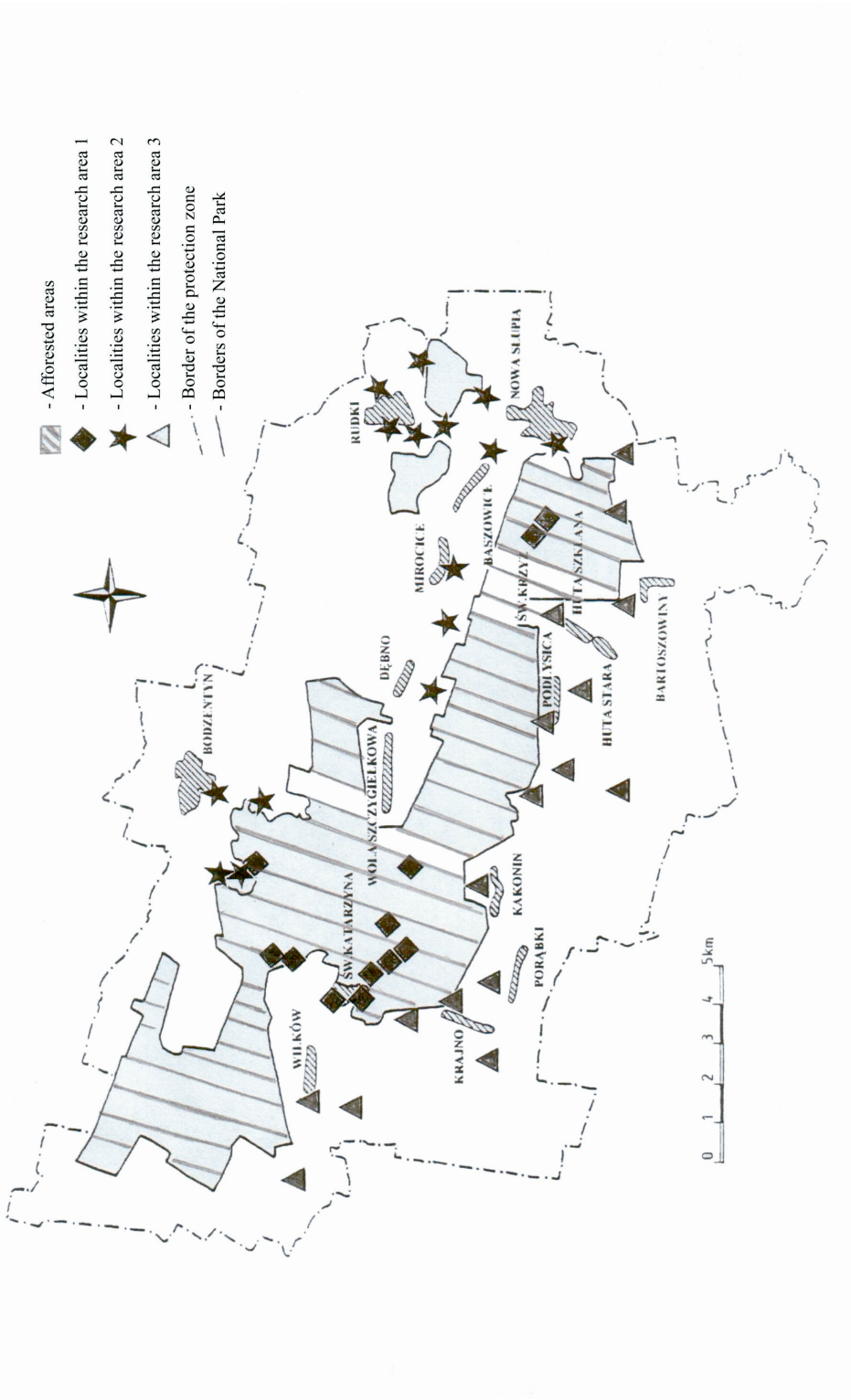

Fig. 1. A map of the Świętokrzyski National Park with its protection zone.

parts of the Łysogóry Mts is 5.7°C (Święty Krzyż Mt.), while in adjacent areas, e.g. in Bodzentyn is 6.9°C. The maximum of the mean air temperature is recorded in July and minimum in January. Severe thermal conditions are reflected also in a shorter vegetation season on the background of adjacent areas. This season is shorter on average of about 2 weeks (185 days). The typical for this area are shorter summers (54 days) and longer winters (119 days). In the top parts of the Łysogóry Mts the mean yearly precipitation varies from 800 to 850 mm, while in areas of lower altitude, e.g. that of Serwis Mt. (250 m asl) the precipitation varies between 550 and 600 mm.
A maximum yearly precipitation recorded in 1961 was 1344.5 mm. A mean number of days with a snow cover in the top parts of the Łysogóry Mts and in the northern slopes is 102 days, while in the Carpathians and Sudety Mts this number is higher. A high mean number of days with a snow cover (72 days) of the thickness 50 cm reflects a mountainous character of winter conditions in this area. The Świętokrzyskie Mts are a barrier for winter movements of the air from the north to the south. Thus, the earliest frost is usually recorded in Bodzentyn and the latest in Święty Krzyż Mt.. In the Łysogóry Mts the western winds (average speed – 3 m/s) and north-western winds are predominant (OLSZEWSKI, SZAŁACH & ŻARNOWIECKI 2000).

IV. RESEARCH LOCALITIES AND METHODS OF COLLECTING

Due to a significant differentiation of the Łysogóry Mts, they were divided into three research areas: area I – dense forest; area II – located north from the research area I; area III – located south from the research area I. The research areas II and III are represented mostly by agricultural land with the only exception of forested Chełmowa Mt and Serwis-Dąbrowa forest. Moreover, the Chełmowa Mt is a strict reserve. In the study area, the localities suitable for bees were sought and visited several times in different seasons of the year: Spring, late Spring, Summer and Autumn. Apiformes were collected by use of entomological nets, the species of host plants were identified during the bee catches. The number of Bombini was studied on the basis of method elaborated by Dylewska (1996). The collected materials were identified mostly by M. DYLEWSKA, a significant part of material of *Bombus* was identified by J. BĄK and members of the genera *Hylaeus* and *Nomada* by W. CELARY. The names of plant families were used after GREUTER et al. (2000), and names of species after MIREK et al. (1995).

The list of research localities, where Apiformes (except Apidae) were collected, is presented below together with abbreviations used in the list of species. Original Polish names are given in brackets, when necessary.

Research area I

ŚwK – Święty Krzyż Mt. (meadows on the top of the mountain)

Go1 – stony forest clearance 1 (Gołoborze 1)

PB – Bielnik meadow (Polana Bielnik)

Ły – Łysica Mt., a forest road from Święta Katarzyna to the top of the mountain

Go 2 – stony forest clearance 2 (Gołoborze 2)

Mr – Mokry Bór forest, the edge of the forest from the side of Święta Katarzyna

Mrp – Mokry Bór forest with mid-forest meadows

Po – Podgórze, mid-forest meadows

Ka – Święta Katarzyna, meadows and between village buildings

Kat – meadows in Święta Katarzyna

Z – road edges and roads, a tourist path from Łysica to Święta Katarzyna

WSz – Wola Szczygiełkowa, mid-forest meadows

Research area II

NS – Nowa Słupia, areas in the vicinity of forests and at the path to Święty Krzyż
GCh – Chełmowa Góra Mt.
Cz – Cząstków Skała
Ru – Rudki
Ba – Baszowice
Mi – Mirocice
Ce – Celiny
Bo – Bodzentyn

Reaearch area III

Ci – Ciekoty
Mą – Mąchocice
DW –Dolina Wilkowska Valley
Kr – Krajno
KD – Krajno Dolne
KG – Krajno Górne
Por – Porąbki
Kak – over Kakonin
BP – Bieliny Poduchowne
HS – Huta Szklana
Br – Bartoszowiny

Bombini were collected on all localities listed above. Additionally, the insects were caught in the following localities:

Research area II

Ser – Serwis Forest
Za – Zapusty
RzS – Słupianka river
Je – Jeziorko
Db – Dębno
GP – Psarska Góra Mt.
Lś – Leśniczówka

Research area III

Pdł – Podłysica
GB – Barania Góra Mt.
SH – Stara Huta
JD – Jastrzębi Dół
Trz – Trzcianka
Ła – Łazy

For chosen bee species a domination coefficient was calculated according to BALOGH (1958):

$$D = \frac{s}{S}100\%$$

where:

s – number of individuals of each species in the research area

S – total number of individuals of all species in the research area

For the purpose of the domination description the following classes were accepted after WITKOWSKI (1975): D_1 – subrecedents, up to 1% of individuals; D_2 – recedents, 1.1-2% of individuals; D_3 – subdominants, 2.1-5% of individuals; D_4 – dominants, 5.1-10% of individuals; D_5 – eudominants, over 10% of individuals.

Additionally, the coefficient of occurrence constancy was calculated according to the equation:

$$C - \frac{q}{Q}100\%$$

where

q – number of catches where a certain species was present

Q – total number of investigated catches.

For this purpose a scale after TISCHLER was used (TROJAN 1975): GAS – absolutely constant species (75.1-100%); GS – constant species (50.1-75%); GA – accessory species (25.1-50%); GP – accidental species (0-25%).

In addition, the assemblage similarity of MARCZEWSKI-STEINHAUSE (TROJAN 1975) was calculated:

$$S = \frac{100w}{(a+b)-w}$$

where

S – similarity

w – number of common species in both assemblages

a – number of species in an assemblage A

b – number of species in an assemblage B.

V. LIST OF SPECIES

In the list of Apiformes, (except Apidae), the name of collector is omitted because all of them were collected by M. DYLEWSKA. However, in the list of Apidae the names of collectors are given.

Colletidae

1. ***Hylaeus brevicornis*** NYLANDER, 1852

I. WSz – 7.08.1983, ♀ on *Stachys*
III. DW – 8.07.1982, ♂ on *Rubus idaeus*

2. ***Hylaeus communis*** NYLANDER, 1852

I. ŚwK – 17.07.1982 2 ♀♀♂ on *Heracleum sphondylium*; W Sz – 7.08.1989, 3 ♀♀ on *Heracleum sphondylium*; DW – 8.07.1982, 3 ♂♂ on *Rubus*; Ka – 20.07.1983, ♂
II. Bo – 7.07.1982, 4 ♂♂ on *Sinapis arvensis;* Cz – 16.07.1982, 2 ♀♀ on *Centaurea* and *Campanula*

3. ***Hylaeus confusus*** NYLANDER, 1852

I. ŚwK – 17.07.1982, 2 ♀♀♂ on *Heracleum sphondylium*; WSz – 7.08.1989, ♀

4. ***Hylaeus difformis*** (EVERSMANN, 1852)

I. ŚwK – 19.07.1982, ♀
II. NS – 13.07.1982, ♀ and 7.07.1989, 2 ♂♂ on *Melissa*; GCh – 16.07.1982, 4 ♀♀ on *Campanula and Centaurea*; Bo – 7.07.1982, ♂ on *Sinapis arvensis* and 10.08.1982, ♂;
Mi – 7.07.1983, 2 ♂♂
III. KG – 10.08.1983, ♂; Kr – 20.07.1982, ♂; BP – 7.08.1982, ♀

5. ***Hylaeus hyalinatus*** SMITH, 1842

I. ŚwK – 17. and 20.07.1982, 3 ♂♂♂; Ka – 20.071983, 2 ♂♂
II. Bo – 8.07.1982, ♀ on *Sinapis arvensis*; Cz – 16.07.1982, ♀♂ on *Campanula*;
NS – 13.07.1982, ♀
III. Kr – 10.08.1983, ♂ and 20.07.1982, ♂; BP – 7.08.1983, ♀

6. ***Hylaeus nigritus*** (FABRICIUS, 1798)

I. ŚwK – 19.07.1982, ♂; WSz – 28.08.1983, ♀ on *Hieracium*
II. GCh – 16.07.1982, 3 ♀♀ on *Sinapis arvensis*; Cz – 16.07.1982, 3 ♀♀
III. Kr – 10.07.1982, ♂; HS – 20.07.1983, 2 ♀♀

7. ***Hylaeus sinuatus*** (SCHENCK, 1853)

II. Bo – 7. and 13.07.1982, 2 ♀♀ 7 ♂♂ on *Campanula* and *Sinapis arvensis*; Ba – 7.07.1982, ♀ on *Campanula*
III. BP – 7.08.1982, ♀; Ci – 8.07.1982, 3 ♂♂ on *Rubus idaeus*

8. ***Colletes punctatus*** MOCSARY, 1877

III. BP – 24.06.1982, 3 ♂♂ on *Heracleum sphondylium* and 17.07.1982, ♀ 18 ♂♂ on *Anthemis arvensis*; 7.08.1982, 5 ♂♂; KD – 20.07.1982, 3 ♀♀

9. ***Colletes succinctus*** (LINNAEUS, 1785)

III. BP – 24.06.1982, 5 ♂♂ on *Heracleum sphondylium* and 17.07.1982, ♀ 18 ♂♂ on *Anthemis arvensis* and 7.08.1983, 4 ♂♂; KD – 20.07.1982, 4 ♀♀; HS – 20.07.1983, 3 ♂♂ on *Ranunculus*

Andrenidae

10. ***Andrena alfkenella*** PERKINS, 1914

II. Bo – 29.04.1983, ♀♀ on *Taraxacum*

11. ***Andrena apicata*** SMITH, 1847

II. NS – 25.05.1982, 4 ♀♀; Ci – 9.05.1982, ♂ on *Salix*

III. BP – 12.05.1982, ♀ on *Taraxacum* and 21 and 27.05.1983, 3 ♀♀ on *Rubus idaeus* and *Taraxacum*; Br – 25.05.1983, ♀ on *Rubus idaeus* and 24.05.1982, ♂ on *Salix*

12. ***Andrena bicolor*** FABRICIUS, 1775

I. ŚwK – 17.07.1982, ♀ and 9.07.1983, 3 ♀♀ on *Salvia*; Ka – 5.05.1982, ♂ *Salix*

II. Bo – 8.07.1983, ♂ on *Campanula* and 18.05.1982, ♀ on *Ribes*; Ru – 9.07.1983, 3 ♀♀ on *Campanula*; NS – 7.07.1983, 2 ♀♀ on *Melissa*

III. Por – 16.05.1983, ♀ on *Crataegus*; Ci – 7.05.1982, ♂ on *Salix*; BP – 25.05.1983, ♂ on *Ranunculus*; HS – 6.05.1982, ♂ on *Salix*; Mą – 5.07.1983, ♀; Br – 7.07.1983, 3 ♀♀

13. ***Andrena bimaculata*** (KIRBY, 1802)

III. BP – 12.05.1982, ♀ on *Taraxacum* and 8.05.1982, 4 ♀♀ on *Ribes*

14. ***Andrena chrysosceles*** (KIRBY, 1802)

II. NS – 8.05.1982, ♂ on *Salix*; Bo – 13.05.1982, ♀

15. ***Andrena clarkella*** (KIRBY, 1802)

I. Ka – 4. - 6.05.1983, 12 ♀♀

16. ***Andrena congruens*** SCHMIEDEKNECHT, 1883

II. Cz – 16.07.1982, ♀ on *Anthemis arvensis*

17. ***Andrena decipiens*** SCHENCK, 1859

II. NS – 24.05.1983, ♀

18. ***Andrena dorsata*** (KIRBY, 1802)

I. Ka – 2.07.1983, 3 ♀♀ on *Potentilla erecta* and 15.05.1982, ♀ and 16. and 19.05.1983, 2 ♀♀ on *Crataegus*

II. Ru – 9.07.1982, 3 ♀♀♂; Bo – 8.07.1983, 37 ♀♀ on *Sinapis arvensis* and *Campanula*; Cz – 16.07.1982, 4 ♀♀ on *Anthemis arvensis*; NS – 25.05.1985, 3 ♀♀; Ba – 07.07.1983, 12 ♀♀

III. BP – 7.07.1983, 13 ♀♀ on *Chamomilla recutita* 7.08.1983, ♀; Br – 7.07.1983, 3 ♀♀; Por – 16.05.1983, ♀

19. ***Andrena fucata*** SMITH, 1847

I. Ka – 25.06.1982, 2 ♀♀ on *Rubus idaeus*; Kat – 4.05.1981, ♀ and 9.06.1981, 9 ♀♀ on *Rubus idaeus*; PB – 27.05.1983, 2 ♀♀ on *Rubus idaeus*

II. Bo – 4.05.1982, ♂

III. Por – 16.05.1983, ♀ on *Crataegus*; BP – 27.05.1983, 4 ♀♀ on *Rubus idaeus*; KG – 9.06.1981, ♀ on *Rubus idaeus*; KD – 20.07.1983, 2 ♀♀ on *Rubus idaeus*

20. ***Andrena fulva*** (MÜLLER, 1766)

III. BP – 6, 8, 12 and 21.05.1982, 16 ♀♀ on *Ribes*

21. ***Andrena fuscipes*** (KIRBY, 1802)

II. Bo – 7 and 8.07.1983, 38 ♀♀ on *Sinapis arvensis*, *Campanula* and *Hieracium*; Ru – 9.07.1983, 3 ♀♀ on *Campanula*
III. Kr – 10.08.1983, ♀

22. ***Andrena gelriae*** VAN DER VECHT, 1927

II. Bo – 2.07.1983, ♀ on *Vicia*

23. ***Andrena gravida*** IMHOFF, 1832

III. Br – 29.04.1983, ♀ on *Pirus* and 25.05.1983, ♀

24. ***Andrena haemorrhoa*** (FABRICIUS, 1781)

I. Ka – 4-6.05.1982, ♀ 4 ♂♂ on *Salix*; ŚwK – 20.05.1982, ♀
II. Bo – 29 and 30.04.1983, 6 ♀♀ 3 ♂♂ and 15.05.1982, 2 ♀♀ 7 ♂♂ on *Taraxacum*; NS – 8, 15 and 17.05.1982, 5 ♀♀ 4 ♂♂ on *Salix* and *Prunus avium* 25.05.1983, 2 ♀♀, 2. and 3.07.1983, on *Vicia*;
III. HS – 6 and 17.05.1982, ♀ 18 ♂♂ on *Prunus avium*; Por – 14.05.1983, 7 ♀♀ on *Crataegus*; Br – 4, 14, 25 and 29.05.1982, 9 ♀♀ 14 ♂♂ on *Taraxacum* and 25.06.1982, ♀; BP – 6, 12, 17 and 21.05.1982, 22 ♀♀ 9 ♂♂ on *Ribes*, *Taraxacum*, *Rubus*; BP – 25.05.1983, 2 ♀♀

25. ***Andrena hattorfiana*** (FABRICIUS, 1775)

II. NS – 7.07.1983, ♀
III. Mą – 5. and 7.07.1983, 3 ♀♀ on *Knautia arvensis*

26. ***Andrena helvola*** (LINNAEUS, 1758)

I. ŚwK – 25.05.1982, ♀ on *Crataegus*
III. Ci – 7.05.1982, ♀ on *Salix*

27. ***Andrena humilis*** IMHOFF, 1832

II. Bo – 29.04.1983, 2 ♂♂ on *Taraxacum*
III. Kr – 14.05.1982, ♂

28. ***Andrena jakobi*** PERKINS, 1921

I. ŚwK – 17.05.1982, ♀
II. Bo – 29.04.1983, ♀ on *Taraxacum*
III. HS – 17.05.1982, ♂ on *Prunus avium*

29. ***Andrena labiata*** FABRICIUS, 1781

II. Ru – 15.05.1982, ♀ on *Taraxacum*
III. BP – 21.05.1982, ♀ on *Veronica chamaedrys* and ♂ on *Taraxacum* and 25 and 27.05.1983, ♀♂; Por – 16.05.1983, 4 ♂♂ on *Veronica chamaedrys*

30. ***Andrena lapponica*** ZETTERSTEDT, 1838

I. Mr – 21. 22 and 23.05.1982, 3 ♀♀ on *Vaccinium myrtillus* and 4.06.1981, 2 ♀♀ on *Vaccinium myrtillus*
II. Ce – 19.05.1982, 2 ♀♀ on *Vaccinium myrtillus*

31. ***Andrena lathyri*** ALFKEN, 1899

II. NS – 25.05.1983, ♂ on *Campanula*
III. BP – 27.05.1983, ♂ on *Rubus*

32. ***Andrena lepida*** SCHENCK, 1853

II. Bo – 4.05.1982, ♂

33. ***Andrena minutula*** (KIRBY, 1802)

I. Ka – 9.07.1982, ♀
II. NS – 24.05.1983, 7 ♀♀ on *Heracleum sphondylium*
III. Bo – 29.04.1983, 2 ♂ on *Taraxacum*

34. ***Andrena minutuloides*** PERKINS, 1914

II. Bo – 29.04.1983, ♀ 2 ♂♂ on *Taraxacum*

35. ***Andrena nigroaenea*** (KIRBY, 1802)

I. Ka – 15.05.1983, ♂
II. Bo – 18.05.1982, ♂ on *Ribes*
III. KG – 15.05.1983, 2 ♂♂ on *Vaccinium myrtillus*; Por – 16.05.1983, ♂ on *Crataegus*; Br – 25.05.1983, ♂

36. ***Andrena nitida*** (MÜLLER, 1776)

I. Mrp – 5.05.1982, ♀ on *Salix*
III. Mą – 8.05.1982, ♀ on *Crataegus*; Por – 15 and 16.05.1983, ♀♂ on *Crataegus*; KG – 15.05.1983, 2 ♂♂ on *Vaccinium myrtillus*

37. ***Andrena pilipes*** FABRICIUS, 1871

III. Mą – 6.05.1982, 3 ♂♂ on *Crataegus*; Ci – 7.05.1982, ♂ on *Salix*

38. ***Andrena praecox*** (SCOPOLI, 1763)

II. Bo – 4.05.1982, ♀ 2 ♂♂ and 18.05.1982, ♀ on *Ribes* and 19.05.1983, ♀♀ on *Pirus* and *Philadelphus coronarius*
III. Ci – 7.05.1982, 7 on *Salix*; KG – 7.05.1982, ♀; Por – 16.05.1983, 2 ♀♀ on *Crataegus*; BP – 12.05.1982, 5 ♀♀ on *Leontodon* and *Taraxacum*. and 25 and 27.05.1983, 2 ♀♀ on *Rubus idaeus*; Br – 14.05.1982, ♂ on *Salix* and 25.05.1983,♀ ; Kr – 14.05.1982, ♀

39. ***Andrena schencki*** F. MORAWITZ, 1866

II. Bo – 2. 07. 1983, ♀ on *Vicia*

40. ***Andrena semilaevis*** PEREZ, 1903

II. NS – 24.05.1983, ♀ on *Philadelphus coronarius*

41. ***Andrena subopaca*** NYLANDER, 1848

I. ŚwK – 17.05.1982, 3 ♀♀; PB – 17.05. 1982, ♀ and 27.05.1983, ♀ on *Ribes*
II. Ru – 14.05.1982, ♂ on *Taraxacum*; Bo – 13.05.1982, ♂ on *Taraxacum*
III. BP – 21.06.1982, ♂ on *Taraxacum* and 13.05.1982, 3 ♀♀ on *Potentilla erecta* and 27.05.1983, ♀ on *Leontodon*

42. ***Andrena tarsata*** NYLANDER, 1848

I. Ka – 2.07.1983, ♀ on *Potentilla erecta*
III. Mą – 6.05.1982, on *Crataegus*

43. ***Andrena thoracica*** FABRICIUS, 1776

II. Bo – 29.04.1983, ♂ on *Taraxacum*

44. ***Andrena tibialis*** (KIRBY, 1802)

III. BP – 17.05.1982, 2 ♀♀ on *Padus avium*

45. ***Andrena trimmerana*** (KIRBY, 1802)

II. Bo – 15 and 24.04.1982, 2 ♂♂ and 4.05.1982, ♂

46. ***Andrena varians*** (ROSSI, 1792)

I. ŚwK – 9.07.1983, ♀ on *Salvia*; Ka – 25.05.1982, ♀
II. Bo – 4.05.1982, 20 ♀♀ 12 ♂♂ on *Prunus spinosa* and *Taraxacum*; Ru – 8.05.1982, ♀ on *Ribes*
III. Por – 16.05.1983, 7 ♀♀ on *Crataegus*; BP – 5 and 6.1982, 6 ♀♀ 4 ♂♂on *Ribes*; HS – 6.05.1982, ♂; Ci – 7.05.1982, ♀ on *Salix*

47. ***Andrena ventralis*** IMHOFF, 1832

II. Bo – 8.05.1982, 20 ♀♀ 12 ♂♂ on *Prunus spinosa*
III. BP – 12.05.1982, ♀ on *Taraxacum*

Halictidae

48. ***Halictus maculatus*** SMITH, 1848

I. Mr – 4.06.1981, ♀ on *Potentilla erecta*
III. KD – 20.07.1982, 4 ♂♂

49. ***Halictus rubicundus*** (CHRIST, 1791)

II. Bo – 29.04.1983, ♀ on *Taraxacum*
III. BP – 27.05.1983, ♀ on *Leontodon*; Ba – 21.05.1983, ♀ on *Taraxacum*

50. ***Seladonia tumulorum*** (LINNAEUS, 1758)

I. Ka – 2.07.1983, ♀
II. Ru – 9.07.1983, 2 ♀♀ on *Lotus corniculatus*; Ba – 9.07.1983, ♀ on *Lotus corniculatus*; Bo – 9.04.1983, ♀ on *Taraxacum*; NS – 7.06.1983, ♀ on *Melissa* and 25.05.1983, ♀
III. KG – 10 and 30.08.1983, 3 ♀♀ 2 ♂♂; KD – 16.05.1983, 2 ♀♀ on *Lamium album* and 30.08.1983, ♂ on *Solidago*; Mi – 7.07.1983, 2 ♀♀

51. ***Lasioglossum lativentre*** (SCHENCK, 1853)

III. Mą – 5.07.1983, ♀

52. ***Lasioglossum leucozonium*** (SCHRANK, 1781)

I. Mr – 2.07.1983, ♀ on *Potentilla erecta*; Ka – 2.07.1983, ♀ on *Potentilla erecta*
II. Ru – 9.07.1983, ♂; NS – 27.08.1983, ♂ on *Hieracium*
III. – HS – 10.08.1983, 4 ♀♀ and 30.08.1983, ♂

53. ***Lasioglossum quadrinotatum*** (KIRBY, 1802)

I. ŚwK – 9.07.1983, ♂
III. KG – 10.08.1983, 2 ♂♂

54. ***Lasioglossum sexnotatum*** (KIRBY, 1802)

I. ŚwK – 17.05.1982, ♀
II. Ru – 9.07.1982, 2 ♀♀; NS – 25.05.1983, ♀; Mi – 7.07.1983, ♀
III. Ci – 7.05.1983, ♀ on *Salix*; KG – 10.08.1983, 4 ♀♀; BP – 27.05.1983, ♀ on *Rubus idaeus*

55. ***Lasioglossum subfasciatum*** (IMHOFF, 1832)

III. Ci – 7.05.1982, ♀ on *Salix.*

56. ***Lasioglossum zonulum*** (SMITH, 1848)

I. Mr – 2.07.1982, ♀ on *Potentilla erecta*

57. ***Evylaeus albipes*** (FABRICIUS, 1781)

I. ŚwK – 9.07.1983, ♀ and 17.07.1982, ♀♂; Mr – 2, 12 and 29.07.1983, 3 ♂♂ on *Potentilla erecta* and *Hieracium*; WSz – 7 and 29.08.1983, ♀♂ and 29.07.1983, ♂ on *Hieracium*
II. Ru – 14.05.1983, 3 ♂♂ on *Taraxacum* and 9.07.1983, ♂; Bo – 4.06.1981, ♀ and 7. and 9.07.1982, 3 ♀♀ on *Anthemis arvensis*; NS – 25.05.1983, 2 ♀♀ and 7.07.1983

III. DW – 8.07.1982, ♀ on *Veronica chamaedrys*; KG – 10 and 30.08.1983, ♀ 2 ♂♂ and 20.07.1983, ♂; KG – 10.08.1983, ♀; KD – 30.08.1983, 2 ♂♂ on *Anthemis arvensis*; BP – 7.08.1983, ♂ and 26.05.1983, 3 ♀♀ on *Ranunculus*; Br – 21.08.1982, 3 ♀♀ on *Taraxacum*

58. ***Evylaeus calceatus*** (SCOPOLI, 1763)

I. ŚwK – 17.06.1982, ♀♂; Mr – 2.07.1983, 2 ♀♀ on *Potentilla erecta*; WSz – 7 and 30.08.1983, ♀♂

II. Ru – 14.05.1982, ♀ on *Taraxacum*; NS – 8.05.1982, ♀ on *Salix*; Bo – 4.06.1981, ♀ and 12 and 13.05.1982, 5 ♀♀ on *Taraxacum* and 7.07.1982, 2 ♀♀ on *Anthemis arvensis* and 29.05.1983, ♀ on *Taraxacum*

III. KG – 20.07.1982, 2 ♀♀ and 10.08.1983, ♂; KD – 17.and 20.07.1982, 5 ♀♀ 2 ♂♂ and 30.08.1983, 3 ♂♂ on *Solidago* and 27.05.1983, 2 ♀♀ on *Rubus idaeus* and 7.08.1983, ♀; HS – 26.07.1983, 3 ♀♀; Br – 21.05.1982, ♀ on *Taraxacum*

Evylaeus fratellus (PEREZ, 1903)

Mentioned by LIANA (2000) *Halictus niger* was not met in the Łysogóry Mountains, though it could be found there.

59. ***Evylaeus fulvicornis*** (KIRBY, 1802)

I. ŚwK – 17.05.1982, 2 ♀♀ and 9.07.1983, ♂; PB – 17.07.1982, 7 ♀♀ on *Potentilla erecta*; Mr – 4 and 5.05.1982, 3 ♀♀; Ka – 13.05.1983, ♀ on *Armoracia rusticana*; WSz – 7.08.1983, 3 ♀♀

II. Ru – 14.05.1982, 3 ♀♀ on *Taraxacum*; Bo – 13.05.1982, 31 ♀♀ on *Taraxacum* and 7 and 12.07.1982, 3 ♀♀ on *Sinapis arvensis* and 27 and 29.04.1983, 8 ♀♀ on *Taraxacum* and 9. and 12.07.1982, 2 ♀♀ and 5.09.1983, ♂ on *Sinapis arvensis*; NS – 25.05.1983, 2 ♀♀ and 7.07.1983, ♀ on *Melissa*

III. Ci – 7.05.1982, 3 ♀♀ on *Salix*; KG – 14.05.1982, 5 ♂♂ and 8.07.1982, ♀♂ on *Hieracium* and 10 and 30.08.1983, 3 ♂♂; KD – 15-16.05.1983, 3 ♀♀ on *Lamium album* and 20.07.1982, ♀♂ and 30.08.1983, ♂ on *Solidago*; Po – 16.05.1983, 2 ♀♀ on *Crataegus* and *Veronica chamaedrys*; HS – 17.09.1983, ♂ and 20.07.1983, ♂; BP – 21.06.1982, ♀ on *Taraxacum* and 27.05.1983, ♀ on *Rubus idaeus* and 7.08.1983, 8 ♀♀; Br – 21.05.1982, ♀

60. ***Evylaeus laticeps*** (SCHENCK, 1869)

II. Ns – 8.08.1983, 2 ♀♀ on *Melissa*; Mi – 7.07.1983, 2 ♂♂

61. ***Evylaeus leucopus*** (KIRBY, 1802)

I. Ka – 9.07.1983, ♀

II. Ru – 9.07.1983, ♀

III. Br – 21.05.1982, ♀ on *Taraxacum*

62. ***Evylaeus minutulus*** (SCHENCK, 1853)

III. BP – 25.05.1989, ♀

63. ***Evylaeus morio*** (FABRICIUS, 1793)

I. ŚwK – 17.07.1983, ♂

II. Ru – 9.07.1983, 4 ♂♂; Bo – 12.07.1982, 2 ♀♀♂; NS – 9.07.1983, 2 ♀♀ on *Melissa*

III. KG – 30.08.1983, ♂; KD – 16.05.1983, ♀ on *Lamium album* and 10 and 30.08.1983, 9 ♂♂ on *Solidago*

64. ***Evylaeus pauxillus*** (SCHENCK, 1853)

II. Bo – 13.06.1982, ♀ on *Campanula* and 7.07.1982, ♀

III. KD – 16.05.1983, ♀ on *Lamium album*

65. ***Evylaeus rufitarsis*** (ZETTERSTEDT, 1838)

I. Mr – 4.06.1981. 2 ♀♀ on *Potentilla erecta*

III. DW – 8.07.1982, 2 ♀♀ on *Achilea salicifolia*; KG – 25.05.1983, ♀

66. ***Evylaeus villosulus*** (KIRBY, 1802)

II. Ru – 9.07.1983, 3 ♂♂ on *Salvia pratensis*

III. BP – 25 and 27.05.1983, 10 ♀♀ on *Ranunculus* and *Leontodon*; HS – 19.09.1983, ♀ on *Campanula*

67. ***Sphecodes ephippius*** (LINNAEUS, 1767)

II. Ru – 14.05.1982, ♀ on *Taraxacum*
III. KD – 30.08.1983, ♂ on *Solidago*; Kak – 20.07.1983, ♂

68. ***Sphecodes monilicornis*** (KIRBY, 1802)

II. Ru – 7.07.1983, ♂; Bo – 18.07.1982, ♀
III. KG – 10.07.1983, ♂ on *Calluna vulgaris*

69. ***Rhophitoides canus*** (EVERSMANN, 1852)

II. NS – 7.07.1983, ♂

70. ***Rophites quinquespinosus*** SPINOLA, 1808

II. Ba – 18.07.1982, ♀♂ on *Leonurus cardiaca*

Melittidae

71. ***Macropis fulvipes*** (FABRICIUS, 1804)

I. PB – 7.08.1983, 4 ♀♀ ♂ and 27.05.1983, 2 ♂♂; WSz – 7.08.1983, 3 ♀♀ 8 ♂♂; Mr – 25.06.1982, 2 ♂♂ on *Lysimachia* and 2 and 22.07.1983, 8 ♀♀ 34 ♂♂ on *Lysimachia* and 10.08.1983, 2 ♂♂ on *Lysimachia*; Ka – 2.07.1983, 3 ♀♀ on *Lysimachia*; Mrp – 25.06.1982, 2 ♂♂
II. Bo – 7.08.1983, ♀
III. DW – 8.07.1982, 2 ♂♂ on *Lysimachia nummularia*; KG – 7.07.1982, 4 ♀♀ and 10.08.1983, 2 ♂♂ on *Lysimachia*

72. ***Macropis europea*** WARNCKE, 1973

I. WSz – 4 and 7.08.1983, 2 ♂♂ and 8.07.1983, ♀; ŚwK – 1 spm (DROGOSZEWSKI 1932)
III. KG – 7.08.1983, ♀

Megachilidae

73. ***Trachusa byssina*** (PANZER, 1798)

I. ŚwK – 9.07.1983, ♂; WSz – 25.06.1982, ♂ on *Echium vulgare* and 7.08.1983, ♀♂ on *Stachys*
III. KG – 9.07.1983, ♀

74. ***Anthidium manicatum*** (LINNAEUS, 1758)

II. NS – 7.07.1983, 2 ♀♀ on *Melilotus wolgica* and 7.08.1983, ♀♂
III. KG – 20.07.1982, ♀ on *Melilotus wolgica*; BP – 7.08.1983, ♂

75. ***Stelis phaeoptera*** (KIRBY, 1802)

II. Ba – 8.07.1982, ♀ on *Centaurea*

76. ***Stelis punctulatissima*** (KIRBY, 1802)

II. Ru – 14.05.1982, 2 ♀♀ on *Ajuga*

77. ***Heriades truncorum*** (LINNAEUS, 1758)

II. Ba – 17.07.1982, ♂ on *Campanula*
III. BP – 17.07.1982, ♂; Br – 7.07.1983, ♀♂

78. ***Chelostoma campanularum*** (KIRBY, 1802)

I. ŚwK – 17.05.1982, ♂; Ka – 29.04.1983, ♀ 8 ♂♂
II. Cz – 16.07.1982, 5 ♀♀ 4 ♂♂ on *Campanula*; Ba – 13 and 15.07.1982, 3 ♂♂ on C*ampanula*; Bo – 8.09.1983, ♀ 3 ♂♂ on *Campanula*, and 29.04.1983, ♂ on *Taraxacum* and 22.05.1982, ♀ on *Ranunculus*; NS – 22.05.1982, 5 ♂♂
III. BP – 7.08.1983, ♀ on *Campanula* and 27.05.1983, 2 ♂♂ on *Primula elatior* and 25.05.1983, 2 ♂♂ on *Ranunculus* and 7.08.1983, ♂ on *Campanula*; KD – 16.05.1983, 2 ♀♀ on *Lamium album*

79. ***Chelostoma florisomne*** (LINNAEUS, 1758)

I. ŚwK – 9.07.1983, 2 ♀♀ on *Campanula*
II. Cz – 16.07.1982, 4 ♂♂; NS – 25.05.1983, 2 ♀♀ 14 ♂♂ and 9.06.1981, 5 ♀♀♂
III. BP – 25 and 26.05.1983, 2 ♀♀ 8 ♂♂ on *Campanula* and *Ranunculus* and 27.05.1983, ♂ on *Primula* and 7 and 8.1983, ♂ on *Campanula*

80. ***Chelostoma rapunculi*** (LEPELETIER, 1841)

I. ŚwK – 9.07.1983, 2 ♀♀ on *Campanula*
II. Cz – 16.07.1982, 4 ♂♂ on *Campanula*
III. BP – 26.05.1983, 2 ♀♀ 6 ♂♂ on *Campanula*

81. ***Hoplitis adunca*** (PANZER, 1798)

II. NS – 26.06.1982, 3 ♀♀ on *Echium vulgare* and 26.06.1983, ♀ on *Echium vulgare* and 13.07.1982, 2 ♂♂; Bo – 7.07.1982, 4 ♀♀ on *Echium vulgare*

82. ***Hoplitis leucomelana*** (KIRBY, 1802)

II. Ru – 8.07.1983, ♀

83. ***Osmia aurulenta*** (PANZER, 1799)

II. Ru – 14.05.1983, ♂ on *Ajuga reptans*

84. ***Osmia brevicornis*** (FABRICIUS, 1798)

II. NS – 25 and 26.06.1982, 3 ♀♀ on *Echium vulgare*

85. ***Osmia caerulescens*** (LINNAEUS, 1758)

I. Ka – 29.04.1982, ♂; ŚwK – 25.05.1983, 2 ♂♂ on *Crataegus*
II. NS – 9.07.1981, ♀♂; Bo – 12.07.1982, ♂
III. KD – 16.05.1983, 2 ♀♀ 3 ♂♂ on *Lamium album*; BP – 24.06.1982, ♀♂ on *Knautia arvensis*; Por – 12.07.1982, ♀♂

86. ***Osmia leaiana*** (KIRBY, 1802)

I. ŚwK – 25.05.1983, ♂ on *Crataegus*; Ka – 29.04.1983, 2 ♂♂
II. NS – 9 and 13.07.1981, 2 ♀♀ on *Lamium*; Ba – 13.07.1982, 5 ♀♀ on *Centaurea*; Bo – 7 and 12.07.1982, 3 ♀♀ on *Cichorium intybus*
III. KD – 16.05.1983, 2 ♀ 4 ♂♂ on *Lamium album*; BP – 24.06.1982, 2 ♂♂ on *Knautia arvensis*

87. ***Osmia parietina*** CURTIS, 1828

I. Mr – 26.06.1982, ♂

88. ***Osmia rufa*** (LINNAEUS, 1758)

I. Ka – 29.04.1983, 3 ♀♀ and 4.05.1983, 2 ♀♀ na *Lotus corniculatus* and 15 and 25.1983, ♀ 3 ♂ on *Crataegus*, *Syringa vulgaris* and *Silene*
II. NS – 8.05.1982, ♂ on *Salix* and 25.05.1983, 10 ♀♀ on *Ranunculus*; Bo – 4.05.1982, ♀ 4 ♂♂ on *Ribes*
III. KG – 15.05.1983, 6 ♂♂ on *Ajuga*; KD – 16.05.1983, 9 ♀♀ 2 ♂♂ on *Lamium album*; BP – 12.05.1982, ♀ on *Ranunculus* and ♂ on *Ribes*; Ba – 25 and 27.05.1983, 3 ♀♀ on *Gymnocarpium robertianum* and *Lotus corniculatus* and *Silene*

89. ***Chalicodoma ericetorum*** LEPELETIER, 1981

II. NS – 25 and 26.06.1982, 4 ♂♂ on *Echium vulgare* and 13.07.1982, ♂ and 8.07.1983, 3 ♀♀ on *Melissa*; Bo – 12.07.1982, 2 ♂♂

90. ***Megachile centuncularis*** (LINNAEUS, 1758)

I. ŚwK – 9.07.1983, ♂ on *Geranium sanguineum*

91. ***Megachile circumcincta*** (KIRBY, 1802)

II. Cz – 9.07.1983, ♀

92. ***Megachile willughbiella*** (KIRBY, 1802)

II. Cz – 16.07.1983, 10 ♀♀ 2 ♂♂; NS – 9.06.1981, ♀; Ba – 9.07.1982, ♂ on *Lotus corniculatus* and 13.07.1983, 3 ♀♀ 3 ♂♂ on *Melilotus wolgica*
III. KD – 20.07.1982, 2 ♀♀ on *Melilotus wolgica* and *Melissa*; BP – 25 and 27.05.1983, 2 ♂♂

93. ***Coelioxys elongata*** LEPELETIER, 1841

II. Ru – 13.07.1982, ♀ on *Coronilla varia*

Anthophoridae

94. ***Nomada fabricina*** (LINNAEUS, 1767)

II. Bo – 13.05.1982, ♂ on *Taraxacum*

95. ***Nomada flava*** PANZER, 1798

I. Mr – 13.05.1983, ♂
II. Bo – 29.04.1983, ♂ on *Taraxacum*
III. KG – 14.05.1982, ♀ on *Vaccinium myrtillus*

96. ***Nomada marshamella*** (KIRBY, 1802)

II. Bo – 29.04.1983, 3 ♀♀ on *Taraxacum*; Ba – 23.05.1982, ♀ on *Taraxacum*; NS – 25.05.1983, ♂
III. KG – 15.05.1983, ♀; BP – 8.05.1982, ♀ on *Ribes* and 21.05.1983, ♀ on *Taraxacum*

97. ***Nomada panzeri*** LEPELETIER, 1841

III. Br – 25.05.1983, ♀ on *Rubus idaeus*

98. ***Anthophora bimaculata*** (PANZER, 1803)

II. NS – 13.07.1982, 4 ♀♀ on *Lamium purpureum*

99. ***Anthophora furcata*** (PANZER, 1798)

I. ŚwK – 9.07.1983, ♂; WSz – 9.07.1982, ♂ and 7.08.1983, 4 ♀♀ 5 ♂♂ on *Stachys silvatica*; Ka – 2, 8 and 9.07.1982, ♀ 3 ♂♂on *Stachys germanica*
II. Bo – 2.07.1983, ♂ and 8-9.07.1982, ♀ 2 ♂♂ on *Arthemisia* and 12 and 13.07.1982, 3 ♂♂ on *Leonurus cardiaca*; Ba – 13.07.1982, 2 ♂♂ on *Leonurus cardiaca*; NS – 13.07.1982, 2 ♂♂ on *Lamium purpureum*
III. KG – 7.0871983, 2 ♀♀; BP – 24.06.1982, 2 ♂♂ on *Arthemisia* and 25.06.1982, ♂ on *Echium vulgare*

100. ***Anthophora plumipes*** (PALLAS, 1772)

I. ŚwK – 17.05.1982, ♂ on *Lamium purpureum*; Mr – 4.05.1982, ♀ 2 ♂♂
II. Bo – 29.04.1983, ♀♂ and 4.05.1982, ♀ 3 ♂♂
III. Br – 14.05.1982, ♂ on *Salix*

101. ***Anthophora pubescens*** (FABRICIUS, 1781)

II. NS – 13.07.1982,4 ♀♀ on *Lamium purpureum*

102. ***Anthophora quadrimaculata*** (PANZER, 1806)

I. ŚwK – 9.07.1983, ♀ 2 ♂♂
II. NS – 13.07.1982, 2 ♂♂ on *Lamium purpureum*; Ba – 13.07.1982, 2 ♂♂ on *Leonurus cardiaca*; Bo – 12.07.1982, ♀ 2 ♂♂ on *Lamium purpureum*
III. KD – 20.07.1982, 4 ♀♀ on *Melissa* and *Lamium purpureum*; BP – 24.06.1982, ♀ 7 ♂♂ on *Heracleum sphondylium* and 17.07.1982, 2 ♀♀ 4 ♂♂ and 7.08.1983, 4 ♀♀ 10 ♂♂ on *Arthemisia* and *Heracleum sphondylium*

103. ***Ceratina cyanea*** (KIRBY, 1802)

I. ŚwK – 17.07.1982, ♀♂ on *Campanula*

II. Cz – 16.07.1982, 2 ♀♀ on *Centaurea*; NS – 27.07.1983, ♂ on *Hieracium*; Ba – 13.07.1982, ♀ on *Campanula*

Apidae

104. ***Bombus distinguendus*** F. MORAWITZ, 1869

III. BP – 07.08.1983, ♀ leg. M. DYLEWSKA

105. ***Bombus hortorum*** (LINNAEUS, 1761)

I. ŚwK – 18.09.1963, ♂ (KOŃCZYK 1965) and 18.07.1981, 16 spm on *Trifolium repens* (ČMAK & SZCZYPCIAK-BĄK 1987); Ka – 18.09.1963, 3♀♀ 3♂♂ on *Geranium* (KOŃCZYK 1965) and 10.09.1963, 2♀♀on *Lamium* (KOŃCZYK 1965) and 20.09.1963, ♀♂ on *Geranium* and 20.09.1964, 3♀♀ on *Ajuga* and *Geleobdolon luteum* leg. M. DYLEWSKA and 20.08.1981, 3 spm on *Linaria vulgaris* (ČMAK & SZCZYPCIAK-BĄK 1987); Ły – 19.07.1993, 2 ♂♂ leg. M. DYLEWSKA and 19.09.1963, ♀ and 02.09.1964, 3 ♂♂ on *Cirsium* and *Lamium* and 12.08.1964, 2 ♀♀ on *Trifolium*, *Calluna vulgaris* and *Betonica* (KOŃCZYK 1965); PB –15.09.1982, 4 spm on *Lamium album* and *Carduus*; Go_1 –18.06.1981, 10 spm on *Vaccinium myrtillus*; Mr – 25.09.1982, 1 spm on *Vaccinum myrtillus*, WSz –12.06..1981, 7 spm on *Rubus hirtus* (ČMAK & SZCZYPCIAK-BĄK 1987),

II. GCh – 09.08.1964, ♀ (KOŃCZYK 1965) and 5.08.1983, 8 spm on *Vicia sepium* (ČMAK & SZCZYPCIAK-BĄK 1987); Ru – 09.07.1983, ♂ on *Lamium* leg. M. DYLEWSKA; SH –10.05.1982, 3 spm on *Pulmonaria officinalis*, Db –07.07.1981, 1 spm on *Ballota*; GP –10.07.1982, 4 spm on *Rubus hirtus*; Je –20.05.1981, 3 spm on *Taraxacum officinalis* (ČMAK & SZCZYPCIAK-BĄK 1987); Lś –30.08.1981, 1 spm on *Trifolium repens*; Ser – 5.08.1983, 4 spm; Za –05.07.1983, 1 spm on *Rhinanthus*, RzS –10.08.1981, 1 spm on *Lamium album* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. BP – 18.07.1981, 2 spm; JD – 20.07.1982, 1 spm on *Papaver*; Pdł – 15.07.1982, 1 spm on *Lamium album*; Trz – 12.07.1983, 1 spm; GB –16.05.1981, 2 spm on *Primula* and *Rubus hirtus* (ČMAK & SZCZYPCIAK-BĄK 1987).

106. ***Bombus hypnorum*** (LINNAEUS, 1758)

I. ŚwK – 02.06.1981, 2 spm on *Trifolium pratense* (ČMAK & SZCZYPCIAK-BĄK 1987); PB – 30.06.1998, 5 spm on *Centaurea* and *Hypericum* (DYLEWSKA et al. 1998); Go_1 –18.07.1981, 1 spm on *Vaccinium myrtillus*; WSz –12.06.1981, 1 spm on *Rubus hirtus* (ČMAK & SZCZYPCIAK-BĄK 1987).

II. NS –18.07.1981, 1 spm on *Vicia sepium* (ČMAK & SZCZYPCIAK-BĄK 1987); Ru – 09.07.1983, ♀♂ leg. M. DYLEWSKA; GCh –05.08.1983, 1 spm on *Rhinanthus*; Za – 05.07.1983, 1 spm on *Coronilla varia* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. HS –18.07.1981, 4 spm on *Echium vulgare*; JD –20.07.1982, 2 spm on *Centaurea jacea*; Trz –12.07.1983, 1 spm on *Helianthus* (ČMAK & SZCZYPCIAK-BĄK 1987).

107. ***Bombus jonellus*** (KIRBY, 1802)

I. Po – 04.06.1981, ♀ leg. M. DYLEWSKA; Mr – 05.05.1962, ♀ (DYLEWSKA & ZABŁOCKI 1972) 23. 05. 1982, 2 ♀♀ on *Salix* leg. M. DYLEWSKA.

108. ***Bombus lapidarius*** (LINNAEUS, 1758

I. PB –15.09.1982, 1 spm on *Trifolium pratense* (ČMAK & SZCZYPCIAK-BĄK 1987) and 30.06.1998, 1 spm (DYLEWSKA et al. 1998); WSz –12.06.1981, 1 spm on *Carduus crispus* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. Kr – 20.08.1983, 2 ♀♀ leg. M. DYLEWSKA.

109. ***Bombus lucorum*** (LINNAEUS, 1761)

I. ŚwK – 12.08.1964, 2 ♀♀on *Trifolium* and 2.08. and 20.09.1963, 2 ♀♀ 6 ♂♂ on *Cirsium*, *Lamium* and *Geranium* leg. J. KOŃCZYK and 18.07.1981, 21 spm on *Hypericum perforatum*, *Trifolium pratense* and *Vicia sepium*; PB –15.09.1982, 2 spm on *Carduus crispus* (ČMAK & SZCZYPCIAK-BĄK 1987) and 30.06.1998, 10 spm on *Centaurea*, *Knautia arvensis* and *Hypericum* (DYLEWSKA et al. 1998); Ka –20.08.1981, 18 spm on *Medicago sativa, Lupinus luteus* and *Lamium*; Por – 07.08.1983, 6 spm; WSz – 12.07.1981, 4 spm on *Lotus corniculatus* and *Lamium album*, Mr – 10.07.1981, 10 spm on *Vaccinium myrtillus* and *Lamium album* (ČMAK & SZCZYPCIAK-BĄK 1987).

II. Lś – 30.05.1981, 3 spm on *Vaccinium myrtillus* and *Linaria vulgaris*; GCh – 5.08.1983, 6 spm on *Anchusa officinalis*; NS – 18.07.1981, 4 spm on *Impatiens*; GP – 10.07.1982, 4 spm on *Melampyrum nemorosum* and *Carduus crispus*; Db – 7.07.1981, 3 spm; Ser – 12.06.1982, 1 spm on *Galeobdolon luteum*; RzS –

10.08.1981, 5 spm on *Vicia sepium*; Za – 5.05.1982, 8 spm on *Pulmonaria officinalis, Impatiens* and *Daktylorhiza majalis* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. JD – 20.05.1981, 5 spm on *Vicia sepium*; GB – 16.05.1981, 7 spm on *Primula*; Trz – 12.07.1983, 4 spm on *Vicia sepium* and *Lupinus luteus*; Ła – 18.07.1981, 8 spm on *Lamium album* and *Carduus crispus*, Pdł – 15.07.1982, 6 spm on *Carduus* and *Linaria vulgaris* (ČMAK & SZCZYPCIAK-BĄK 1987).

110. ***Bombus magnus*** VOGT, 1911

I. Po – 3.07.1998, 1 spm on *Hypericum* (DYLEWSKA et al. 1998)

111. ***Bombus mesomelas*** GERSTAECKER, 1869

I. ŚwK – 3.09.1964, ♂ (KOŃCZYK 1965)

112. ***Bombus muscorum*** (LINNAEUS, 1758)

II. NS – 25.05.1983, ♀ on *Robinia pseudoacacia*; Ba – 09.07.1983, ♀ on *Lotus corniculatus* leg. M. DYLEWSKA

113. ***Bombus pascuorum*** (SCOPOLI, 1763)

I. ŚwK – 2, 3 and 4.09.1964, 2 ♀♀ 11 ♂♂ on *Lamium*, *Hypericum*, *Trifolium* and *Cirsium*; and 2 and 12.07.1969, ♀♂ on *Lamium* and *Hypericum* and 12.08.1969, 3 ♀ 6 ♀♀on *Calluna vulgaris*, *Hypericum*, *Cirsium*, *Betonica officinalis*, *Trifolium* and *Stachys* (KOŃCZYK 1965); 20.09.1963, 3 ♀♀ ♂ on *Geranium, Cirsium, Lamium purpureum* leg. M. DYLEWSKA and 30.06.1981, 23 spm on *Ranunculus* and *Trifolium repens* and *Vicia sepium* and *Lathyrus sylvestris* and *Lathyrus pratensis* and 15.07.1982 4 spm on *Lamium album* and *Stachys arvensis* (ČMAK & SZCZYPCIAK-BĄK 1987); PB – 2.09.1964, ♀ 4 ♂♂ on *Cirsium* and *Calluna yulgaris* and *Betonica* (KOŃCZYK 1965) and 15.09.1982, 10 spm on *Carduus crispus* and *Lamium album* (ČMAK & SZCZYPCIAK-BĄK 1987) and 30.06.1998, 12 spm on *Centaurea, Knautia arvensis* and *Hypericum* (DYLEWSKA et al. 1998); Ka – 18.09.1963, 2 ♂♂ leg. M. DYLEWSKA and 20.08.1981, 13 spm on *Cirsium arvense* and *Carduus crispus* (ČMAK & SZCZYPCIAK-BĄK 1987); Go_2 – 2. and 11.07.1964, 2 spm on *Cirsium* and *Lamium* (KOŃCZYK 1965) and 17.06.1983, 6 spm on *Vaccinium myrtillus*; WSz – 12.07.1981, 7 spm on *Echium vulgare* and *Stachys arvensis* and *Melampyrum nemorosum*; Mr – 10.08.1982, 8 spm on *Vaccinium* and *Lamium album*; Por – 28.05.1982, 7 spm on *Primula* and *Pulmonaria officinalis* (ČMAK & SZCZYPCIAK-BĄK 1987) and 3.07.1998, 11 spm on *Centaurea Taraxacum*, *Hieracium*, *Gladiolus paluster*, *Prunella vulgaris*, *Cirsium* and *Stachys palustris* (DYLEWSKA et al. 1998); Ły – 12. and 19.09.1963, ♀♂ on *Lamium purpureum*; Z – 18.09.1963, ♂ leg. M. DYLEWSKA

II. Db – 18.07.1981, 10 spm on *Vicia sepium* and *Lathyrus pratensis* and *Centaurea jacea* (ČMAK & SZCZYPCIAK-BĄK 1987); Bo – 12.07.1982, ♀ leg. M. DYLEWSKA; GCh – 05.08.1983, 6 spm on *Lathyrus pratensis* and *Lathyrus sylvestris*; GP – 10.07.1982, 1 spm on *Galeopsis ladonum*; Lś – 30.08.1981, 4 spm on *Lathyrus pratensis*, NS – 18.07.1982, 4 spm on *Echium vulgare* and *Cirsium arvense*; Ser – 15.07.1981, 3 spm on *Echium vulgare*, Za – 05.07.1983, 9 spm on *Vicia sepium* and *Echium vulgare* and *Cirsium arvense*; RzS – 10.08.1981, 3 spm on *Galeopsis ladanum* (ČMAK & SZCZYPCIAK-BĄK 1987);

III. BP – 17.08.1982, 4 spm on *Trifolium repens* and *Trifolium pratense*; JD – 20.05.1981, 1 spm on *Pulmonaria officinalis*; Pdł – 15.07.1982, 1 spm; HS – 18.07.1981, 2 spm; Trz – 12.07.1983, 1 spm; SH – 28.08.1983, 2 spm on *Stachys arvensis*; Ła – 18.07.1981, 2 spm; GB – 20.06.1981, 4 spm on *Rubus hirtus* (ČMAK & SZCZYPCIAK-BĄK 1987).

114. ***Bombus pratorum*** (LINNAEUS, 1761)

I. ŚwK – 1 spm (DROGOSZEWSKI 1932) 2.06.1981, 12 spm on *Primula*, *Rubus hirtus* and *Geranium*; Ka – 20.08.1981, 9 spm on *Vaccinium myrtillis* and *Trifolium pratense*; PB – 12.07.1982, 9 spm on *Echium vulgare*, *Lamium album* and *Carduus* (ČMAK & SZCZYPCIAK-BĄK 1987) and 3.07.1998, 33 spm on *Centaurea*, *Knautia arvensis* and *Hypericum perforatum* and *Lamium*, *Betonica*, *Trifolium*, *Cirsium*, *Solidago*, *Senecio* and *Dipsacus* (DYLEWSKA et al. 1998); Po – 28.05.1982, 2 spm on *Hypericum perforatum* and *Pulmonaria officinalis* (ČMAK & SZCZYPCIAK-BĄK 1987) and 3.07.1998, 1 spm on *Cirsium* (DYLEWSKA et al. 1998); Go_2 – 13.08.1982, 6 spm; WSz – 12.06.1981, 1 spm on *Galeobdolon luteum* (ČMAK & SZCZYPCIAK-BĄK 1987); Ły – 2.08.1964, 1 spm on *Lamium* (KOŃCZYK 1965)

II. Db – 10.07.1982, 3 spm on *Hieracium* and *Carduus crispus*; GCh – 05.08.1983, 1 spm; GP – 10.07.1982, 3 spm on *Centaurea jacea*; Je – 20.05.1981, 1 spm on *Papaver*; NS – 18.07.1981, 1 spm on *Geranium* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. Pdł – 15.07.1982, 13 spm on *Rubus hirtus* and *Trifolium pratense*; JD – 20.07.1982, 7 spm on *Echium vulgare* and *Lamium album*; HS – 20.06.1982, 3 spm; Trz – 12.07.1983, 7 spm on *Trifolium repens*; SH – 26.06.1983, 3 spm on *Rubus hirtus*; Ła – 18.07.1981, 3 spm; GB – 20.06.1981, 2 spm on *Carduus crispus* (ČMAK & SZCZYPCIAK-BĄK 1987).

115. ***Bombus ruderarius*** (MŰLLER, 1776)

I. Ka – 28.06.1964, ♀ (KOŃCZYK 1965).

II. NS – 18.07.1981, 1 spm on *Trifolium repens*; GCh – 10.07.1982, 2 spm on *Vicia sepium* and *Lathyrus pratensis*; Db – 10.08.1981, 1 spm on *Lamium album*; Ba – 15.06.1982, 1 spm on *Trifolium pratense* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. BP – 18.07.1981, 1 spm on *Vaccinium myrtillus*; GB – 20.07.1982, 2 spm on *Centaurea jacea* and *Anthyllis* (ČMAK & SZCZYPCIAK-BĄK 1987).

116. ***Bombus subterraneus*** (LINNAEUS, 1758)

I. ŚwK – 1 spm (DROGOSZEWSKI 1932) 08.06.1982, 4 spm on *Trifolium pratense* and *Echium vulgare*; Ka – 12.07.1983, 2 spm on *Lathyrus sylvestris*; PB – 15.08.1981, 4 spm on *Scabiosa columbaria* and *Medicago sativa*; Po – 07.08.1983, 1 spm on *Anchusa officinalis* (ČMAK & SZCZYPCIAK-BĄK 1987).

II. Ser – 05.08.1983, 1 spm on *Lamium album* (ČMAK & SZCZYPCIAK-BĄK 1987).

117. ***Bombus sylvarum*** (LINNAEUS, 1761)

I. Ka – 20.08.1981, 1 spm on *Trifolium pratense*; PB – 20.06.1982, 1 spm on *Rubus hirtus* (ČMAK & SZCZYPCIAK-BĄK 1987).

118. ***Bombus terrestris*** (LINNAEUS, 1758)

I. ŚwK – 15.05.1981, 8 spm on *Primula* and *Pulmonaria officinalis* (DYLEWSKA et al. 1998) and 15.08.1982, 3 spm on *Vicia sepia*; Ka – 12.07.1983, 1 spm on *Centaurea jacea*; Go_2 – 12.06.1982, 3 spm; PB – 12.07.1982, 4 spm on *Vicia sepium* and *Trifolium pratense*; Mr – 10.08.1982, 1 spm on *Vaccinium myrtillus*; WSz – 13.07.1983, 1 spm on *Anchusa* (ČMAK & SZCZYPCIAK-BĄK 1987).

II. GCh – 05.08.1983, 1 spm on *Lupinus luteus*; Db – 07.07.1981, 2 spm on *Trifolium pratense* and *Trifolium repens* (ČMAK & SZCZYPCIAK-BĄK 1987).

III. BP – 18.08.1981, 3 spm on *Stachys arvensis* (ČMAK & SZCZYPCIAK-BĄK 1987) and 30.06.1998, 3 spm (DYLEWSKA et al. 1998); Trz – 12.07.1983, 1 spm on *Trifolium repens* (ČMAK & SZCZYPCIAK-BĄK 1987).

119. ***Bombus veteranus*** (FABRICIUS, 1793)

II. Ba – 18.05.1982, 1 spm on *Taraxacum officinale*; Db – 10.08.1981, 2 spm on *Trifolium repens* and *Trifolium pratense*; GCh – 05.06.1983, 1 spm on *Vaccinium myrtillus* (ČMAK & SZCZYPCIAK-BĄK 1987).

120. ***Psithyrus barbutellus*** (KIRBY, 1802)

I. ŚwK – 12.08.1964, ♂ on *Hieracium*, *Stachys* and 2.09.1964, ♂ and 20.09.1963, ♂ on *Cirsium*; PB – 2.09.1964, 2♂♂ on *Cirsium* and *Solidago* (KOŃCZYK 1965); Ka – 16.07.1981, 11 spm leg. J. BĄK.

121. ***Psithyrus bohemicus*** (SEIDL, 1837)

I. Łysogóry – 14.08.1950, 7♂♂ leg. B. PISARSKI; ŚwK – 11,12 and 19.08.1964, 42 ♂♂ on *Rubus*, *Trifolium*, *Hieracium*, *Lamium*, *Cirsium, Stachys*; Ły – 02, 06 and 07.08.1964, 19 ♂♂ on *Lamium*, *Rubus*; PB – 2.09.1964, 7 ♂♂ on *Solidago, Trifolium, Hypericum* and *Cirsium* (KOŃCZYK 1965) and 18.07.1981, 12 spm leg J. BĄK and 30.07.1998, 2 spm (DYLEWSKA et al. 1998); Go_1 – 6.08.1964, 18 ♂♂ on *Hypericum*, *Dipsacus silvestris*, *Leontodon*, *Lamium*; Ka – 5, 7 and 11.08.1964, 16 ♂♂ on *Rubus, Trifolium*, *Lamium* and 28.05.1964, 2 ♀♀ on *Vaccinium myrtillus* and *Galeobdon* and 5.07.1964, 6 ♂♂ on *Rubus idaeus*, *Lamium* and 18.09.1964, ♂ on *Trifolium*, and 11.08.1964, ♂ on *Trifolium repens* (KOŃCZYK 1965) and 18.09.1963, 2 ♂♂ leg. M. DYLEWSKA; Ły – 14.08.1964, 5 ♂♂ on *Lamium* and *Betonica officinalis* (KOŃCZYK 1965).

II. GCh – 02.08.1964, ♂ on *Lamium* (KOŃCZYK 1965).

122. ***Psithyrus campestris*** (PANZER, 1801)

I. Łysogóry – 11.08.1950, 5 ♂♂ leg. B. PISARSKI; Ka – 20.08.1958, ♂ leg. M. DYLEWSKA and 16.08.1981, 15 spm leg. J. BĄK; PB – 2.09.1964, 25 ♂♂ on *Trifolium* and *Cirsium* and 16.08.1981, 18 spm leg. J. BĄK; ŚwK – 2 - 4 and 20.09.1964, 40 ♂♂ on *Cirsium, Hypericum, Lamium* (KOŃCZYK 1965) and 9.07.1983, ♂ on *Salvia* leg. M. DYLEWSKA.

II. Ru – 8.07.1983, ♂ leg. M. DYLEWSKA.

III. HS - 20.09.1964, 2 ♂♂ on *Cirsium* and 26.06.1982, ♀ on *Echium vulgare*; Kak – 19.09.1963, ♂ on *Hieracium* (KOŃCZYK 1965).

123. ***Psithyrus rupestris*** (FABRICIUS, 1793)

I. PB – 2.09.1964, 136 ♂♂ on *Lamium* and *Betonica, Solidago, Hypericum, Calluna vulgaris* (KOŃCZYK 1965) and 30.06.1998, 1 spm (DYLEWSKA et al. 1998); ŚwK – 20.09.1963, ♂ and 2 - 4.06.1964, 90 ♂♂ (KOŃCZYK 1965) and 20.09.1983, ♂ on *Lamium*; Ły – 2. and 7.08.1964, 23 ♂♂ on *Lamium purpureum* and *Cirsium*; Ka – 18.09.1963, ♂ and 20.08.1958, ♂ leg. M. DYLEWSKA and 20.08.1982, 14 spm leg. J. BĄK.

124. ***Psithyrus sylvestris*** LEPELETIER, 1832

I. PB – 20.08.1982, 10 ♂ leg. J. BĄK and 7.08.1983, ♂ on *Centaurea* leg. M. DYLEWSKA and 3.07.1998, 2 ♂♂ (DYLEWSKA et al. 1998); Ka – 16.07.1981, 6 spm leg. J. BĄK.

125. ***Psithyrus vestalis*** (FOURCROY, 1785)

I. PB – 2.09.1964, ♂ on *Trifolium* and 8.08.1981, 8 spm leg. J. BĄK; Ły – 2.08.1964, 2 ♂♂ on *Rubus*; ŚwK – 12.08.1964, ♂ on *Calluna vulgaris* (KOŃCZYK 1965).

126. ***Apis mellifera*** LINNAEUS, 1758

Found in all mentioned localities.

VI. FAUNISTIC ANALYSIS

1. The numbers of collected species and individuals

In the Łysogóry Mts and adjacent areas were collected 2672 individuals of Apiformes representing 126 species, including *Apis mellifera*; this is about 26.6% of the Apiformes fauna of Poland. The numbers of individuals and species collected in the three areas are presented in Table I.

Table I

Number of species (sp) and specimens (spm) of the Apiformes families collected in the areas I, II, III in Łysogóry Mts

Families	Area I		Area II		Area III		Total	
	sp	spm	sp	spm	sp	spm	sp	spm
Colletidae	7	30	5	37	6	55	9	122
Andrenidae	13	50	30	267	25	219	38	536
Halictidae	13	43	16	114	19	135	23	292
Melittidae	2	113	1	3	1	6	2	122
Megachilidae	9	35	18	136	10	77	21	248
Anthophoridae	6	25	9	43	6	43	10	111
Apidae	19	995	12	127	10	119	23	1241
Total	69	1291	91	727	77	654	126	2672
Total except Apidae	50	296	79	600	67	535	103	1431

The numerical data for Bombini presented in Table I show a considerable dominance (about 9 times) of collected individuals within the forest area I, in comparison to materials taken from agricultural areas II and III. Similarly, the number of species of Bombini in each of the research areas is different (19, 12 and 10, respectively). These results correspond with the data from mid-forest meadows in the Łysogóry Mts by MASSALSKI (1967) in relation to Apiformes. The numbers of other species of Apiformes (excluding Bombini) are lower in the area I than in areas II and III (50,

79 and 67 respectively) and a similar condition is observed upon numbers of collected individuals (296, 600 and 535, respectively). The presented numbers show a distinct dominance of the research data from the area II. These results are similar to those obtained from Babia Mt and Tatra Mts (DYLEWSKA 1966, 1991), where the lower subalpine forest on northern slopes appeared to be the richest area for species of Apiformes. It can be a result of a greater fold-like character of the northern slopes in comparison to southern slopes, which decline steeply and are exposed to winds. In the Łysogóry Mts, due to the folded character of northern slopes and adjacent areas, the warm stands with populations of Apiformes can be found. In recapitulation of Table I, the attention is drawn to significantly low number of Melittidae (2 species) and Anthophoridae (10 species).

2. Differentiation of populations in localities

The number of specimens and species from the research areas I, II and III are presented in Tables II, III and IV.

Table II

Occurrence of Apiformes in localities within the area I

No.	Families	Area I											
		ŚwK	Go1	PB	Go2	Ły	Ka	Kat	Z	Mr	Mrp	Po	WSz
1.	Colletidae												
	sp	6		1			3						4
	spm	20		1			3						6
2.	Andrenidae												
	sp	6		2			8	1		2			
	spm	12		4			18	10		6			
3.	Halictidae												
	sp	6		1			3			8			3
	spm	11		7			3			14			8
4.	Melittidae												
	sp			1			1				1		2
	spm			7			3				87		16
5.	Megachilidae												
	sp	7					4			1			1
	spm	10					21			1			3
6.	Anthophoridae												
	sp	4					1			2			1
	spm	7					4			4			10
7.	Apidae												
	sp	13	3	13	2	5	10		1	4		6	7
	spm	310	19	292	8	58	138		1	13		30	22
Total of species		42	3	18	2	5	30	1	1	17	1	6	18
Total of specimens		370	19	311	8	58	190	10	1	38	87	30	65

Table II with the research data on Apiformes indicates that in the research area I localities in Święty Krzyż Mt., Bielnik meadow and Święta Katarzyna have richer fauna. There were collected

42, 18 and 30 species and 370, 311 and 190 specimens, respectively. Also over 10 species were found in the Mokry Bór area and in the mid-forest meadow near Wola Szczygiełkowa (17, 18).

Table III

Occurrence of Apiformes in localities within the area II

No	Families	Area II														
		NS	Ser	GCh	Cz	Za	RzS	Ru	Ba	Mi	Je	Db	Ce	Bo	GP	Lś
1.	Colletidae															
	sp	2		2	3				1	1				3		
	spm	4		8	7				1	1				7		
2.	Andrenidae															
	sp	12			2			5	2	3			1	19		
	spm	41			5			12	13	9			2	185		
3.	Halictidae															
	sp	10						11	2	2				8		
	spm	19						23	3	3				66		
4.	Melittidae															
	sp													1		
	spm													1		
5.	Megachilidae															
	sp	10			5			4	5					6		
	spm	63			30			5	17					21		
6.	Anthophoridae															
	sp	6			2				3					6		
	spm	14			2				6					21		
7.	Apidae															
	sp	6	3	7		3	2	3	2		3	3		1	4	3
	spm	9	8	14		21	4	4	2		5	5		1	11	8
Total of species		46	3	9	12	3	2	23	15	6	3	3	1	44	4	3
Total of specimens		150	8	22	44	21	4	44	42	13	5	5	2	302	11	8

Table III presents research localities along with the number of collected species and specimens in the research area II. Within this area over 100 specimens and 40 species were collected in both localities – Nowa Słupia and Bodzentyn. Over 10 species were found in Cząstków Skała, Rudki and Baszowice, the remained localities were represented by 1-9 species.

In Table IV, the research localities along with number of collected species and specimens in the research area III are presented. In this area 257 specimens (41 species) were found only in Bieliny Poduchowne. Over 10 species were found in Huta Szklana, Porąbki, Krajno Górne, Krajno Dolne and Bartoszowiny. The number of specimens of various species of Bombini as well as the number of species (Table I) collected in the research areas I, II, III, differ from those of other Apiformes. In the research area I, the most common Bombini occurred in the mid-forest meadows Święty Krzyż Mt. (13 species and 310 specimens), Polana Bielnik meadow (respectively 13 and 292) and in Święta Katarzyna (10, 138). In other areas considerably less species and individuals were taken: in the area II in 12 research localities 1-7 species and 1-21 specimens and in the area III in 10 localities: 1-6 species and 1-21 specimens were collected.

Table IV

Occurrence of Apiformes in localities within the area III

No	Families	Area III																
		Ci	Mą	DW	Kr	KD	KG	Por	Kak	JD	Pdł	GB	BP	HS	SH	Br	Trz	Ła
1.	Colletidae																	
	sp			3	4	2	1						5	2				
	spm			9	5	7	1						34	5				
2.	Andrenidae																	
	sp	4	3		2	1	4	9					14	5		7		
	spm	3	5		2	2	6	26					107	25		39		
3.	Halictidae																	
	sp	3	3			8	9	1					6	4		6		
	spm	5	5			40	34	2					34	7		8		
4.	Melittidae																	
	sp			1			1											
	spm			2			6											
5.	Megachilidae																	
	sp					5	3	1					9			2		
	spm					26	8	2					36			5		
6.	Anthophoridae																	
	sp					1	3						3			2		
	spm					4	4						33			2		
7.	Apidae																	
	sp				1				1	5	4	5	4	5	2		6	3
	spm				2				1	16	21	17	13	15	5		15	13
	Total of species	7	6	4	7	17	21	11	1	5	4	5	41	16	2	17	6	3
	Total of specimens	8	10	11	9	79	59	30	1	16	21	17	257	52	5	54	15	13

3. The numbers of species of Aculeata occurring in the Świętokrzyski National Park on the background of Polish fauna

In the Table V, the numbers of species of Aculeata occurring in the Łysogóry Mts and in adjacent areas are presented on the background of whole Poland. These data are based on the results described in this paper and in other works dealing with this region (CZECHOWSKA & CZECHOWSKI 1999, CZECHOWSKI et al. 2002, KOWALCZYK 1990, KRZYSZTOFIAK 1984) as well as on the work on aculeates of the Ojców National Park (DYLEWSKA & WIŚNIOWSKI 2003) and other publications (WIŚNIOWSKI & KOWALCZYK 1998a, 1998b, 2002). The numbers of wild bee species (Apiformes) in Poland are given in the folloving papers: BANASZAK 2000, BANASZAK et al. 2001, CELARY 1999, CELARY & WIŚNIOWSKI 2001, 2003, DYLEWSKA 2000, PAWLIKOWSKI & CELARY 2003, PESENKO et al. 2002, WIŚNIOWSKI 2003, 2004, WIŚNIOWSKI & SZCZEPKO 2004, WIŚNIOWSKI & WERSTAK 2003. The data show that the Łysogóry Mts holds only 26.6% of the total Apiformes fauna of Poland. In general, the Aculeata found in the Świętokrzyski National Park are represented by 28.6% species.

Table V

Numbers and percents of listed species of the Aculeata in Poland and in the Łysogóry Mts.

Families	Number of species		%
	Poland	Łysogóry Mts	
Chrysidoidea			
Chrisididae	70	16	22.9
Vespoidea			
Tiphidae	6	1	16.7
Sapygidae	4	1	25.0
Mutillidae	7		
Pompilidae	84		
Eumenidae	49	18	36.7
Vespidae	15	12	80.0
Scoliidae	2	1	50.0
Formicidae	101	25	24.8
Apoidea			
Sphaecidae	230	97	42.2
Colletidae	41	9	22.0
Andrenidae	98	38	38.8
Halictidae	106	23	21.7
Melittidae	11	2	18.2
Megachilidae	88	21	23.9
Anthophoridae	87	10	11.5
Apidae	40	23	57.5
total *Apiformes*	471	126	26.6
total *Aculeata*	1039	297	28.6

VII. ECOLOGICAL ANALYSIS

1. The numbers, domination and constancy of species

For the purpose of describing the number, domination and constancy of Apiformes within the three research areas, only these species are taken into account, that were collected in a minimum number of 10 specimens. The number of species in particular families is as follows: Colletidae – 5, Andrenidae – 8, Halictidae – 7, Melittidae – 1, Megachilidae – 7, Antophoridae – 2 and Apidae – 9. Altogether 39 species were found (Table VI).

In the research area I, 15 species are distinguished with at least 10 specimens collected. Eudominants are only *Psithyrus bohemicus* and *Ps. rupestris*. Dominants are: *Bombus lucorum*, *B. pascuorum*, *B. pratorum*, *Psithyrus campestris* and *Macropis fulvipes*. Remaining species belong to subdominants (*B. hortorum*), recedents (*Andrena fucata*, *Evylaeus fulvicornis*, *Anthophora furcata, B. terrestris*) and subrecedents (*Hylaeus sinuatus*, *Chelostoma campanularum* and *B. subterraneus*). In the area I, absolutely constant species were absent. Constant species are represented by: *B. hortorum*, *B. pascuorum* and *Ps. bohemicus*. The group of accessory species includes: *Andrena fucata*, *Evylaeus fulvicornis*, *Macropis fulvipes*, *Anthophora furcata*, *B. lucorum*, *B. pratorum*, *B. subterraneus*, *B. terrestris* and *Ps. rupestris*. From among 15 species distinguished on the basis of at least 10 specimens 3 are accidental: *Hylaeus sinuatus*, *Chelostoma campanularum*, *Ps. campestris.*

Table VI

Number of specimens (N) collected at least 10. of the species dominant (D) and stability (S) in the area I, II, III

Lp.	Families	Area I			Area II			Area III		
		N	D	S	N	D	S	N	D	S
1.	Colletidae									
	Hylaeus communis				10	1.4 D_2	44.4 GA			
	Hylaeus difformis				13	1.9 D_2	44.4 GA			
	Hylaeus sinuatus	10	0.9 D_1	18.2 GP						
	Colletes punctatus							30	4.6 D_3	20.0 GP
	Colletes succinctus							12	1.8 D_2	40.0 GA
2.	Andrenidae									
	Andrena clarkella				10	1.4 D_2	11.1 GP			
	Andrena dorsata				57	8.2 D_4	44.4 GA	21	3.2 D_3	40.0 GA
	Andrena fucata	14	1.3 D_2	27.3 GA						
	Andrena fuscipes				42	6.1 D_4	22.2 GP			
	Andrena haemorrhoa				31	4.5 D_3	22.2 GP	83	12.7 D_5	40.0 GA
	Andrena praecox				13	1.9 D_2	22.2 GP	13	2.0 D_2	50.0 GA
	Andrena varians				34	4.9 D_3	44.4 GA	18	2.8 D_3	30.0 GA
	Andrena ventralis				32	4.6 D_3	11.1 GP			
3.	Halictidae									
	Seladonia tumulorum							10	1.5 D_2	30.0 GA
	Evylaeus albipes				12	1.7 D_2	44.4 GA	12	1.8 D_2	40.0 GA
	Evylaeus calceatus				11	1.6 D_2	44.4 GA	20	3.0 D_3	40.0 GA
	Evylaeus fulvicornis	17	1.6 D_2	36.4 GA	53	7.6 D_4	44.4 GA	34	5.2 D_4	70.0 GS
	Evylaeus morio							10	1.5 D_2	10.0 GP
	Evylaeus villosulus							11	1.7 D_2	20.0 GP
	Lasioglossum leucozonium							13	2.0 D_2	20.0 GP
4.	Melittidae									
	Macropis fulvipes	108	10.0 D_4	36.4 GA						
5.	Megachilidae									
	Chelostoma campanularum	10	0.9 D_1	18.2 GP	23	3.3 D_3	44.4 GA			
	Chelostoma florisomne				25	3.6 D_3	22.2 GP	12	1.8 D_2	10.0 GP
	Hoplitis adunca				10	1.4 D_2	22.2 GP			
	Osmia leaiana				10	1.4 D_2	33.3 GA			
	Osmia rufa				16	2.3 D_3	22.2 GP	22	3.4 D_3	40.0 GA
	Chalicodoma ericetorum				10	1.4 D_2	22.2 GP			
	Megachile willughbiella				20	2.9 D_3	33.3 GA			
6.	Anthophoridae									
	Anthophora furcata	15	1.4 D_2	27.3 GA	11	1.6 D_2	33.3 GA			
	Anthophora quadrimaculata							32	4.9 D_3	20.0 GP
7.	Apidae									
	Bombus hortorum	51	4.7 D_3	58.3 GS	27	3.9 D_3	53.3 GS	10	1.5 D_2	35.3 GA
	Bombus lucorum	71	6.7 D_4	41.7 GA				30	4.6 D_3	23.5 GP
	Bombus pascuorum	91	8.4 D_4	66.7 GS	31	4.5 D_3	53.3 GS	17	2.6 D_3	47.1 GA
	Bombus pratorum	73	6.8 D_4	50.0 GA				38	5.8 D_4	41.2 GA
	Bombus subterraneus	11	1.01 D_1	33.3 GA						
	Bombus terrestris	12	1.1 D_2	33.3 GA						
	Psithyrus bohemicus	120	11.1 D_5	58.3 GS						
	Psithyrus campestris	67	6.2 D_4	25.0 GP						
	Psithyrus rupestris	254	22.2 D_5	41.7 GA						

Notes:

D_1 – subrecedents, up to 1% individuals
D_2 – recedents from 1.1% to 2% individuals
D_3 – subdominants, from 2.1% to 5% individuals
D_4 – dominants, od 5.1% do 10% individuals
D_5 – eudominants, over 10% individuals

GP – accidental species (0-25%)
GA – accessoric species (25.1-50%)
GS – constant species (50.1-75%)
GAS – absolutely constant species (75.1-100%)

In the area II, 22 species were found, each with at least 10 specimens collected. Eudominants are not present among them, 3 dominants are distinguished: *Andrena dorsata*, *A. fuscipes* and *Evylaeus fulvicornis*. The remained species are subdominants (9 species) and recedents (10 species). Species mentioned in the table VI, found in this area are subrecedents. Absolutely constant species are not found in the research area II. The only constant species are *B. hortorum* and *B. pascuorum.* Other species are accesory (11) and accidental (9).

In the research area III, the 20 species of Apiformes are distinguished, each with at least 10 specimens collected. Among them one eudominant (*Andrena haemorrhoa*) and 2 dominants (*Evylaeus fulvicornis* and *B. pratorum*) are present. The remained species are subdominants (8) and recedents (9). In the area III accessory species (12) are dominant, with participation of accidental species (7). Only *Evylaeus fulvicornis* appears to be a constant species, but absolutely constant species are not represented in this area. Remaining Apiformes, mentioned in the table VI, are accidental species. On the basis of analysis of the species number in each family of Apiformes it can be stated that in the area I, the most numerous species belong to the family Apidae, while other families are poorly represented. In the area II, the most numerous species belong to the families Andrenidae and Megachilidae, and in the area III – to Andrenidae. Species of Apiformes that occurred in all research areas are: *Evylaeus fulvicornis*, *Bombus hortorum* and *B. pascuorum.*

2. Host plants

Numbers of individuals in each family of Apiformes found in the research areas on host plants are presented in Tables VII, VIII, IX. The names of species or genera of host plants are given.

The numerical data presented in the Table VII show that in the research area I, 805 specimens of Apiformes were collected on at least 52 species of plants from 19 families. The number of individuals from each family varied from 12 (Colletidae) to 639 (Apidae). The most often visited plants represented genera: *Lamium* (158 specimens), *Cirsium* (70), *Trifolium* (70), *Rubus* (67) and *Lysimachia* (49). The highest number of Colletidae was taken on *Heracleum sphondylium* (9). Andrenidae visited mostly *Rosacae* (22) and *Salvia* (9); Halictidae were found on *Potentilla erecta* (17), Melittidae on *Lysimachia nummularia* (49), Megachilidae and Anthophoridae on *Stachys germanica* (15 and 9 respectively) and Apidae on *Lamium album* (157) and also on *Campanula* (17).

The data presented in the table VIII indicate that in the research area II were collected 552 specimens of Apiformes on 45 genera of plants from 18 families. However, in this area the members of Melittidae were not found. The family Andrenidae (210) is dominanting, with a significant share of the family Apidae (122). The most often visited genera were *Taraxacum* (11), *Campanula* (66), *Prunus* (52) and *Sinapis* (53). Most species of Colletidae were collected on *Sinapis arvensis* (14), Andrenidae on *Prunus spinosa* (52) and *Taraxacum* (44); Halictidae on *Taraxacum* (55); Megachilidae on *Campanula* (21); Anthophoridae on *Lamium* (15), and Apidae on *Vicia sepium* (23).

The research area III, located south from the forest part of the Łysogóry Mts, holds the lowest number of specimens of Apiformes: 490 individuals on 43 plant genera, which represented 17 families. Similarly to the area II, the area III was represented by the highest number of specimens of Andrenidae (190) and Apidae (95). Over 40 individuals were found on *Taraxacum* (49)*, Rubus* (48) and *Lamium* (42). The most often visited plant by members of Colletidae was *Anthemis arvensis* (38).

Most of the Andrenidae were collected on *Taraxacum* (37) and *Rubus* (34); Halictidae on *Solidago* (15); Megachilidae on *Lamium album* (24) and *Campanula* (16); Anthophoridae on *Arthemisia* (9). Apidae were found mostly on *Rubus* and *Trifolium* (15 and 10 respectively) and Melittidae on *Lysimachia nummularia*. In the Łysogóry Mts, Apiformes were found on 63 genera of plants in total. In the research area I they were found on 47 genera, in the area II on 45 and in the area III on 43 genera. Of this number, 19 genera visited by insects were common for all three research areas. The members of Apidae seek food on at least 38 species of plants, those of Andrenidae on 7 and Megachilidae on 8 species.

Table VII

Number of specimens of the Apiformes families recorded on food plants in the area I in Łysogóry Mts.

No.	Family	Plant species	Number of specimens							Total
			Colletidae	Andrenidae	Halictidae	Melittidae	Megachilidae	Anthophoridae	Apidae	
1.	Ranunculaceae	*Ranunculus* sp.							2	2
2.	Caryophyllaceae	*Silene* sp.					1			1
3.	Clusiaceae	*Hypericum perforatum*							40	40
4.	Brassicaceae	*Armoracia rusticana*			1					1
5.	Saliacaceae	*Salix* sp.		2					2	4
		Vaccinium myrtillus		5					38	43
		Calluna vulgaris							23	23
6.	Primulaceae	*Primula* sp.							10	10
		Lysimachia nummularia				49				49
7.	Rosaceae	*Rubus idaeus*	1	14						15
		Rubus hirtus							52	52
		Crataegus sp.		3			4			7
		Potentilla erecta		5	17					22
8.	Grossulariaceae	*Ribes* sp.		2						2
9.	Fabaceae	*Trifolium repens*							27	27
		Trifolium pratense							43	43
		Vicia sepium							18	18
		Lathyrus pratensis							1	1
		Lathyrus sylvestris							6	6
		Medicago sativa							5	5
		Lupinus luteus							10	10
		Lotus corniculatus					2		2	4
10.	Geraniaceae	*Geranium* sp.					1		11	12
11.	Apiaceae	*Heracleum sphondylium*	9							9
12.	Dipsacaceae	*Dipsacus sylvestris*							2	2
		Knautia arvensis							3	3
		Scabiosa columbaria							3	3
13.	Oleaceae	*Syringa vulgaris*					1			1
14.	Boraginaceae	*Echium vulgare*					1		12	13
		Pulmonaria officinalis							8	8
		Anchusa officinalis							2	2
15.	Scrophulariaceae	*Melampyrum nemorosum*							1	1
		Linaria vulgaris							3	3
16.	Lamiaceae	*Ajuga* sp.							1	1
		Salvia sp.		9					5	14
		Lamium album							157	157
		Lamium purpureum						1		1
		Galeobdolon luteum							3	3
		Prunella vulgaris							1	1
		Stachys sylvatica	1				15	9	6	31
		Stachys germanica						4		4
		Betonica officinalis							21	21
17.	Campanulaceae	*Campanula* sp.					4	2		6
18.	Asteraceae	*Cirsium arvense*							70	70
		Taraxacum officinale							1	1
		Carduus crispus							18	18
		Centaurea jacea							5	5
		Hieracium sp.	1		2				5	8
		Leontodon sp.							3	3
		Senecio sp.							1	1
		Solidago sp.							17	17
19.	Iridaceae	*Gladiolus paluster*							1	1
		Total insect specimens	12	40	20	49	29	16	639	805
		Total plant species	4	7	3	1	8	4	10	52

Table VIII

Number of specimens of the Apiformes families recorded on food plants in the area II in Łysogóry Mts.

No.	Family	Plant species	Number of specimens							Total
			Colletidae	Andrenidae	Halictidae	Melittidae	Megachilidae	2Anthophoridae	Apidae	
1.	Ranunculaceae	*Ranunculus* sp.					11			11
2.	Papaveraceae	*Papaver* sp.							1	1
3.	Brassicaceae	*Sinapis arvensis*	14	35	4					53
4.	Saliacaceae	*Salix* sp.		7	1		1			9
5.	Ericaceae	*Vaccinium myrtillus*		2					3	5
6.	Rosaceae	*Rubus hirtus*							4	4
		Prunus spinosa		52						52
		Pirus sp.		1						1
7.	Grossulariaceae	*Ribes* sp.		4			4			8
8.	Hydrangeaceae	*Philadelphus coronarius*		2						2
9.	Fabaceae	*Trifolium repens*							4	4
		Trifolium pratense							3	3
		Vicia sepium		1					23	24
		Lathyrus pratensis							11	11
		Lathyrus sylvestris							3	3
		Lupinus luteus							1	1
		Lotus corniculatus			3		1		1	5
		Coronilla varia					1		1	2
		Robinia pseudoacacia							1	1
		Melilotus wolgica					8			8
10.	Balsaminaceae	*Impatiens* sp.							7	7
11.	Geraniaceae	*Geranium* sp.							1	1
12.	Apiaceae	*Heracleum sphondylium*		7						7
13.	Boraginaceae	*Echium vulgare*					12		8	
		Pulmonaria officinalis							6	6
		Anchusa officinalis							6	6
14.	Scrophulariaceae	*Melampyrum nemorosum*							2	2
		Linaria vulgaris							1	1
		Rhinanthus sp.							2	2
15.	Lamiaceae	*Ajuga* sp.					3			3
		Galeopsis ladonum							4	4
		Salvia sp.			3					3
		Ballota nigra							1	1
		Lamium album							3	3
		Lamium purpureum						15	2	17
		Galeobdolon luteum							1	1
		Leonurus cardiaca			2			7		9
		Melissa officinalis	2	2	6		3			13
16.	Campanulaceae	*Campanula* sp.	10	33	1		21	1		66
17.	Asteraceae	*Arthemisia* sp.						3		3
		Cichorium intybus					3			3
		Anthemis arvensis		5	5					10
		Cirsium arvense							5	5
		Taraxacum sp.		44	55		1	6	4	110
		Carduus crispus							4	4
		Centaurea jacea	3				6	2	6	17
		Hieracium sp.		15	1			1	1	18
18.	Orchidaceae	*Dactylorhiza majalis*							2	2
		Total insect specimens	29	210	81	–	75	35	122	552
		Total plant species	4	14	10	–	13	7	31	48

Table IX

Number of specimens of the Apiformes families recorded on food plants in the area III in Łysogóry Mts.

No.	Family	Plant species	Number of specimens							Total
			Colletidae	Andrenidae	Halictidae	Melittidae	Megachilidae	Anthophoridae	Apidae	
1.	Dryopteridaceae	*Gymnocarpium robertianum*					1			1
2.	Ranunculaceae	*Ranunculus* sp.	3	1	8		8			20
3.	Papaveraceae	*Papaver* sp.							1	1
4.	Caryophyllaceae	*Silene* sp.					1			1
5.	Saliacaceae	*Salix* sp.		14	5			1		20
6.	Ericaceae	*Vaccinium myrtillus*		4				1	1	6
		Calluna vulgaris			1					1
7.	Primulaceae	*Primula elatior*					3		8	11
		Lysimachia nummularia				4				4
8.	Rosaceae	*Rubus idaeus*	4	24	4			1		33
		Rubus hirtus							15	15
		Crataegus sp.		26	1					27
		Potentilla erecta		3						3
		Prunus spinosa		20						20
		Padus sp.		2						2
9.	Grossulariaceae	*Ribes* sp.		34				1		35
10.	Fabaceae	*Trifolium repens*							10	10
		Trifolium pratense							8	8
		Anthyllis vulneraria							1	1
		Vicia sepium							7	7
		Lupinus luteus							2	2
		Lotus corniculatus					1			1
		Melilotus wolgica					2			2
11.	Apiaceae	*Heracleum sphondylium*	8					7		15
12.	Dipsacaceae	*Knautia arvensis*		3			4			7
13.	Boraginaceae	*Echium vulgare*						1	8	9
		Pulmonaria officinalis							1	1
14.	Scrophulariaceae	*Veronica chamaedris*		5	2					7
		Linaria vulgaris							3	3
15.	Lamiaceae	*Lamium album*			7		24		9	40
		Lamium purpureum						2		2
		Stachys arvensis							5	5
		Melissa officinalis						2		2
16.	Campanulaceae	*Campanula* sp.			1		16			17
17.	Asteraceae	*Helianthus* sp.							1	1
		Arthemisia sp.						9		9
		Anthemis arvensis	38		2					40
		Chamomilla recutita		13						13
		Achillea salicifolia			2					2
		Cirsium arvense							2	2
		Taraxacum sp.		37	7			5		49
		Carduus crispus							9	9
		Centaurea jacea							3	3
		Hieracium sp.			2				1	3
		Leontodon sp.		4	1					5
		Solidago sp.			15					15
Total insect specimens			53	190	58	4	60	30	95	490
Total plant species			4	14	14	1	10	10	19	46

VIII. ZOOGEOGRAPHICAL ANALYSIS

1. Division into zoogeographical elements

In the Łysogóry Mts and adjacent areas the 12 groups of zoogeographical elements were distinguished. These are listed as follows:

a/ Cosmopolitan species – 1 (0.8%): *Apis mellifera*

b/ Holarctic species – 10 (8%): *Andrena clarkella*, *Halictus rubicundus*, *Lasioglossum leucozomium*, *Lasioglossum zonulum*, *Evylaeus rufitarsis*, *Chelostoma rapunculi*, *Osmia caerulescens*, *Megachile centuncularis*, *Anthophora furcata*, *Bombus lucorum*

c/ Palaearctic species – 32 (24.8%): *Colletes succinctus*, *Andrena apicata*, *Andrena bimaculata*, *Andrena haemorrhoa*, *Andrena humilis*, *Andrena subopaca*, *Andrena tibialis*, *Andrena ventralis*, *Andrena thoracica*, *Lasioglossum quadrinotatum*, *Evylaeus albipes*, *Evylaeus calceatus*, *Evylaeus laticeps*, *Evylaeus villosulus*, *Lasioglossum zonulum*, *Anthidium manicatum*, *Heriades truncorum*, *Hoplitis leucomelana*, *Osmia rufa*, *Megachile circumcineta*, *Megachile willughbiella*, *Bombus hypnorum*, *Bombus pascuorum*, *Bombus ruderatus*, *Bombus subterraneus*, *Bombus terrestris*, *Psithyrus barbutellus*, *Psithyrus bohemicus*, *Psithyrus campestris*, *Psithyrus rupestris*, *Psithyrus sylvestris*, *Psithyrus vestalis*

d/ West Palaearctic species – 36 (28.8%): *Andrena alfkenella*, *Andrena bicolor*, *Andrena chrysosceles*, *Andrena congruens*, *Andrena dorsata*, *Andrena fucata*, *Andrena gravida*, *Andrena hattorfiana*, *Andrena helvola*, *Andrena nitida*, *Andrena schencki*, *Halictus maculatus*, *Lasioglossum lativentre*, *Seladonia tumulorum*, *Evylaeus morio*, *Evylaeus pauxillus*, *Sphecodes ephippius*, *Sphecodes monilicornis*, *Rophites quinquespinosus*, *Stelis phaeoptera*, *Stelis punctulatissima*, *Chelostoma campanularum*, *Chelostoma florisomne*, *Hoplitis adunca*, *Osmia brevicornis*, *Coelioxys elongata*, *Nomada panzeri*, *Bombus distinguendus*, *Bombus muscorum*, *Bombus pratorum*, *Bombus ruderarius*, *Bombus veteranus*

e/ European species – 24 (19.2%): *Hylaeus brevicornis*, *Hylaeus hyalinatus*, *Andrena fulva*, *Andrena fuscipes*, *Andrena jakobi*, *Andrena pilipes*, *Andrena semilaevis*, *Andrena varians*, *Lasioglossum fulvicorne*, *Evylaeus minutulus*, *Macropis fulvipes*, *Macropis europea*, *Osmia leaiana*, *Nomada marshamella*, *Anthophora plumipes*, *Anthophora quadrimaculata*, *Anthophora bimaculata*, *Bombus hortorum*, *Bombus lapidarius*, *Bombus magnus*, *Bombus sylvarum*

f/ Eurocaucasian species – 8 (6.4%): *Hylaeus communis*, *Hylaeus difformis*, *Hylaeus nigritus*, *Hylaeus sinuatus*, *Andrena labiata*, *Andrena lathyri*, *Andrena praecox*, *Evylaeus leucopus*

g/ Eurosiberian species – 3 (2.4%): *Lasioglossum sexnotatum*, *Evylaeus leucopus*, *Trachusa byssina*

h/ Montane species – 1 (0.8%): *Bombus mesomelas*

i/ Boreo-montane species – 4 (3.2%): *Andrena lapponica*, *Andrena tarsata*, *Osmia parietina*, *Bombus jonellus*

k/ Subpontic species – 2 (1. 6%): *Colletes punctatus*, *Osmia aurulenta*

l/ Submediterranean species – 1 (0. 8%): *Ceratina cyanea*

m/ Subponto-mediterranean species – 4 (3.2%): *Andrena decipiens*, *Lasioglossum subfasciatum*, *Chalicodoma ericetorum*, *Anthophora pubescens*

2. Montane and boreo-montane species

Bombus mesomelas – montane xerothermic species living on sunny slopes. In the Łysogóry Mts it was found in 1965 in Święty Krzyż Mt. (1♂) on the mid-forest meadow with southern exposition. In the other regions of Poland it is known from Babia Mt. (DYLEWSKA 1966), Tatra Mts (NOSKIEWICZ 1920) and Pieniny Mts (DYLEWSKA 1962), however, for the last 30 years the presence of this species in these mountains has not been confirmed.

Andrena lapponica – considered as a boreo-montane species, originally described from the Lapland and Tatra Mts. In the Łysogóry Mts found in Mokry Bór (5♀♀), Celiny (2♀♀) and in adjacent areas on *Vaccinium myrtillus*. It lives below the subalpine zone of the Carpathians and everywhere in Poland in woods with *Vaccinium myrtillus*.

Andrena tarsata – boreo-montane species, found in the Łysogóry Mts and adjacent areas: in Święta Katarzyna (1♀) near Mokry Bór on *Potentilla erecta* and near Mąchocice on *Crataegus*. In other regions of Poland it was found in the Subtatra region (DYLEWSKA 1991), Krynica in the Carpathians (NOSKIEWICZ 1958), Western Pomerania (BLÜTHGEN 1919), Masuria (MÖSCHLER 1938), Great Poland (TORKA 1933) and Lower Silesia (DITTRICH 1903).

Osmia parietina – boreo-montane species, found in the Łysogóry Mts in Mokry Bór. In other regions of Poland it is known from slopes of the Antałówka Mt. in the Subtatra region (DYLEWSKA 1991) and from several other localities in Poland.

Bombus jonellus – boreo-montane species, collected in the Łysogóry Mts in Mokry Bór (3 ♀♀) and in Podgórze (1♀). It is known from numerous localities of wet forest in Poland.

Montane and boreo-montane species were observed mostly in Mokry Bór, in the wet pine forest and fir-tree forest. Similar results have been published by MICHALSKI & RATAJCZAK (1989), and LIANA (2000).

3. Subpontic, submediterranean and subponto-mediterranean species

Colletes punctatus – subpontic species found in the Łysogóry Mts in the research area III, in Krajno Dolne (3♀♀) and on deforested part of southern slopes in Bieliny Poduchowne (5♀♀) on *Heracleum spondylium.* In other regions of Poland it is known only from the Pieprzowe Mts (BANASZAK 2003).

Andrena decipiens – subponto-mediterranean species, found in the research areas in Nowa Słupia (♀). It was recorded in Poland from Silesia, Ojców National Park, vicinity of Zamość and Masuria (DYLEWSKA 1987, DYLEWSKA & WIŚNIOWSKI 2003, PAWLIKOWSKI 1985, KOSIOR & FIJAŁ 1992).

Lasioglossum subfaciatum – subponto-mediterranean species, found in Ciekoty (♀) on *Salix*. In other regions of Poland it is known from the Kraków-Częstochowa Upland (CELARY 2000), Great Poland, Lower Silesia, vicinity of Przemyśl, the Western Beskid and Carpathians (PESENKO et al. 2000).

Osmia aurulenta – subpontic species, found in the adjacent area of Rudki (1♂) on *Ajuga reptans*. It was recorded in the Polish Carpathians from Zawoja Wilczna (DYLEWSKA 1966), Pieniny Mts (DYLEWSKA 1962) and other dispersed sites in Poland (BANASZAK 1979, 1980, PAWLIKOWSKI 1985, KOSIOR & FIJAŁ 1992).

Chalicodoma ericetorum – subponto-mediterranean species found in Bodzentyn and Nowa Słupia (3♀♀,5♂♂) on *Echium vulgare*. In other regions of Poland it is known from Zawoja Wilczna (DYLEWSKA 1966), Pieniny Mts (DYLEWSKA 1962) and from the numerous warm, sunny sites in Poland.

Ceratina cyanea – submediterranean species, within the area of study it was found in Święty Krzyż Mt. (♀♂) on the mid-forest meadow with southern exposition and also in Nowa Słupia (♂), Cząstków (2♀♀) and Baszowice (♀) on deforested northern slopes of the Łysogóry Mts on *Centaurea, Hieracium* and *Campanula*. In Poland it is known from the Ojców National Park, Zawoja Wilczna in the Carpathians (DYLEWSKA 1966) and from a dozen or so sites in Poland, excluding north-eastern regions (BANASZAK 1979, 1980, PAWLIKOWSKI 1985, KOSIOR & FIJAŁ 1992).

Anthophora pubescens – subponto-mediterranean species, found in Nowa Słupia (4♀♀) on *Lamium purpureum*. In other regions of Poland it was found in the Sudety Mts and in the central and northern Poland (BANASZAK 1980).

4. The numbers of zoogeographical elements of Apiformes in the Świętokrzyski National Park on the background of several national parks in southern Poland

Table X presents the numbers of zoogeographical elements found in the following national parks in Poland: Świętokrzyski NP, Ojców NP, Babia Mt NP, Tatra NP and Pieniny NP. The data in this table were obtained form references by DYLEWSKA (1962, 1991), DYLEWSKA & NOSKIEWICZ (1963), DYLEWSKA & WIŚNIOWSKI (2003) and CELARY (1998).

Table X

Zoogeographical elements of the National Parks of southern Poland and similarity between Świętokrzyski National Park and Ojców, Babia Mt., Tatra Mts., Pieniny National Parks

Zoogeographical element	Number of species in National Parks				
	Świętokrzyski N.P.	Ojców N.P.	Babia Mt. N.P.	Tatra N.P.	Pieniny N.P.
Cosmopolitic	1	1	1	1	1
Holartctic	10	13	7	7	13
Palearctic	32	43	29	40	42
West-Palearctic	36	53	31	34	59
European	24	44	26	45	51
European-Caucasian	8	11	5	6	–
European-Siberian	3	2	–	8	3
Alpine	–	–	1	1	–
Montane	1	2	2	7	6
Boreo-Alpine	–	–	1	1	1
Boreo-Montane	4	7	8	14	4
Submediterranean	1	4	–	5	3
Subsiberian-Mediterranean	–	–	–	1	–
Subpontic	2	3	–	1	6
Subponto-Mediterranean	4	9	1	2	6
Total	126	192	112	173	195
$\frac{100w}{(a+b)-w}$	100.0	43.4	28.1	32.4	35.5

The data from Table X indicate that the number of species occurring in the Świętokrzyski National Park is closest to the number of species from the Babia Mt NP (126 and 112 respectively). However, the Łysogóry Mts differ from all other parks by having a low number (5) of montane and boreo-montane species. Only in the Babia Mt the subpontic, submediterranean and subponto-mediterranean species were less numerously represented. A greatest number of common species (96) was found in the Łysogóry Mts and Ojców NP.

The similarity percentage, calculated with the equation presented in the table, is highest (43.4%) in these areas, in other parks it varies from 28.1 to 35.5%. Similar results were presented by LIANA (1990) for Orthoptera, on the basis of the JACCARDS' number. According to this author, the fauna of the Little Poland Upland and the Ojców NP shows a greatest similarity to that of the Łysogóry Mts. In the Świętokrzyski NP the montane species were not found. On the other hand, the individual north-montane species were discovered, what was also confirmed by studies on Coleoptera (KUŚKA 1989). The number of thermophilous species of Apiformes is highest in the Łysogóry Mts.

IX. CHANGES IN THE APIFORMES FAUNA IN THE ŁYSOGÓRY MTS DURING THE LAST HALF-CENTURY

1. Changes in the number of Bombini

The first studies on the number of Bombini on northern slopes of Święty Krzyż Mt. were carried out at the beginning of the 60-ies of the last century. The results showed that the area of 100 m^2 held about 150 individuals. Table XI contains the data on the numbers of Bombini in the years 60-ies and in 1998 in the Łysogóry Mts and in several chosen national parks of southern Poland. These data were taken from work on bumble-bees of Poland (DYLEWSKA 1996) and from other papers dealing with the species composition and numbers of Bombini of blooming meadows in the national parks (DYLEWSKA et al. 1998).

Table XI

Average number of Bombini per 100 m^2 in chosen glades in National Parks

National Park	Number of Bombini per 100 m^2 in years			
	1955-1965	1970-1975	1985-1994	1998-2000
Świętokrzyski N.P.	150	–	4.5	12.7 10.7
Ojców N.P.	150	5	18	18.2
Pieniny N.P.	500	5	18	25.8
Babia Mt. N.P.	150	–	–	6
Tatra N.P.	250	6	2	15.8 9.7
Gorce N.P.	–	–	–	15
Magura N.P.	–	–	–	10.7

The data in Table XI prove that a decrease in number of Bombini is up to tenfold. In the years 1970-1994 the research on the number of Bombini was carried out in mentioned national parks, excluding the Łysogóry Mts. This exclusion was caused by the lack of agricultural practices on mid-forest meadows in Święty Krzyż Mt. and by overgrowing of this area with shrubs.

At the beginning of the 80-ies the researches were undertaken in Święta Katarzyna, however, the results are not comparable, as the outcome of catches was 4,5 individuals per 100 m^2. During this period the number of bumble-bees in the remained national parks was very low, in average 5-6 individuals per 100 m^2. From 1991 an increase up to 18 individuals per 100 m^2 was observed in Ojców NP and Pieniny Mts. Till 1994, in the Tatra Mts less and less of bumble-bees were found – 2 individuals per 100 m^2. In 1998, as it is shown in the Table XI, in all mentioned national parks over 10 individuals per 100 m^2 were found and in the Pieniny Mts even almost 26 per 100 m^2. From 1999 a regular yearly research on the numbers of Apiformes was carried out in the mentioned national parks. The research proved a slight increase or stabilisation in number of these insects at the level from the year 1998. A decrease in the number of Apiformes was most likely caused by pollution of the air and agriculatural land along with decrease of blooming.

In the 60-ies blooming reached the value of around several to a dozen or so percentage, and presenly is below 1%. It equals several to a dozen or so individuals per 100 m^2 (DYLEWSKA et al. 1998).

2. The condition of Apiformes in the Łysogóry Mts

The condition of Apiformes can be qualified by the number of parasitic species. Table XII presents the number of parasitic species collected in the Łysogóry Mts and in chosen national parks of southern Poland.

Table XII

Number of parasitic species of Apiformes found in Świętokrzyski National Park (Łysogóry Mts.) and in some national parks of southern Poland

Genus	Świętokrzyski N.P.	Ojców N.P.	Babia Mt. N.P.	Tatra N.P.	Pieniny N.P.	Bieszczady N.P.	Poland
Sphecodes	2	7	3	7	8	5	21
Stelis	2	3	2	1	2	9	10
Dioxys	–	–	–	–	–	–	1
Coelioxys	1	3	1	2	5	–	13
Nomada	4	22	9	17	20	5	51
Biastes	–	–	–	1	1	–	3
Ammobates	–	–	–	–	–	–	1
Pasites	–	–	–	–	–	–	1
Epeolus	–	–	–	–	–	–	4
Epeoloides	–	–	–	–	–	–	1
Melecta	–	1	–	–	–	–	2
Thyreus	–	1	1	–	–	–	3
Total	9	37	16	28	36	19	111

The data in the table shows that the condition of Apiformes without Apidae is rather poor, as the number of parasitic species is very low (9).

In Table XIII, species of the social parasites found in the years 50-ies and 60-ies are presented. In the 80-ies and 90-ies a lower number of parasites is indicated.

Table XIII

Number of social parasites (*Psithyrus*) collected in Łysogóry Mts. in the top woody area

Species	Number of social parasites collected in years	
	1950-1963	1980-1998
Psithyrus barbutellus	5	11
Psithyrus bohemicus	127	14
Psithyrus campestris	71	34
Psithyrus rupestris	252	16
Psithyrus sylvestris	1	18
Psithyrus vestalis	4	8
Total	460	101

X. RESULTS AND CONCLUSIONS

1. In the Łysogóry Mts and adjacent areas 126 species of Apiformes were found during the years 1950 - 1998. This number represents 26.6% of the fauna of Poland.

2. The highest, forested parts of the Łysogóry Mts, stretching from the north-west to the south-east, are populated mostly by Bombini – 20 species. In addition, 50 other species of Apiformes were found.

3. In the deforested area (farmlands) to the south from forested one (the research area III), 77 species of Apiformes were found, and in the fields stretching to the north from forested areas (the research area II), 91 species.

4. In the forested area only some sites held a greater number of Apiformes. Only in Święty Krzyż Mt., Polana Bielnik meadow and Święta Katarzyna were found respectively 370, 311 and 190 specimens (mostly Bombini).

5. In adjacent areas on the northern slopes, from among 15 sites, only in Nowa Słupia and Bodzentyn respectively 150 and 302 individuals were collected, mostly belonging to Andrenidae and Megachilidae. In agricultural fields, on the southern side below the main mountain range, from among 17 localities, only in Bieliny Poduchowne 257 individuals were collected, mostly from the family Andrenidae.

6. In the forest area only 2 eudominant species *(Psithyrus bohemicus* and *Ps. rupestris*) were found. In the area located to the north from the forested area no eudominants were found. On the other hand, *Andrena haemorrhoa* was the eudominant species in the fields located to the south from the forested area.

7. In the Łysogóry Mts and adjacent areas no absolute constant species were found. In the forested area constant species were *Bombus hortorum, B. pascuorum* and *Psithyrus bohemicus*. In the field, constant species were: *Bombus hortorum, B. pascuorum* and *Evylaeus fulvicornis*.

8. The most often visited plants in the forested area were: *Lamium, Cirsium, Trifolium, Rubus* and *Lysimachia*, and in the fields: *Taraxacum, Campanula, Prunus, Sinapis, Rubus* and *Lamium.*

9. In the Łysogóry Mts the most common were widely distributed elements – 113 species. Additionally, 1 montane and 4 boreo-montane species were found. The number of these species was comparatively lowest (5) on the background of the species numbers found in other national parks of southern Poland (Ojców NP – 9, Babia Mt NP – 10, Tatra NP– 21, Pieniny NP – 10).

10. In the year 1998, over 10-times less individuals of Bombini were found than in the 60-ies. It proves a significant decrease of all Apiformes. In comparison with the 60-ies a very low number of social parasites was found, indicating a poor condition of Apiformes in the Łysogóry Mts.

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