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# The *Apoidea* of the Pieniny National Park. Part I. *Megachilidae* and *Apidae* (partim)

[Pls. XIV—XV]

***Apoidea* Pienińskiego Parku Narodowego. Część I. *Megachilidae* i *Apidae* (partim)**

***Apoidea* Пенинского Парка. Часть I. *Megachilidae* и *Apidae* (partim)**

## INTRODUCTION

No detailed study on the fauna of the *Apoidea* of the Pieniny Mts. has hitherto been made. KUNTZE (1934) in his „Problemy zoogeograficzne Pienin" quotes only one representative of this group of insects, namely, *Andrena agilissima* (SCOP.). The existing faunistic papers dealing with other groups of animals of the Pieniny Mts.: *Aves* (SITOWSKI, 1931; BOCHEŃSKI, 1960), *Apterygota* (STACH, 1919), *Coleoptera* (TENNENBAUM, 1926), *Lepidoptera* (SITOWSKI, 1906, 1910) proved the occurrence not only of species widely spread in Europe but also of montain and Boreal-Alpine species. However, the most interesting elements in the Pieniny Mts. are the thermophilous species indigenous to the south and south-eastern Europe and having in the Pieniny Mts. the northern border of their ranges, for example, the above mentioned *Andrena agilissima* (SCOP.). This species is known in Poland, beyond the Pieniny Mts., only from Upper Silesia. Of other *Hymenoptera*, it is of interest to note such a species as *Lasius emarginatus* LATR. *(Formicidae)* reported from the Pieniny Mts. and Podolia (West USSR). Different opinions with regard to the origin of the termophilous species in the Pieniny Mts. are to be found in the literature on the flora and fauna of that region. Thus, some botanists (PAWŁOWSKI, 1924, 1953) found in the Pieniny Mts. some endemic species, which, according to their opinions, survived on the southern slopes from the worm interglacial phases or even from the Pliocene. The Pieniny Mts. were not covered by ice and on the rocks of the southern exposure the thermophilous species may have survived, whilst the northern slopes were inhabited by the species characteristic of northern fauna and flora. On the other hand, the zoologists (KUNTZE, 1934; KUNTZE & NOSKIEWICZ, 1938), judging by the faunistic investigations in the Pieniny Mts. and in Podolia, did not find any endemic animal species in the former region. These authors find another explanation of the origin of the thermophilous species in the region in question. According to their opinions, these species are to be considered as relicts from the warm postglacial phase and not from Pliocene. In the postglacial phase the Podolian steppe was extending for the whole of Subcarpathian Region and most part of Poland. However, STACH (1919) found several endemic species of the *Apterygota* in the Pieniny Mts. and consider that they have survived from the pre-glacial time.

The study on the *Apoidea* in the Pieniny Mts. provided us with the further data which throw some light on the above mentioned questions. My investigations have been made thanks the initiative of Prof. Dr. J. STACH, the late Keeper of the Cracow Branch of the Institute of Zoology of the Polish Academy of Sciences, and through the kindness of Ing. T. ZARĘBA, the Director of the Pieniny National Park. The collecting of the material was continued from 1957 to 1961 during the whole period of the activity of the *Apoidea* (from April to September). The entire collection, comprising about 4000 specimens, contains chiefly the members of the *Apoidea*, but also the representatives of other groups of the *Hymenoptera*.

In the present paper which is the first part of my study on the *Apoidea* of the Pieniny Mts. I am giving the results of the investigations on the family *Megachilidae* and the genera *Clisodon* PATTON, *Anthophora* LATR., *Eucera* SCOP., *Bombus* LATR. and *Psithyrus* LEP. of the family *Apidae*. The remainder of the material will be worked out together with Prof. Dr. J. NOSKIEWICZ.

I wish to tender my thanks to those who have so kindly helped me in any way during the preparation of this paper. Prof. Dr. J. NOSKIEWICZ has kindly helped me in the identifying of many species. Prof. Dr. J. STACH and Prof. Dr. J. FUDAKOWSKI have read the typescript in detail providing me with many constructive suggestions. Mgr. H. TRZCIŃSKA has identified the plants visited by *Apoidea*.

## I. A CHARACTERISTICS OF THE TERRAIN

The Pieniny Mts. are a small range of the Carpathians; they are 10 km. long and 4 km. wide. The highest peak, Trzy Korony (pl. XIV, fig. 1) has the altitude of 982 m. which is below the upper line of the lower forest-zone in the Tatra Mts. The Pieniny Range lies latitudinally, having a ridge dividing its slopes into the northern and southern ones. The northern slopes fall gently down to the Krośnica Brook; they show small widespreading streamlets. These slopes are thickly wooded; the covering forest is moist, it forms the *Fagetum carpaticum* — complex (PAWŁOWSKI, 1959). On the northern slopes there is a rich meadow flora. KULCZYCKI (1927) distinguished three meadow-complexes in the Pieniny Mts., namely,

1. *Agrostidetum vulgaris* (in central and western Pieniny Mts.)
2. *Airetum flexuosae* (top parts and eastern Pieniny Mts.)
3. *Nerdetum stricte* (chiefly in eastern Pieniny Mts.).

On the southern side of the range there are rocky and stony limestone slopes falling steeply down to the Dunajec River. KULCZYCKI (1927) distinguishes several floral complexes there. Of these, the following two are the richest with flowers visited by the *Apoidea*-species:

1. *Festucetum rubre normale* (occurring chiefly between Czorsztyn and Sromowce Niżne)
2. *Festucetum rubre piennicum* (distinguished in Wąwóz Sobczański on the slopes of Grabczycha [east from Sromowce Niżne] and in the gorge of the Dunajec River.

The southern slopes above the rocks covers the forest of a rather similar type to that on the northern slopes but being thinner. The forest of the southern slopes is well insolated and has numerous scattered stony gaps and small meadows with a rich flora. Below the belt ot rocks, between Sromowce Wyżne and Sromowce Niżne, there are strongly insolated, cultivated fields and meadows. The range is limited from west, south and east by the Dunajec River, and from north by the Krośnica Brook.

The climate of the Pieniny Mts. was studied by SMÓLSKI (1960) and FABIANOWSKI (1957) who found it to be different from that in the Tatra Mts. In relation to such Carpathian ranges as the Tatra Mts. and the Gorce Mts., the Pieniny Mts. show the least rain fall (Pieniny Mts. — 602-854 mm. a year, depending on the region; Gorce Mts. [Rabka] 898 mm. a year; Tatra Mts. [Morskie Oko] 1762 mm. a year), the highest average day-temperature, the thinner snow-cover and the shortest time of its existence, and the least cloudness. The above circumstances cause such a strong insolation and dryness of the climate, which is especially marked on the southern slopes of the range. The influence of the cool winds, blowing here chiefly from north, west or east, is to be observed mostly on the tops and on the northern slopes. Such circumstances are due to a special microclimatic conditions which are favourable for the xerothermophilous species of animals.

The Pieniny Mts. have been divided into three regions, namely: 1. The Czorsztyn Pieniny, extending from Czorsztyn to Wąwóz Sobczański. 2. The region of Trzy Korony Mt. 3. The Pieninki (Small Pieniny Mts.). However, such a division is not acceptable in the present study as comprising different habitats. Thus, and the rocky slopes extending from Czorsztyn to the Sromowce Niżne are contained in the first of the above mentioned regions; the second region comprises the rocks of the Trzy Korony and Grabczycha; and the small rocks falling to the Pieniński Potok are within the third region. Moreover, the meadows of the northern slopes are in all three regions, etc. Therefore the division accepted in the present paper distinguishes regions which are individual ecological habitats. Each habitat is provided with a number which will subsequently be used in comments or tables:

I — forests of the northern slopes (pl. XIV, fig. 2),

II — meadows of the southern slopes,

III — forests of the southern slopes,

IV — glades of the southern slopes of the Trzy Korony mass (Kosarzyska, Ligarki, Łazek Wyżni) and meadows of the south-eastern slopes falling steep down to the River Dunajec (pl. XV, fig. 3),

V — dry meadows of the southern slopes extending from the meadows at the foot of the Trzy Korony Mt. up to Góra Zamkowa at Czorsztyn: here belongs also a meadow lying in the upper part of the Pieniński Potok Valley,

VI — screes and rocks of the southern slopes (pl. XV, fig. 4),

VII — fields and meadows lying at the foot of the southern slopes above the villages Sromowce Wyżne, Sromowce Średnie, Kąty and Sromowce Niżne,

VIII — riversides osiers by the Dunajec River and the Krośnica Brook.

## II. LIST OF SPECIES

### Family: *Megachilidae*

#### Genus: *Trachusa* Pz.

1. *T. serratule* Pz.

IV. Kosarzyska 16. VI. 1958, ♂; 10. VIII. 1960 ♂.

V. Nowa Góra 26. VI. 1961, ♂ on *Coronilla varia* L. — Nanowe 8. VIII. 1960 ♂♂ ♀♀ on *Medicago falcata* L.

VI. Grabczycha 15. VI. 1958, ♂; 21. VI. 1958, ♂. — Ostra Skała 21. VI. 1958, ♂ on *Lotus corniculatus* L. — Zamczysko 21. VI. 1961, ♂ ♀ on *Lotus corniculatus* L.; 11. VII. 1961, ♀. — Goła Góra 28. VIII. 1959, ♂ ♀ on *Lotus corniculatus* L.

#### Genus: *Anthidium* F.

1. *A. punctatum* Latr.

V. Podskalnia Góra 11. VIII. 1959, ♂ on *Medicago falcata* L.

VI. Grabczycha 23. V. 1960, ♂; 13. VI. 1961, ♀♀ on *Medicago falcata* L.; 21. VI. 1958, ♀ on *Sedum* sp.; 27. VI. 1961, ♂ on *Medicago falcata* L.; 6. VII. 1961, ♀; 11. VIII, 1960, ♂♂ on *Medicago falcata* L.; 16. VIII. 1960 ♂. — Ostra Skała 21. VI. 1958. ♂♂ on *Sedum* L. — Zamczysko 21. VI. 1961 ♂ ♀ on *Medicago falcata* L.; 11. VII. 1960, ♀ on *Medicago falcata* L.; 13. VIII. 1959, ♀. — Trzy Korony 6. VII. 1957, ♂. — Goła Góra 11. VIII. 1959, ♂.

2. *A. montanum* Mor. f. *flavomaculata* Fr.

VI. Grabczycha 10. VIII. 1959, ♂.

3. *A. manicatum* (L.).

V. Podskalnia Góra 1. VI. 1961, ♀ on *Ononis* L. — Nanowe 6. VII. 1957, ♂♂ ♀♀ on *Stachys germanica* L. — Nowa Góra 12. VIII. 1959, ♀. — Zamczysko 13. VIII. 1959, ♂♀♀ on *Stachys germanica* L. (one ♀ in a nest under stones).

VI. Zamczysko 21. VI. 1961, ♀; 11. VII. 1961, ♂♀. — Goła Góra 20. VII. 1958 ♀; 11. VIII. 1959, ♂♂; 28. VIII. 1959, ♂ on *Stachys germanica* L. — Grabczycha 6. and 11. VIII. 1960, ♀♀. — Trzy Korony 15. VIII. 1958, ♀.

## Genus: *Anthidiellum* Cockl.

1. *A. strigatum* (Pz.)

V. Nowa Góra, 12. VIII. 1959, ♀.

VI. Grabczycha 23. V. 1960 ♂; 6. VII. 1961, ♂ on *Medicago falcata* L.; 5. VIII. 1960, ♂♂ on *Medicago falcata* L.; 16. VIII. 1960 ♂; 24. VIII. 1957, ♂. — Podskalnia Góra 12. VII. 1961, ♂. — Goła Góra 11. VIII. 1959, ♂. — Trzy Korony 21. VII. 1961, ♀ on *Lotus corniculatus* L.

## Genus: *Stelis* Pz.

1. *S. ornatula* (Klug.)

VI. Podskalnia Góra VI. 1961, ♀. — Zamczysko 11. VII. 1961, ♀.

2. *S. signata* (Latr.).

V. Podskalnia Góra 12. VII. 1961, ♂♂ on *Lotus corniculatus* L.

## Genus: *Heriades* Spin.

1. *H. truncorum* (L.).

VI. Wąwóz Sobczański 4 and 11. VII. 1957, ♀♀; 17. VII. 1957, ♀ on *Medicago falcata* L. — Grabczycha 6 and 10. VIII. 1959, ♀♀ on *Medicago falcata* L.

## Genus: *Chelostoma* Latr.

1. *Ch. maxillosum* (L.).

III. Gojny Las 28. V. 1958, ♂♂♀♀ on *Rannunculus* L.; 21. VI. 1961, ♂; 16. VIII. 1958, ♂♂♀♀ on *Rannunculus* L. — Trzy Korony 19. VI. 1961, ♂.

IV. Ligarki 22. V. 1958, ♀; 7. VI. 1959, ♂ (leg. K. Malski); 13. VI. 1958, ♂ (leg. K. Malski); 16. VII. 1958, ♀. — Wyżni Łazek 28. V. 1958, ♂ on *Rannunculus* L.; 16. VI. 1958, ♂ on *Rannunculus* L.; 22. VI. 1961, ♂♂♀ on *Rannunculus* L.; 25. VI. 1958, ♂♂ on *Rannunculus* L. — Meadow at the foot of Klejowa Góra 9. and 13. VI. 1960, ♂♂ (leg. K. Malski); 14. and 16. VI. 1960, ♂♂♀♀ on *Rubus* L. near nests in wooden huts and flying over the sand by the Dunajec. — Kosarzyska 13. VI. 1958, ♂ (leg. K. Malski); 16. VI. 1958, ♂; 18. VIII. 1960, ♀.

V. Gojny Las 13. VI. 1961, ♀ on *Rannunculus* L.; 25. VI. 1958, ♂♀♀ on *Rannunculus* L.; 16. VII. 1957, ♂ on *Campanula* L.

VI. Goła Góra 22. V. 1958, ♂. — Grabczycha 13. VI. 1961, ♂ on *Rannunculus* L.; 15. VI. 1958, ♂ on *Rannunculus* L.; 17. VI. 1960, ♂ (leg. K. Malski); 20. VI. 1961, ♂♀ on *Rannunculus* L.; 17. VII. 1959, ♂ (leg. K. Malski). — Ostra Skała 15. VI. 1958, ♀ on *Rannunculus* L. — Pieniński Potok 15. VI. 1961, ♂♂ on *Rannunculus* L.

VII. Sromowce Niżne 17. V. 1958, ♂♂ on *Rannunculus* L.; 23. V. 1958, ♂♂♀ on *Taraxacum* L.; 20. VI. 1958, ♀.

2. *Ch. florisomne* (L.).

VI. Ostra Skała 5. and 16. VII. 1958, ♂♂ on *Campanula* L. — Trzy Korony 8. VII. 1957, ♂. — Grabczycha 17. VII. 1957, ♂ on *Campanula* L.

3. *Ch. distinctum* Stöckh.
IV. Ligarki 18. VI. 1959, ♀.
VI. Ostra Skała 27. VI. 1961, ♂.
VII. Sromowce Niżne 20. VII. 1958, ♂.
4. *Ch. ventralis* Schlett.
VI. Podskalnia Góra 1. VII. 1961, ♀.
5. *Ch. nigricorne* Nyl.
VI. Grabczycha 6. VII. 1961, ♂; 11. VII. 1957, ♂ on *Campanula* L.; 11. VIII. 1960, ♂♂ on *Campanula* L.; 24. VIII. 1957, ♀. — Ostra Skała 5. and 6. VII. 1957, ♂♂ on *Campanula* L.; 10. and 16. VII. 1957, ♂♀ on *Campanula* L.; 27. VI. 1961, ♂♂.

## Genus: *Osmia* Pz.

1. *O. rufa* (L.).
III. Góra Zamkowa 13. IV. 1960, ♂ on *Salix caprea* L.
V. Czorsztyn 14. IV. 1960, ♀.
VII. Sromowce Niżne 6. and 10. V. 1960, ♂♂♀ on *Taraxacum* L.; 14. and 16. V. 1960, ♂♂ on *Taraxacum* L.
VIII. Krościenko 14. VI. 1960, ♂♂ on *Salix* L. — Sromowce Niżne 20. V. 1958.
2. *O. cerinthidis* Moor.
III. Gojny Las 22. VI. 1961, ♀.
V. Nowisko 10. VI. 1961, ♀.
VI. Goła Góra 23. VI. 1958, ♀; 6. VI. 1961, ♀♀ on *Cerinthe minor* L. — Podskalnia Góra 8. VI. 1961, ♂ on *Anthylis vulneraria* L. — Ostra Skała 15. VI. 1958, ♀ on Vicia sp.; 20. and 21. 1958, ♀♀ on *Coronilla varia* L.
VII. Kąty 13. V. 1960, ♂♂♀♀ near nests in wooden huts. — Sromowce Niżne 26. VI. 1961, ♀♀ on *Cerinthe minor* L.
VIII. Sromowce Niżne 20, V. 1958, ♂♂; 24. V. 1958, ♀♀ near nests in wooden huts.; 6. VI. 1960, ♂; 9. VI. 1961, ♀♀. — Wielka Polana 20. V. 1958, ♂ on *Taraxacum* sp.; 26. V. 1958 ♂♂ on *Stellaria holostea* L.
3. *O. coerulescens* (L.).
VIII. Wielka Polana 30. V. 1957, ♀.
4. *O. villosa* Schck.
VI. Grabczycha 12. VI. 1961, ♀; 15. VI. 1958, ♀. — Ostra Skała 13. VI. 1961, ♂ on *Cirsium* Mill.; 25. VI. 1958, ♀.
5. *O. andrenoides* Spin.
IV. Kosarzyska 16. VI. 1958, ♀. — Wyżni Łazek 28. VI. 1958, ♀.
V. Pieniński Potok Valley 16. V. 1958, ♂♂.
VI. Goła Góra 20. V. 1958, ♂; 23. V. 1959, ♀♀; 9. VI. 1961, ♀ on *Trifolium pratense* L.; 10. VI. 1961, ♂♂♀♀ on *Geranium* L. — Grabczycha 20. VI. 1961, ♀; 6. VII. 1961, ♀. — Podskalnia Góra 1. VII. 1961; ♀♀; 8. VI. 1961, ♀ on *Leontodon hispidus* L.
6. *O. parietina* Curt.
VII. Sromowce Niżne 30. VI. 1961, ♂.
7. *O. atrocaernlea* Schill.
VII. Sromowce Niżne 6. VI. 1960, ♂ on *Taraxacum* L.
8. *O. fulviventris* (Pz.).
VI. Podskalnia Góra 1. VII. 1961, ♀. — Wąwóz Sobczański 11. VII. 1957, ♀ (leg. K. Malski).
9. *O. mitis* Nyl.
VI. Grabczycha 23. V. 1960, ♀ on *Campanula* L.; 11. VIII. 1960 ♀ on *Campanula* L. — Zamczysko 21. VI. 1961, ♂♂. — Trzy Korony 8. VII. 1957 ♀. — Ostra Skała 13. VI. 1961, ♂. — Goła Góra 28. VIII. 1959, ♀ on *Campanula* L.

10. *O. parvula* DUF. et PÉR.
VI. Grabczycha 10. VIII. 1959, ♀♀; 24. VIII. 1959, ♀.
11. *O. leaiana* (K.).
IV. Gorge of the Dunajec, 27. VI. 1957, ♀.
VI. Ostra Skała 21. VI. 1958, ♀ on *Coronilla varia* L. — Grabczycha 6. VII. 1961, ♀.
11. *O. leucomelana* (K.).
VI. Podskalnia Góra 1. VII. 1961, ♀.
12. *O. adunca* (Pz.).
VI. Grabczycha 13. VI. 1961, ♂♂ on *Echium vulgare* L.; 20. and 21. VI. 1961, ♂♂♀♀ on *Echium vulgare* L. — Ostra Skała 15. VI. 1957, ♀; 5. VII. 1957, ♀♀ on *Echium vulgare* L.
13. *O. spinolae* SCHCK.
VI. Grabczycha 12. VI. 1961, ♀♀ on *Echium vulgare* L. — Zamczysko 21. VI. 1961, ♂♀♀ on *Echium vulgare* L. — Wąwóz Sobczański 1. VII. 1961, ♀♀ on *Echium vulgare* L. — Ostra Skała 5. VII. 1957, ♂♂♀♀ on *Echium vulgare* L.
VII. Sromowce Niżne 4. VII. 1961, ♂.
14. *O. spinulosa* (K.).
VI. Grabczycha 10. VIII. 1959 ♀, Goła Góra 4. VI. 1961 ♂, Podskalnia Góra 1. and 12. VII. 1961, ♂♀♀. — Kotłowa Valley 8. VIII. 1959, ♀.

## Genus: *Megachile* LATR.

1. *M. circumcincta* (K.).
IV. Kosarzyska 16. VI. 1958, ♂.
V. Nowa Góra 26. VI. 1961, ♀ on *Coronilla varia* L.
VI. Grabczycha 15. VI. 1958, ♀♀ on *Coronilla varia* L.; 25. VI. 1958, ♀♀. — Ostra Skała 15. VI. 1958, ♂ on *Vicia* L.; 21. VI. 1958, ♀♀ on *Vicia* L. and *Coronilla varia* L. — Pieniński Potok Valley 15. VI. 1961, ♀ on *Vicia silvatica* L.
VII. Sromowce Niżne 8. VI. 1961, ♂ on *Trifolium* L.; 4. VII. 1957, ♂♂ on *Trifolium* L.
VIII. Wielka Polana 5. VIII. 1960, ♀.
2. *M. nigriventris* SCHCK.
V. Nowa Góra 26. VI. 1961, ♀ on *Coronilla varia* L.
VI. Grabczycha 21. VI. 1958, ♀ on *Coronilla varia* L. — Podskalnia Góra 1. VII. 1961, ♀ on *Vicia* L.
3. *M. ericetorum* LEP.
VIII. 25. and 27. VI. 1961, ♀♀ near nests in wooden huts.
4. *M. ligniseca* (K.).
III. Gojny Las 6. VII. 1957, ♀ on *Coronilla varia* L.; 8. VII. 1957, ♂ on *Cirsium* MILL.; 16. VIII. 1960, ♀ on *Cirsium* MILL. Faćmiech 10. VII. 1957, ♂.
5. *M. willoughbiella* (K.).
III. Gojny Las 14. VIII. 1960, ♀♀; 27. VIII. 1959, ♀.
IV. Wyżni Łazek 19. VIII. 1959, ♀.
V. Nanowe 10. VI. 1961, ♂ on *Lotus corniculatus* L. — Nowa Góra 26. VI. 1961, ♂♀ on *Coronilla varia* L. — Gojny Las 7. VIII. 1957, ♀ on *Salvia glutinosa* L. — Kotłowa Dolina 8. VIII. 1960, ♀ on *Carduus* L.
VI. Grabczycha 11. VII. 1960, ♀ on *Salvia glutinosa* L.; 5. VIII. 1960, ♀; 6. VIII. 1959, ♀; 24. VIII. 1959, ♀♀ on *Salvia glutinosa* L.; 4. IX. 1959, ♀♀ on *Salvia glutinosa* L. — Ostra Skała 15. VI. and 21. VI. 1958, ♂♂; 25. VI. 1958, ♀; 23. VIII. 1957, ♀ on *Cirsium* L. — Podskalnia Góra 1. VII. 1961, ♂♀. — Zamczysko 11. VII. 1961, ♀. — Pieniński Potok Valley 15. VI. 1961, ♂ on *Vicia silvatica* L.
VII. Podskale 12. VII. 1961, ♀. — Sromowce Niżne 10. VIII. 1961, ♀.

6. *M. centuncularis* (L.).
IV. Ligarki 12. VIII. 1959, ♂.
V. Nanowe 26. VI. 1961, ♂.
VI. Grabczycha 27. VI. 1961, ♂.
7. *M. versicolor* SM.
V. Nanowe 10. VI. 1961, ♀ on *Lotus corniculatus* L.; 8. VIII. 1960, ♂.
VI. Grabczycha 6. VII. 1961, ♂♂♀; 4. IX. 1959, ♀ on *Salvia glutinosa* L. — Goła Góra 10. VI. 1961, ♂. — Ostra Skała 17. VII. 1957, ♂. — Wąwóz Sobczański 24. VIII. 1957, ♀ (leg. K. MALSKI).

### Genus: *Coelioxys* LATR.

1. *C. rufescens* LEP.
VI. Grabczycha 21. VI. 1958, ♀. — Goła Góra 9. VI. 1961, ♀ on *Geranium* L.; 28. VIII. 1959, ♂.
2. *C. alata* FÖRST.
VI. Grabczycha 10. VIII. 1959, ♂.
3. *C. quadridentata* (L.).
VI. Grabczycha 15. VI. 1958, ♀♀ on *Vicia* L.; 20. VI. 1961, ♂; 6. VIII. 1959, ♀ on *Mentha* sp. — Ostra Skała 15. VI. 1958, ♂♀♀ on *Vicia* L.
4. *C. lanceolata* NYL.
VI. Grabczycha 20. VI. 1961, ♂.
5. *C. elongata* LEP.
VI. Grabczycha 15. VI. 1958, ♂.

## Family: *Apidae*

### Genus: *Eucera* SCOP.

1. *E. longicornis* (L.).
II. Dolina Ociemne 31. VI. 1958, ♂. — Wymiarki 10. VII. 1961, ♀ on *Lathyrus silvester* L.
III. Nowisko 10. VI. 1961, ♂♂♀ on *Anthylis vulneraria* L.
IV. Wyżni Łazek 28. V. 1958, ♂♂. — Kosarzyska 16. VI. 1958, ♂♂. — Meadow at the foot of Klejowa Góra 16. VI. 1961, ♂.
V. Nowa Góra 26. VI. 1961, ♀♀ on *Coronilla varia* L. — Pieniński Potok 10. VII. 1961, ♀ on *Vicia silvatica* L.
VI. Grabczycha 29. VI. 1958, ♀.
VII. Sromowce Niżne 16. V. 1960, ♂♂; 19. and 29. V. 1958, ♂♂ on *Trifolium* L. 8. and 9. VI. 1961, on *Trifolium* L. — Podskale 15. VI. 1958, ♂♂♀♀ on *Trifolium* L. — Podnowe 4. VII. 1957, ♂♂♀♀ on *Trifolium* L.

### Genus: *Clisodon* PATTON

1. *C. furcatus* (Pz.).
IV. Ligarki 13. VIII. 1959, ♀.
V. Czoło 11. VII. 1957, ♀.
VI. Grabczycha 21. VI. 1961, ♂.
Ostra Skała 6. VII. 1957, ♂♀ on *Campanula* L.
VII. Sromowce Niżne 15. VI. 1958, ♂.

### Genus: *Anthophora* Latr.

1. *A. quadrimaculata* (Pz.).
VI. Ostra Skała 21. VIII. 1957, ♀. — Grabczycha 16. VIII. 1960, ♀ on *Lamnium purpureum* L.; 5. VIII. 1960, ♀ on *Mentha sp.*
2. *A. aestivalis* Pz.
VII. Wielka Polana 20. V. 1958, ♂ on *Taraxacum* L.
3. *A. acervorum* (L.).
IV. Wyżni Łazek 4. V. 1960, ♀ on *Primula elatior* L.
V. Nowa Góra 15. V. 1958, ♂. — Macelowa Dolina 23. V. 1958, ♀♀.
VI. Grabczycha 26. V. 1958, ♂♀. — Goła Góra 27. V. 1958, ♂.
VII. Magierowa Skała 17. V. 1958, ♂ on *Taraxacum* L. — Kąty 22. V. 1958, ♂.

### Genus: *Bombus* Latr.

1. *B. hortorum* (L.).
I. Pieniński Potok V. 1957, ♀♀ on *Pulmonaria* L. — Dolina Ociemne 26. VI. 1957, ♀♀.
II. Bańków Gronik 24. V. 1957, ♀♀ on *Taraxacum* L. — Trzy Korony 9. VII. 1957, ♂♀♀. — Wymiarki 10. VII. 1961; ☿☿; 10. VIII. 1960, ♀♀.
III. Gojny Las 28. V. 1958, ♀ on *Lonicera* L.; 14. VIII. 1960, ☿☿; 21. VIII. 1959, ♀♀ on *Cirsium* L.
IV. Wyżni Łazek 4. and 11. V. 1961, ♀♀ on *Primula elatior* L. — Gorge of the Dunajec 14. V. 1960, ♀♀ on *Taraxacum* L.; 9. VI. 1960, ☿☿ (leg. K. Malski). — Meadow at the foot of Klejowa Góra 25. VI. 1958, ♀. Szopka Pass 1. VII. 1957, ☿☿; 9. and 11. VII. 1957, ☿☿; 10. VII. 1961, ♀♀. — Ligarki 10. VIII. 1960, ♂♂ ♀♀ ☿☿ on *Centaurea* L. — Kosarzyska 10. VIII. 1960, ♂♂ ♀♀ ☿☿ on *Centaurea* L. — Trzy Korony 22. VIII. 1956, ☿ (leg. W. Bazyluk and K. Winnik).
V. Gojny Las 6. VII. 1957, ☿ on *Lotus corniculatus* L. — Pieniński Potok 10. VII. 1961, ♀♀ ☿☿ on *Lotus corniculatus* L.; 5. VIII. 1960, ♂ on *Cirsium* L.; 21. IX. 1960, ♂ on *Cirsium* L. — Czoło 11. VII. 1957, ☿☿. — Nanowe 8. VIII. 1960, ☿☿ on *Brunella* L.
VI. Zamczysko 11. VI. 1961, ☿☿ on *Lotus corniculatus* L. — Wąwóz Sobczański 11. VII. 1957, ☿☿; 2. VIII. 1957, ♀. — Ostra Skała 16. VII. 1957, ☿☿ on *Lotus corniculatus* L.; 8. VIII. 1960, ☿☿ on *Carduus sp.*; 15. VIII. 1958, ♀♀. — Goła Góra 7. VIII. 1958, ☿☿ on *Lotus corniculatus* L.
VII. Sromowce Niżne 14. V. 1960, ♀♀ on *Taraxacum* L.; 4. VII. 1957, ♀♀ on *Trifolium sp.* — Podskale 12. VII. 1961, ☿☿ on *Lotus corniculatus* L.
VIII. Krościenko 31. V. 1957, ♀ on *Salix* L. — Wielka Polana 7. VII. 1957 ☿☿.
1a. *B. hortorum* (L.) *m. nigricans* (Schmdkn.).
V. Pieniński Potok 16. VI. 1961, ♀.
VI. Pieniński Potok 21. VIII. 1959, ♂.
VII. Sromowce Niżne 4. VII. 1957, ♀.
2. *B. ruderatus* (F.).
III. Gojny Las 25. V. 1957, ♀ on *Lonicera* L.; 16. VII. 1957, ♂.
3. *B. subterraneus* (L.).
V. Pieniński Potok 9. VII. 1957, ☿. — Czoło 11. VII. 1957, ☿. — Nanowe 19. VII. 1957, ♀; 8. VIII. 1960, ☿.
IV. Ligarki 23. VIII. 1957, ♂♂ on *Centaurea* L. — Szopka Pass 28. VIII. 1957, ♂.
4. *B. distinguendus* Mor.
V. Czoło 11. VII. 1958, ☿☿. — Nowa Góra 12. VIII. 1959, ♂.
5. *B. pomorum* (Pz.)
VI. Goła Góra 20. V. 1958, ♀.
6. *B. elegans* Seidl.

IV. Kosarzyska 23. VIII. 1957, ♂♂ on *Centaurea* L. — Ligarki 23. VIII. 1957, ♂ on *Centaurea* L. — Trzy Korony 22. VIII. 1956, ♂ (leg. W. Bazyluk and K. Winnik).

V. Nowa Góra 12. VIII. 1959, ♂; 28. VIII. 1957, ♂♂.

VI. Wąwóz Sobczański 17. VII. 1957, ♀; 2. VIII. 1957, ♂.

VII. Podnowe 20. V. 1958, ♀. — Sromowce Niżne 4. VII. 1957, ♀♀ on *Trifolium* L.

7. *B. agrorum* (F.).

I. Dolina Ociemne 26. V. 1957, ♀♀ on *Pulmonaria* L. — Czarny Potok 28. VIII. 1959, ♂.

II. Bańków Gronik 24. V. 1957, ♀♀ on *Taraxacum* L. and *Primula* L. — Domiarki 9. VI. 1960, ♀♀ on *Primula elatior* L. — Trzy Korony 9. VII. 1957, ♀♀. — Wymiarki 10. VII. 1961, ♀♀; 18. VIII. 1957, ♂♂. — Ociemne Valley 20. VIII. 1960, ♀.

III. Nowa Góra 24. V. 1957, ♀ on *Lonicera* L. — Gojny Las 8. VII. 1957, ♀; 25. VII. 1957, ♀♀ on *Lonicera* L.; 23. VIII. 1957, ♀♀. — Nowisko 26. VIII. 1957, ♂♂; 27. VIII. 1958, ♂♂ on *Brunella* L.

IV. Meadow at the foot of Klejowa Góra 14. V. 1960, ♀ on *Taraxacum* L.; 16. VI. 1961, ♀ on *Lotus cornicolatus* L.; 30. VI. 1961, ♀♀. — Szopka Pass 21. V. 1958, ♀ on *Lathyrus* L.; 28. VIII. 1957, ♀♀. — Ligarki 16. V. 1958, ♀; 18. VIII. 1959, ♀♀ on *Centaurea* L. — Wyżni Łazek 22. VI. 1961, ♀ on *Rubus* L.; 25. VI. 1958, ♀ ♀♀. — Meadow on Faćmiech 22. VI. 1958, ♀♀; 10. VII. 1957, ♀ ♀. — Gorge of the Dunajec 8. VII. 1957, ♀♀.

V. Gojny Las 6. VII. 1957, ♀♀ on *Lotus corniculatus* L. — Nanowe 4. VII. 1961, ♀ on *Brunella* L.; 19. VII. 1957, ♀; 8. VIII. 1960, ♀. — Pieniński Potok 10. VII. 1961, ♀ on *Lotus cornicolatus* L.; 5. VIII. 1960 ♂ ♀. — Czoło 11. VII. 1957, ♀♀. — Kotłowa Dolina 8. VIII. 1959, ♀ on *Carduus* L.; 30. VIII. 1958, ♂ on *Carduus* L. — Nowa Góra 12. VIII. 1959, ♀ on *Carduus* L.; 27. VIII. 1947, ♀.

VI. Grabczycha 16. V. 1958, ♀; 23. V. 1960, ♀♀; 10. VII. 1957, ♀♀ ♀♀ on *Salvia* L.; 11. VIII. 1960, ♀ on *Centaurea* L.; 2. IX. 1958, ♂ on *Centaurea* L. — Pieniński Potok 15. VI. 1961, ♀♀ on *Vicia silvatica* L. — Ostra Skała 5. VII. 1957, ♀♀ on *Echium vulgare* L.; 15. VIII. 1960, ♀; 21. VIII. 1957, ♂ ♀. — Zamczysko 11. VII. 1961, ♀♀ on *Coronilla varia* L.

VII. Kąty 13. V. 1960, ♀. — Wielka Polana 7. VIII. 1957, ♀♀. — Sromowce Niżne 10. VIII. 1961, ♀.

VIII. Kąty 13. V. 1960, ♀♀ on *Salix* L.

8. *B. humilis* (Ill.).

V. Nowa Góra 11. VII. 1957, ♀♀ ♀♀; 27. VII. 1957, ♀; 27. VIII. 1957, ♀; 28. VIII. 1957, ♂♂ ♀♀.

VI. Goła Góra 20. V. 1958, ♀; 11. VIII. 1959, ♀; 28. VIII. 1959, ♂. — Zamczysko 11. VII. 1958, ♀. — Wąwóz Sobczański 17. VII. 1957, ♀♀; 2. VIII. 1957, ♀.

VII. Podnowe 28. VIII. 1959, ♀.

9. *B. ruderarius* (Müll.).

II. Domiarki 10. VI. 1960, ♀. — Wymiarki 10. VII. 1961, ♀ on *Coronilla varia* L.; 10. VIII. 1960, ♀♀ on *Coronilla varia* L. — Ligarki 18. VIII. 1959, ♂.

IV. Szopka Pass 18. V. 1958, ♀. — Kosarzyska 10. VIII. 1960, ♂ ♀ ♀.

V. Pieniński Potok 11. VII. 1961, ♂ ♀. — Czoło 11. VII. 1958, ♀. — Nowa Góra 11. VII. 1957, ♀; 12. VIII. 1959, ♂; 23. VIII. 1959, ♂ on *Carduus* L. — Nanowe 19. VII. 1957, ♀; 8. VIII. 1960, ♀. — Pieniński Potok 18. VIII. 1960, ♀.

VI. Podskalnia Góra 17. V. 1960, ♀. — Goła Góra 7. VIII. 1958, ♀.

VII. Podnowe 20. V. 1957, ♀♀ on *Taraxacum* L. — Sromowce Niżne 22. V. 1958, ♀ on *Taraxacum* L.; 4. VII. 1957, ♀♀. — Szewców Gronik 11. VII. 1957, ♀♀ on *Lotus cornicolatus* L.

10. *B. silvarum* (L.).

II. Wymiarki 10. VII. 1961, ♀. — Szewców Gronik 11. VII. 1957, ♀. — Toporzysko 21. IX. 1960, ♀♀ on *Carduus* L.

V. Czoło 11. VII. 1957, ♀♀. — Dolina Kotłowa 30. VIII. 1958, ♀ on *Carduus* L.
IV. Ligarki 16. VI. 1958, ♀.
VI. Goła Góra 22. V. 1958, ♀; 28. VIII. 1959, ♀. — Wąwóz Sobczański 3. 11. and 17. VII. 1957, ♀♀. — Grabczycha 24. VIII. 1957, ♂.
VII. Sromowce Niżne 8. V. 1960, ♀ on *Taraxacum* L.; 4. VII. 1957, ♀ ♀♀ on *Carduus* L. — Podnowe 20. V. 1958, ♀. — Podskale 12. VII. 1961, ♀♀ on *Lotus corniculatus* L.

11. *B. equestris* (F.).
II. Toporzysko 21. IX. 1960, ♀ on *Brunella* L.
VII. Podskale 12. VI. 1961, ♀ on *Coronilla varia* L. — Sromowce Niżne 15. VI. 1958, ♀; 4. VIII. 1957, ♀ on *Trifolium* L.

12. *B. confusus* Schck.
VIII. Krościenko 27. V. 1958, ♀. — Sromowce Niżne 23. V. 1958, ♀.

13. *B. lapidarius* (L.).
II. Wymiarki 10. V. 1960, ♀ on *Primula elatior* L.; 10. VII. 1961, ♀♀ on *Coronilla varia* L. — Bożencki Gronik 30. V. 1958, ♀ (leg. T. Oleś). — Trzy Korony 23. VIII. 1957, ♂♂ on *Centaurea* L. — Toporzysko 21. IX. 1960, ♂♂ ♀♀ on *Centaurea* L.
III. Gojny Las 17. VII. 1957, ♀♀ on *Campanula* L.; 21. VIII, 1959, ♀ on *Coronilla varia* L.; 23. VIII. 1957, ♂ on *Coronilla varia* L. — Nowisko 26. VIII. 1957, ♂♂ ♀♀ on *Trifolium* L.; 27. VIII. 1958, ♂ on *Trifolium* sp.
IV. Szopka Pass 18. V. 1958, ♀ on *Primula elatior* L.; 3. and 11. VII. 1957, ♀♀; 10. VII. 1961, ♀♀ on *Trifolium* L. — Wyżni Łazek 28. V. 1958, ♀ on *Primula elatior* L. — Trzy Korony 9. VII. 1957, ♀♀. — Ligarki 8. VIII. 1959, ♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ on *Centaurea* L. — Kosarzyska 23. VIII. 1957, ♂♂ on *Centaurea* L.
V. Pieniński Potok 10. VII. 1961, ♀ on *Trifolium* L.; 5. VIII. 1960, ♀♀ on *Coronilla varia* L. — Czoło 11. VII. 1957, ♂♂ ♀♀ on *Ajuga* L. — Nanowe 19. VII. 1957, ♀♀ on *Trifolium* L. — Dolina Kotłowa 4. VIII. 1959, ♀ on *Carduus* L. — Nowa Góra 27. VIII. 1957, ♂♂ ♀♀ on *Carduus* L.; 28. VIII. 1957, ♂♂ ♀♀ on *Coronilla varia* L.
VI. Goła Góra 22. V. 1958, ♀ on *Taraxacum* L.; 7. VIII. 1958, ♀ on *Geranium* L.; 28. VIII. 1959, ♀ on *Carduus* L. — Wąwóz Sobczański 6. VII. 1957, ♀; 17. VII. 1957, ♀♀ on *Medicago* L. — Grabczycha 6. VII. 1961, ♀♀ on *Sedum* L. — Podskalnia Góra 12. VII. 1961, ♀ on *Coronilla varia* L. — Zamczysko 13. VIII. 1959, ♀ on *Coronilla varia* L.
VII. Podnowe 20. V. 1958, ♀ on *Taraxacum* L. — Podskale ♂♂ ♀♀ on *Coronilla varia* L. and on *Lotus cornicolatus* L.
VIII. Wielka Polana 4. IX. 1959, ♂ on *Carduus* L.

14. *B. soroeensis* (F.) ssp. *soroeensis* (F.).
II. Trzy Korony 9. VII. 1957, ♀♀; 23. VIII. 1959, ♀ on *Centaurea* L.
III. Gojny Las 21. VIII. 1959, ♀♀. — Nowisko 26. VIII. 1957, ♀♀ on *Thymus* L.
IV. Wyżni Łazek 25. VI. 1958, ♀. Gorge of the Dunajec River 25. VI. 1958, ♀♀. — Ligarki 18. VIII. 1959, ♂ ♀♀ on *Centaurea* L.; 23. VIII. 1957. ♂♂ ♀ on *Centaurea sp.* — Kosarzyska 19. VIII. 1959, ♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ ♀♀ on *Centaurea* L. — Faćmiech 21. VIII. 1959, ♀.
V. Czoło 11. VII. 1957, ♀. — Nowa Góra 27. and 28. VIII. 1957, ♂ ♀♀ on *Carduus* L.
VI. Pieniński Potok 3. VI. 1957, ♀; 15. VI. 1961, ♀. — Grabczycha 10. VII. 1957, ♀; 5. and 11. VIII. 1960, ♀♀ on *Campanula* L.; 2. IX. 1959, ♀. — Ostra Skała 16. VII. 1957, ♀ on *Campanula* L.; 27. VIII. 1959, ♀♀ on *Campanula* L.
VII. Sromowce Niżne 10. VIII. 1960, ♀. — Kąty 13. VIII. 1959, on ♀ *Thymus* L.

14a. *B. soroeensis* (F.) ssp. *proteus* (Gerst.).
I. Ociemne Valley 31. V. 1957, ♀.

II. Gojny Las 5. VIII. 1961, ♀.
IV. Kosarzyska 19. VIII. 1959, ♀; 23. VIII. 1957, ♀♀ on *Centaurea* L.
V. Czoło 11. VII. 1957, ♂ ♀. — Macelak 13. VIII. 1959, ♂ ♀ on *Thymus* L. — Nowa Góra 27. VIII. 1957, ♂.
VI. Grabczycha 10. VII. 1959, ♀; 2. IX. 1959, ♂. — Goła Góra 28. VIII. 1959, ♀.
VII. Sromowce Niżne 4. VI. 1957, ♀ on *Trifolium* L.

15. *B. pratorum* (L.).
I. Ociemne Valley 22. IV. 1959, ♀ on *Taraxacum* L.; 26. VI. 1957, ♀♀ on *Lonicera* L. — Góra Zamkowa 11. V. 1960, ♀ on *Salix* L. — Pieniński Potok Valley 3. VI. 1957, ♀♀.
II. Trzy Korony 9. VII. 1957, ♀ ♀♀. — Ociemne Valley 20. VIII. 1960, ♂.
III. Cyhrla 5. V. 1960, ♀ on *Taraxacum* L. — Faćmiech 16. V. 1958, ♀. — Nowa Góra 24. V. 1957, ♀♀ on *Lonicera* L. and on *Veronica chamaedris* L. — Gojny Las 25. V. 1957, ♀ ♀ on *Lonicera* L.; 8. VII. 1957, ♂ ♀♀; 16. and 17. VII. 1957, ♂ ♀ on *Campanula* L.; 10. VIII. 1960, ♂ ♀; 17. and 21. VIII. 1957, ♂♂. — Nowisko 26. VIII. 1957, ♂.
IV. Ligarki 4. V. 1960, ♀ on *Primula elatior* L.; 16. VI. 1958, ♀ on *Rubus* L. — Gorge of the Dunajec River 16. V. 1961, ♀ on *Taraxacum* L. — Kosarzyska 16. VI. 1958, ♀ on *Rubus* L.; 23. VIII. 1957, ♀ on *Centaurea*. — Wyżni Łazek 22. VI. 1961, ♀ on *Rubus* L. — Szopka Pass 15. VI. 1961, ♀; 3. VII. 1957, ♀♀; 11. VII. 1957, ♀ on ♀ on *Cirsium* Mill. — Ligarki 16. VI. 1958, ♀ on *Rubus* L. — Meadow at the foot of Klejowa Góra 20. VI. 1961, ♀♀ on *Rubus* L. — Gojny Las 7. VII. 1957, ♀. — Faćmiech 10. VII. 1957, ♂♂ on *Centaurea* L.
V. Nanowe 26. VI. 1961, ♂; 4. VII. 1961, ♂ on *Thymus* L.; 8. VIII. 1960, ♂♂ ♀ on *Brunella* L. — Czoło 11. VII. 1957, ♀ on *Brunella* L. — Nowa Góra 11. VII. 1957, ♀♀; 12. VIII. 1959, ♂. — Pieniński Potok 5. VIII. 1960, ♂ ♀ on *Cirsium* Mill. — Dolina Macelowa 7. VIII. 1960, ♂ on *Carduus* L. — Dolina Kotłowa 8. VIII. 1959, ♂ on *Mentha* L.
VI. Grabczycha 6. VII. 1961, ♂; 10. VII. 1957, ♂♂; 5. VIII. 1960, ♀; 24. VIII. 1957 ♀. — Wąwóz Sobczański 3. VII. 1957, ♀♀; 10. VII. 1961 ♀, on *Thymus* L. — Ostra Skała 5. VII. 1957, ♀♀ on *Echium vulgare* L.; 10. VII. 1957, ♀; 21. VIII. 1957, ♀ on *Centaurea* L.
VII. Podnowe 7. VII. 1957, ♀♀. — Sromowce Niżne 10. VIII. 1961, ♀ on *Thymus* L.

16. *B. hypnorum* (L.).
II. Trzy Korony 9. VII. 1957, ♀. — Wymiarki 10. VII. 1961, ♀.
III. Gojny Las 8. VII. 1957, ♀; 6. VIII. 1957, ♀ on *Coronilla varia* L.; 14. and 15. VIII. 1960, ♀♀; 27. VIII. 1959 ♀ on *Centaurea* L. — Trzy Korony 16. VIII. 1958, ♀.
V. Góra Zamkowa 11. V. 1960, ♀ on *Salix* L. — Nowa Góra 11. VII. 1957, ♀; 23. VIII. 1959, ♂ on *Carduus* L.
IV. Kosarzyska 16. VI. 1958, ♀. — Ligarki 16. VI. 1958, ♀; 18. VIII. 1959, ♂ on *Centaurea* L.; 23. VIII. 1957, ♀ on *Centaurea* L. — Gojny Las 5. VII. 1957, ♀♀ on *Coronilla varia* L. — Gorge of the Dunajec River 8. VII. 1957, ♀; 28. VIII. 1957 ♂♂. — Faćmiech 21. VIII. 1959, ♂ on *Centaurea* L.
VI. Grabczycha 6. VII. 1961, ♀; 10. VII. 1957, ♀; 5. VIII. 1960, ♀♀. — Pieniński Potok 28. VIII. 1957, ♀.

17. O. *terrestris* (L.).
I. Dolina Ociemne 26. V. 1957, ♀ on *Lonicera* L. — Pieniński Potok 28. VIII, 1957, ♂♂.
II. Bańków Gronik 24. V. 1957, ♀ on *Taraxacum* L. — Wymiarki 10. VII. 1961, ♀ on *Vicia* L. — Hudziary 24. VII. 1957, ♀ (leg. T. Oleś). — Trzy Korony 23. VIII. 1957, ♂.
III. Góra Zamkowa 24. V. 1957, ♀ on *Lonicera* L. — Gojny Las 25. VI. 1957, ♀♀; 6. VII. 1957, ♀♀ on *Coronilla varia* L.; 21. and 28. VIII. 1957, ♂♂ ♀♀; 6. VIII. 1958,

♀♀ on *Campanula* L.; 21. VIII. 1959, ♂ ♀; 22. IX. 1960, ♂. — Nowisko 26. and 27. VIII. 1957, ♂♂ ♀♀ on *Thymus* L.

IV. Ligarki 16. VI. 1958, ♀ on *Rubus* L.; 23. VIII. 1957, ♂♂ on *Centaurea* L.; 22. IX. 1960, ♂. — Szopka Pass 2. VII. 1957, ♀♀. — Kosarzyska 23. VIII. 1957, ♂♂ on *Centaurea* L.

V. Góra Zamkowa 11. V. 1960, ♀♀ on *Salix* L. — Gojny Las 7. and 6. VII. 1957, ♀♀ on *Coronilla varia* L. — Nanowe 12. VII. 1959, ♂ on *Trifolium* L.; 19. VII. 1957, ♀ on *Thymus* L.; 8. VIII. 1960, ♂ on *Thymus* L. — Dolina Kotłowa 4. VIII. 1959, ♀ on *Mentha* L.; 30. VII. 1958, ♂♂ on *Carduus* L. — Nowa Góra 27. and 28. VIII. 1957, ♂♂ ♀♀ on *Carduus* L. — Pieniński Potok 20. IX. 1960, ♀.

VI. Grabczycha 23. V. 1960, ♀; 10. VII. 1957, ♀♀ on *Coronilla varia* L.; 5. VIII. 1958, ♀. — Wąwóz Sobczański 3. VII. 1957, ♀; 11. and 17. VII. 1957, ♀♀. — Ostra Skała 5. and 17. VII. 1957, ♀♀ on *Campanula* L.; 21. VIII. 1957, ♂♂ on *Centaurea* L.

VII. Podnowe 10. VIII. 1961, ♂♂ ♀♀ on *Brunella* L.

VIII. Sromowce Niżne 30. V. 1957, ♀ on *Taraxacum* L.; 7. VII. 1957, ♀♀ on *Thymus* L.

18. *B. lucorum* (L.).

II. Hudziary 24. VII. 1957, ♀ (leg. T. Oleś).

III. Gojny Las 10. VIII. 1960, ♀♀ on *Coronilla varia* L.; 21. VIII. 1957, ♂♂; 21. VIII. 1959, ♀♀. — Nowisko 26. VIII. 1957, ♂ on *Thymus* L.

IV. Faćmiech 22. VI. 1958, ♀. — Gorge of the Dunajec River 8. VII. 1957, ♀. — Kosarzyska 23. VIII. 1957, ♂ ♀♀ on *Centaurea* L. — Ligarki 23. VIII. 1957, ♂♂ on *Centaurea* L. — Szopka Pass 28. VIII. 1957, ♂ on *Cirsium* Mill.

V. Nanowe 12. VII. 1959, ♂ on *Thymus sp.*; 9. VIII. 1960 ♂, on *Thymus* L. — Rabsztyn 13. VIII. 1959, ♂ on *Brunella* L. — Nowa Góra 28. VIII. 1957, ♀.

VI. Grabczycha 20. VI. 1961, ♀ on *Coronilla varia* L.; 5. VIII. 1960, ♀♀; 24. VIII. 1957, ♂ ♀. — Zamczysko 11. VII. 1961, ♀ on *Coronilla varia* L. — Ostra Skała 21. VIII. 1957, ♀ on *Carduus* L. — Wąwóz Sobczański VIII, 1957, ♂ ♀. — Pieniński Potok 28. VIII. 1957, ♂♂.

VII. Sromowce Niżne 4. VII. 1957, ♀ on *Thymus* L.

VIII. Wielka Polana 5. VIII. 1959, ♀ on *Thymus* L.

19. *B. mastrucatus* Gerst.

II. Pieniński Potok, 20. V. 1960, ♀ on *Symphytum* L. — Trzy Korony 9. VII. 1957, ♀ on *Thymus* L. — Wymiarki 10. VIII. 1961, ♀♀.

III. Gojny Las 10. and 14. VIII. 1960, ♀♀ on *Salvia* L.; 21. and 27. VIII. 1959, ♀♀; 4. IX. 1959, ♂♂ ♀.

IV. Wyżni Łazek 4. V. 1960, ♀ on *Primula elatior* L. — Kosarzyska 21. V. 1957, ♀ on *Primula elatior* L.; 10. VIII. 1960, ♂ ♀♀ on *Centaurea sp.*; 23. VIII. 1957, ♀ on *Coronilla varia* L. — Ligarki 16. VI. 1958, ♀ on *Rubus* L. — Szopka Pass 10. VII. 1961, ♀♀; 3. VIII. 1957, ♂ on *Carduus* L. — Trzy Korony 23. VIII. 1957, ♂ on *Centaurea* L.

V. Pieniński Potok 10. VII. 1961, ♀♀ on *Coronilla varia* L.; 11. VII. 1957, ♀. — Czoło 11. VII. 1957, ♀ on *Thymus* L.

VI. Grabczycha 23. V. 1960, ♀; 2. IX. 1959, ♂♂ ♀. — Wąwóz Sobczański 11. and 17. VII. 1957, ♀♀ on *Thymus* L. — Ostra Skała 16. VII. 1959, ♀; 8. VIII. 1960, ♀♀.

VII. Podskale 10. VII. 1961, ♀ on *Coronilla* L. — Sromowce Niżne 12. VIII. 1960, ♀ on *Thymus* L.

### Genus: *Psithyrus* Lep.

1. *P. vestalis* (Fourcr.).

I. Kopa Siana 18. V. 1958, ♀ (leg. T. Oleś). — Hukowa Skała 28. V. 1958, ♀ on *Taraxacum* L.

II. Pieniński Potok 4. V. 1960, ♀ on *Petasites glabratus* (Maly).
IV. Ligarki 18. VIII. 1959, ♂ on *Centaurea* L. — Szopka Pass VIII, 1957, ♂ on *Cirsium* L. — Kosarzyska 23. VIII. 1957, ♂♂ on *Centaurea* L.
V. Gojny Las 10. VII. 1959, ♂ on *Carduus* L.
VI. Pieniński Potok 28. VIII. 1957, ♂♂.
VII. Sromowce Niżne 6. VI. 1960, ♀ on *Taraxacum* L.

2. *P. bohemicus* (Seidl.).
II. Wymiarki 18. VIII. 1957, ♂ on *Cirsium* Mill.
III. Gojny Las 21. VIII. 1957, ♂ on *Thymus* L.
IV. Ligarki 18. VIII. 1959, ♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ on *Centaurea* L. Gorge of the Dunajec River 21. VIII. 1959, ♀. — Trzy Korony 23. VIII. 1957, ♂. — Kosarzyska 23. VIII. 1959, ♂.
V. Nowa Góra 23. VIII. 1958, ♂; 27. VIII. 1957, ♂.
VI. Wąwóz Sobczański 3. VIII. 1957, ♂ on *Carduus* L. — Ostra Skała 8. VIII. 1960, ♂. — Pieniński Potok 28. VIII. 1957, ♂.
VIII. Wielka Polana 16. V. 1958, ♀ on *Taraxacum* L.

3. *P. rupestris* (F.).
III. Gojny Las 12. VI. 1961, ♀ on *Rubus* L.
IV. Kosarzyska 19. VIII. 1959, ♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ *Centaurea* sp. — Trzy Korony 23. VIII. 1957, ♂♂. — Ligarki 23. VIII. 1957, ♂♂ on *Centaurea* L.; 29. VIII. 1959 ♂ on *Centaurea sp.*; 22. IX. 1960, ♂.
V. Dolina Kotłowa 27. VIII. 1959, ♂ on *Carduus* L. — Nowa Góra 28. VIII. 1957, ♂♂.
VII. Sromowce Niżne 4. VII. 1957, ♀ on *Thymus* L.

4. *P. campestris* (Pz.).
II. Pasternik 4. VI. 1957, ♀ (leg. T. Oleś). — Wymiarki 10. VIII. 1960, ♂ on *Centaurea* L.; 18. VIII. 1957, ♂.
III. Nowisko 16. VI. 1961, ♀ on *Taraxacum* L. — Faćmiech 22. VI. 1958, ♀♀ on *Rubus* L. — Gojny Las 21. VIII. 1957, ♂♂; 23. VIII. 1960, ♂; 27. VIII. 1959, ♂♂ on *Cirsium* Mill.; 22. IX. 1960, ♂♂.
IV. Meadow at the foot of Klejowa Góra 16. VI. 1961, ♀ on *Taraxacum* L. — Ligarki 18. VIII. 1959, ♂♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ on *Centaurea* L. — Trzy Korony 23. VIII. 1957, ♂♂. — Kosarzyska 19. VIII. 1959, ♂♂ on *Centaurea* L.; 23. VIII. 1957, ♂♂ on *Centaurea* sp. — Wyżni Łazek 27. VIII. 1957, ♂♂ on *Centaurea* L. — Szopka Pass VIII. 1957, ♂ on *Cirsium* Mill.
V. Czoło 11. VII. 1957, ♂. — Pieniński Potok 10. VIII. 1960, ♀ on *Cirsium* Mill.; 21. IX. 1960, ♂♂. — Nowa Góra 12. VIII. 1959, ♂♂ on *Carduus* L.; 27. and 28. VIII. 1957, ♂♂ on *Carduus* L. — Rabsztyn 13. VIII. 1959, ♂ on *Thymus* L.
VI. Goła Góra 20. V. 1958, ♀ on *Taraxacum* L. — Grabczycha 5. VIII. 1960, ♂; 24. VIII. 1957, ♂♂. — Ostra Skała 21. VIII. 1957, ♂♂. — Wąwóz Sobczański VIII. 1957, ♂♂ on *Carduus* L.
VII. Sromowce Niżne 15. VI. 1958, ♀; 4. VIII. 1957, ♂.
VIII. Kras 30. VI. 1961, ♀.

5. *P. barbutellus* (K.).
III. Gojny Las 15. VIII. 1960, ♂♂. — Nowisko 26. VIII. 1957, ♂.
IV. Rabsztyn 13. VIII. 1959, ♂. — Ligarki 18. VIII. 1959, ♂ on *Centaurea* L. — Kosarzyska 19. VIII. 1959, ♂♂ on *Centaurea* L.; 23. VIII. 1957, ♂ on *Centaurea* L. — Trzy Korony 22. VIII. 1956, ♂ (leg. W. Bazyluk and K. Winnik); 23. VIII. 1957, ♂ on *Cirsium* Mill.
VII. Sromowce Niżne 10. VIII. 1961, ♂.

6. *P. silvestris* Lep.
II. Wymiarki 12. VIII. 1960, ♀; 18. VIII. 1957, ♂.
III. Gojny Las 10. and 14. VIII. 1960, ♂♂; 21. VIII. 1957, ♂♂. — Nowisko 27. VIII. 1958, ♂.

IV. Faćmiech 16. and 21. 1958, ♀♀. — Wyżni Łazek 28. V. 1958, ♀♀ on *Primula elatior* L.; 16. VI. 1958, ♀. — Meadow at the foot of Klejowa Góra 14. V. 1960, ♀♀ on *Taraxacum* L. — Trzy Korony 9. VII. 1957, ♂. — Szopka Pass 10. VII. 1961, ♂♂. — Kosarzyska 10. VIII. 1960, ♂ on *Centaurea* L.; 19. VIII. 1959, ♂♂ on *Centaurea sp.*; 23. VIII. 1957, ♂♂ on *Centaurea* L. — Ligarki 18. VIII. 1959, ♂♂ ♀ on *Centaurea* L.; 23. VIII. 1957, ♂♂ on *Centaurea sp.* — Gorge of the Dunajec River 28. VIII. 1957, ♂.

V. Dolina Macelowa 18. V. 1958, ♀ on *Taraxacum* L.; 7. VIII. 1960, ♂♂. — Gojny Las 8. VII. 1958, ♂. — Nanowe 18. VII. 1957, ♂ on *Thymus* L.

VI. Pieniński Potok 4. V. 1960, ♀ on *Petasites glabratus* (MALY). — Ostra Skała 17. V. 1957, ♀♀; 19. V. 1958, ♀; 10. VII. 1957, ♂. — Grabczycha 15. VI. 1960, ♀; 10. VII. 1957, ♂♂; 24. VIII. 1957, ♂; 5. VIII. 1960, ♂♂. — Goła Góra 7. VII. 1958, ♂.

7. *P. quadricolor* LEP.

IV. Kosarzyska 23. VIII. 1957, ♂ on *Centaurea* L. — Ligarki 23. VIII. 1957, ♂♂ on *Centaurea* L.

VI. Goła Góra 7. VIII. 1958, ♂.

## III. A ZOOGEOGRAPHIC CHARACTERISTICS OF THE *MEGACHILIDAE* OF THE PIENINY MTS.

### 1. The *Megachilidae* of the Pieniny Mts. on the Ground of their Distribution in Poland

I have accepted a division of Poland into six different faunistic regions with regard to the fauna and distribution of the *Megachilidae*. These regions are as follows:

1. Pieniny Mts.
2. Tatra Mts.
3. Polish Carpathians but for the Tatra Mts. and the Pieniny Mts.
4. Sudeten Mts. and Upper Silesia.
5. Central Poland (Subcarpathian Lowland, South-Poland Upland, and lowlands extending in the north as far as Bydgoszcz but for Białowieża. region).
6. North Poland (Pomerania, Pomeranian Lake District and Białowieża-region).

The investigations of the family *Megachilidae* in the Tatra Mts. and other ranges of the Carpathians were made by WIERZEJSKI (1874), ŚNIEŻEK (1910) and NOSKIEWICZ (1920). In Central Poland and in Subcarpathian Lowland, the regions of Szczucin (distr. Tarnów) and of Przemyśl were studied by NIESIOŁOWSKI (1948) and KRYSIŃSKI (1957). The data on the family under consideration pertaining to the Kraków-region are to be found in the papers of WIERZEJSKI (1868, 1874), ŚNIEŻEK (1910), ŁOZIŃSKI (1920) and NOSKIEWICZ (1923). The most interesting species of the *Megachilidae* from the Pieprzowe Mts. near Sandomierz and from the steppe-areas of the Nida Valley quoted NOSKIEWICZ (1952). Moreover, the *Megachilidae* of Central Poland were collected by DROGOSZEWSKI (1932, 1934) in Małopolska (South Poland), by TORKA (1913, 1916) and SZULCZEWSKI (1948) in Wielkopolska (Central-western Poland), and by MINKIEWICZ (1935) in Kazimierz Dolny on the Vistula River. The data on the *Megachilidae* of North Poland are to be found in the papers of BLÜTHGEN (1919, 1942) (Pomerania), BRIESCHKE (1888, 1889), ALFKEN (1909, 1912, 1913), SPEISER (1906, 1908), MINKIEWICZ (1935), BAER (1903, 1904) and MOESCHLER (1938) (Pemeranian Lake District). The papers of BISCHOFF (1925) and ADOLPH (1934) deal with the *Megachilidae* of North-eastern Poland. The *Megachilidae* of the Sudeten Mts. and Silesia were published by DUCKE (1898, 1900), DITTRICH (1903), ALFKEN (1924), TORKA (1924), NOSKIEWICZ (1948, 1947, 1949), MACKO and NOSKIEWICZ (1954) and PAX (1921).

The data contained in the above mentioned papers allow to give a detailed analysis of the distribution of the *Megachilidae* in Poland to have a base for a characteristics of the species found in the Pieniny Mts. The distribution of the *Megachilidae* in Poland is shown on Tables I—VI. The presence of a species in the respective regions (numbered I—VI on the top of each table) is marked by an uninterrupted line. The probable presence of species is marked with an interrogation mark.

Table I

The distribution of the species of the genera *Trachusa* Pz., *Anthidium* F., *Anthidiellum* COCKL. and *Paranthidiellum* COCKL. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Trachusa serratule* Pz. | + | | + | + | + | + |
| 2. | *Anthidium punctatum* LATR. | + | | ? | + | + | + |
| 3. | *Anthidium montanum* MOR. | + | + | | | | |
| 4. | *Anthidium manicatum* (L.) | + | | ? | + | + | + |
| 5. | *Anthidium oblongatum* LATR. | | | | + | + | |
| 6. | *Anthidium florentinum* F. | | | | | + | |
| 7. | *Anthidiellum strigatum* Pz. | + | | ? | + | + | + |
| 8. | *Paranthidiellum lituratum* Pz. | | | | + | + | |

In the Pieniny Mts. are found: one member of the genus *Trachusa* Pz., three members of the genus *Anthidium* F. and one member of the genus *Anthidiellum* COCKL. Three species are new to the Polish Carpathians, namely, *Anthidium punctatum* LATR., *A. manicatum* (L.) and *Anthidiellum strigatum* Pz. The occurrence of these species in other ranges of the Carpathians (till now they are known only from the Pieniny Mts.) is very probable as they are reported from other regions of Poland being also widely spread is the whole of Europe. A very interesting species found in the Pieniny Mts. is *Anthidium montanum* MOR. which has hitherto been known from the Tatra Mts., the Sudeten Mts., the Alps and other mountaineous regions in Germany. *Trachusa serratule* Pz. is distributed throughout Poland up to the foot of the

Tatra Mts. (Zakopane). *Paranthidiellum lituratum* Pz., a species known in Poland from Upper Silesia and Lublin Upland, has not as yet been found in the Pieniny Mts. A similar situation is observed with regard to *Anthidium oblongatum* LATR. which is reported from Upper Silesia and Opatów-region in Central Poland. The presence of *A. florentinum* F. in Poland needs verification, for this species was quoted only by WIERZEJSKI (1868) from Kraków-region. It has not subsequently been found again in that region. Moreover, the specimens of *A. florentinum* F. cited by WIERZEJSKI are absent from his collection.

Table II

The distribution of the species of the genera *Stelis* Pz. and *Dioxys* LEP. et SERV. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *S. signata* (LATR.) | + | | + | + | + | + |
| 2. | *S. punctulatissima* (K.) | ? | | + | + | + | + |
| 3. | *S. breviscula* (NYL.) | | | ? | + | + | + |
| 4. | *S. phaeoptera* K. | ? | | + | + | + | + |
| 5. | *S. minuta* LEP. et SERV. | ? | | + | + | ? | + |
| 6. | *S. minima* SCHCK. | | | | | | + |
| 7. | *S. ornatula* (KLUG) | + | | ? | + | + | + |
| 8. | *S. franconica* BLÜTHG. | | | | + | | |
| 9. | *Dioxys tridentata* (NYL.) | | | ? | + | ? | + |

In the Table II is shown that only two species of the genus *Stelis* Pz. were found in the Pieniny Mts. These are *S. ornatula* (KLUG.) and *S. signata* LATR. Both are new to the Polish Carpathians being widespread in Poland and in other parts of Europe. *S. punctulatissima* (K.), *S. phaeoptera* K. and *S. minuta* LEP. et SERV. are species widely spread in Europe and known throughout Poland including the Carpathians, however, they have not as yet been found in the Pieniny Mts. However, it is probable that these species occur in the Pieniny Mts. Their absence from the collection made in the Pieniny Mts. is probably due to their rarity in the nature. Moreover, three following species have not as yet been found in the Pieniny Mts.: *S. breviscula* (NYL.), *S. minima* SCHCK. and *S. franconica* BLÜTHG. Of these, *S. breviscula* (NYL.) is widely known in Poland being distributed in Northand Central Europe, thus the occurrence of this species in the Pieniny Mts. is very probable. The remaining two species are known in Poland only from few localities; *S. minima* SCHCK. is reported from North Poland (STÖCKHERL in 1932, mentions this species to be distributed throughout Europe) and *S. franconica* BLÜTHG., a mediterranean species, was quoted from Silesia by NOSKIEWICZ (1954). The only Polish representative of the genus *Dioxys* LEP. et SERV., *D. tridentata* (NYL.), was recorded from Silesia and North Poland.

Table III

The distribution of the species of the genera *Heriades* SPIN. and *Chelostoma* LATR. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Heriades truncorum* (L.) | + | | ? | + | + | + |
| 2. | *Heriades crenulatus* NYL. | | | | | + | |
| 3. | *Chelostoma maxillosum* (L.) | + | | + | + | + | + |
| 4. | *Chelostoma florisomne* (L.) | + | + | + | + | + | + |
| 5. | *Chelostoma distinctum* STÖCKH. | + | | ? | ? | + | ? |
| 6. | *Chelostoma ventralis* SCHLETT. | + | | | | | |
| 7. | *Chelostoma nigricorne* NYL. | + | + | + | + | + | + |

*Chelostoma ventralis* SCHLETT. is a species new to the fauna of Poland; it is a submediterranean species of which the localities in Hungary, Central Czechoslovakia (Zlín), South-eastern Czechoslovakia (Král-Chlumec) and in Moravia (Bzenec) have hitherto been considered to be the most northern limits of its range. *Heriades trunculorum* (L.) and *Chelostoma distinctum* STÖCKH. are new to the Polish Carpathians. The former has hitherto been known from Silesia, Central- and North Poland and its occurrence is very probable in other ranges of the Carpathians as indicates its distribution [Europe, North Africa, Asia Minor (STÖCKHERT, 1932)]. The latter is also supposed to be distributed in other ranges of the Carpathians as known from Central- and South Europe (in Poland reported from Bydgoszcz-region). The remaining three species of the genus *Chelostoma* LATR., namely, *Ch. florisomne* (L.), *Ch. maxillosum* (L.) and *Ch. nigricorne* NYL. are known throughout Poland; only *Ch. maxillosum* (L.) has not as yet been found in the Tatra Mts. The unknown in the Pieniny Mts. *Heriades crenulatus* NYL. is a pontomediterranean species found in Poland in the Pieprzowe Góry near Sandomierz.

Of the twenty-eight species of the genus *Osmia* PZ. found in Poland, fourteen have been collected in the Pieniny Mts. Of these, one species, namely, *Osmia andrenoides* SPIN. is new to the fauna of Poland. *O. andrenoides* SPIN. has the pontomediterranean type of distribution; its northernmost localities are in Podolia (West URRS), south-eastern Czechoslovakia, Hungary, Vienna region and in Turyngia and Baden in Germany. Of the remaining fourteen species, six were already previously quoted from the Carpathians; these are: *Osmia, villosa* SCHCK., *O. parietina* CURT., *O. fulviventris* (PZ.), *O. leucomelana* (K.), *O. adunca* (PZ.) and *O. spinolae* SCHCK. The two following species known from the Carpathians have not as yet been found in the Pieniny Mts.: *O. inermis* ZETT. The imagines of the former feed on *Vaccinium myrthillus* L. and the occurrence of this species in the Pieniny Mts., where *Vaccinium myrthillus* L. is only very rarily found, is unlikely. However, the latter is a pontomediterranean species quoted from Mszana Dolna (Central Carpathians) by ŚNIEŻEK (1910), thus its occurrence in the

Table IV

The distribution of the species of the genus *Osmia* Pz. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Osmia rufa* (L.) | + | | ? | + | + | + |
| 2. | *Osmia coerulescens* (L.) | + | | ? | + | + | + |
| 3. | *Osmia uncinata* Gerst. | | | ? | + | + | + |
| 4. | *Osmia inermis* Zett. | | + | ? | + | | + |
| 5. | *Osmia pilicornis* Sm. | | | | + | | + |
| 6. | *Osmia maritima* Friese | | | ? | ? | | + |
| 7. | *Osmia xanthomaelana* (K.) | | | ? | + | + | ? |
| 8. | *Osmia nirgiventris* Zett. | | | | + | | + |
| 9. | *Osmia bicolor* (Schrank) | | | ? | + | + | + |
| 10. | *Osmia villosa* Schck. | + | + | + | + | | |
| 11. | *Osmia ononidis* Ferton | | | | | + | |
| 12. | *Osmia aurulenta* Pz. | | | ? | + | + | + |
| 13. | *Osmia tridentata* Duf. et Pér. | | | | + | + | + |
| 14. | *Osmia andrenoides* Spin. | + | | | | | |
| 15. | *Osmia atrocoerulea* Schill. | + | | + | + | + | + |
| 16. | *Osmia parietina* Curt. | + | | + | + | | + |
| 17. | *Osmia emarginata* Lep. | | | | + | + | + |
| 18. | *Osmia cerinthidis* Mor. | + | | | | + | |
| 19. | *Osmia fulviventris* (Pz.) | + | | + | + | + | + |
| 20. | *Osmia mitis* Nyl. | + | | ? | + | + | ? |
| 21. | *Osmia parvula* Duf. et Pér. | + | | ? | + | + | + |
| 22. | *Osmia leaiana* (K.) | + | | ? | + | + | + |
| 23. | *Osmia leucomelana* (K.) | + | | + | + | + | + |
| 24. | *Osmia papaveris* Latr. | | | | + | + | + |
| 25. | *Osmia adunca* (Pz.) | + | | + | + | + | + |
| 26. | *Osmia spinole* Schck. | + | | + | + | + | + |
| 27. | *Osmia spinulosa* (K.) | + | | | ? | + | + |
| 28. | *Osmia bidentata* Mor. | | | | | + | |

region under consideration is possible. Seven species found in the Pieniny Mts. are new to the Polish Carpathians, these are: *O. rufa* (L.), *O. coerulescens* (L.), *O. cerinthidis* Mor., *O. mitis* Nyl., *O. parvula* Duf. et Pér., *O. leaiana* (K.) and *O. spinulosa* (K.). Judging by the existing literature (Noskiewicz, 1920) only two species of the genus *Osmia* Pz. are known in the Tatra Mts., namely, *O. inermis* Zett. and *O. villosa* Schck. The former is known only from the Tatra Mts. and the latter is distributed in the mountainous regions of Central Europe including the Polish Carpathians and the Sudeten Mts. It is of interest to note that the specimens reported from Kraków by Łoziński (1920) as *O. villosa* Schck. have been identified by the present writer to be *Megachile circumcineta* (K.).

From the Polish Carpathians are reported seventeen species of the genus *Osmia* Pz. Of these, ten species are distributed throughout Poland, these are: *O. rufa* (L.), *O. coerulescens* (L.), *O. atrocoerulea* Schill., *O. fulviventris*

(Pz.), *O. mitis* Nyl., *O. parvula* Duf. et Pér., *O. leaiana* (K.), *O. leucomelana* (K.), *O. adunca* (Pz.) and *O. spinole* Schck. This group comprises species widely spread in Europe; some of these are known from Central Asia and North Africa. It is noticeable that *O. mitis* Nyl., a species considered to be an Boreal-Alpine element, is among the above ten species, however, it is known from a considerable number of localities in lowlands of Poland.

Some species are known from the whole of Poland but not in the Carpathians are expected to occur in that region, since they are known from a rather large area including Central Europe. These are *O. uncinata* Gerst., *O. bicolor* (Schrank) and *O. aurulenta* Pz.

Only one Boreal-Alpine species, namely, *O. parietina* Curt., has as yet been found in the Pieniny Mts. Besides *O. parietina* Curt., three further Boreal-Alpine species, *O. pilicornis* Sm., *O. maritima* Friese and *O. nigriventris* Zett. are known from Poland. *O. parietina* Curt., beyond the Pieniny Mts., was reported in Poland from Zakopane (Śnieżek, 1910), Białowieża (Bischoff, 1925) and Pomerania Lake District (Alfken, 1912). *O. pilicornis* Sm. and *O. nigriventris* Zett. is known from the Sudeten Mts. and North Poland. *O. maritima* Friese prior to 1942 was considered to be a species confined to the Baltic and North See coasts, however, it has subsequently been found in the French and Suiss High Alps (Blüthgen, 1942).

The most interesting group of the thermophil species in the Pieniny Mts. comprises there species. *O. andrenoides* Spin., as discussed above, is known in Poland only from the Pieniny Mts. *O. cerinthidis* Mor. and *O. spinulosa* (K.), beyond the Pieniny Mts. have been collected in North- and Central Poland. *O. ononidis* Ferton, *O. emarginata* Lep., *O. bidentata* Mor., *O. tridentata* Duf et Pér. and *O. papaveris* Latr. are known in other xerothermic regions of Poland.

So far, seventeen species of the genus *Megachile* Latr. have been found in Poland. Of these, seven species have been stated in the Pieniny Mts. Three species, namely, *M. nigriventris* Schck., *M. willoughbiella* (K.) and *M. ligniseca* (K.), beyond the Pieniny Mts., are known also from other ranges of the Carpathians including the Tatra Mts. The reamining four species, *M. circumcineta* (K.), *M. ericetorum* Lep., *M. centuncularis* (L.) and *M. versicolor* Sm. are new to the Polish Carpathians, being known from all other regions of Poland. Three species known from other ranges of the Carpathians, namely, *M. lagopoda* (L.), *M. maritima* K. and *M. octosignata* Nyl. have not as yet been found in the Pieniny Mts. However, they are expected to be found in that region, as being known from Central Europe and other regions. The following four species are expected to occur in the Pieniny Mts. or other ranges of the Carpathians, as found in several areas in Poland: *M. analis* Nyl., *M. argentata* F., *M. alpicola* Alfk., *M. rotundata* (F.).

The species of the genus *Megachile* Latr. living in the Pieniny Mts. or in other ranges of the Carpathians can be divided into the following groups. The first

Table V

The distribution of the species of the genus *Megachile* LATR. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Megachile analis* NYL. | | | ? | + | | + |
| 2. | *Megachile circumcineta* (K.) | + | | ? | + | + | + |
| 3. | *Megachile nigriventris* SCHCK. | + | + | + | ? | | + |
| 4. | *Megachile ericetorum* LEP. | + | | ? | + | + | + |
| 5. | *Megachile lagopoda* (L.) | ? | | + | + | + | + |
| 6. | *Megachile maritima* K. | ? | | + | + | + | + |
| 7. | *Megachile willoughbiella* (K.) | + | + | + | + | + | + |
| 8. | *Megachile ligniseca* (K.) | + | + | + | + | + | + |
| 9. | *Megachile centuncularis* (L.) | + | | ? | + | + | + |
| 10. | *Megachile argentata* F. | | | ? | + | + | + |
| 11. | *Megachile pilidens* ALFK. | | | | + | + | |
| 12. | *Megachile versicolor* SM. | + | | ? | + | + | + |
| 13. | *Megachile pyraenea* PÉR. | | | | + | | |
| 14. | *Megachile alpicola* ALFK. | | | ? | + | + | + |
| 15. | *Megachile octosignata* NYL. | ? | | + | ? | + | + |
| 16. | *Megachile rotundata* (F.) | | | ? | + | + | + |
| 17. | *Megachile apicalis* SPIN. | | | ? | + | + | + |

of them comprises the species found in the Pieniny Mts. or other ranges of the Carpathians and found in all other distinguished regions of Poland. These are: *M. circumcineta* (K.), *M. ericetorum* LEP., *M. lagopoda* (L.), *M. maritima* L., *M. willoughbiella* (K.), *M. ligniseca* (K.), *M. centuncularis* (L.) and *M. versicolor* SM. The listed species are widespread in Poland and some as *M. ericetorum* LEP., *M. maritima* K., and *M. centuncularis* (L.) are known from Central Asia and *M. lagospoda* (L.) is reported from North Africa. The other group comprises the species distributed in the Polish Carpathians, Upper Silesia and North Poland. These are three Boreal-Alpine species: *M. analis* NYL., *M. nigriventris* SCHCK. and *M. pyrenea* PÉR. Of these only one, *M. nigriventris* SCHCK., has been found in the Pieniny Mts. (it is known also from other ranges of the Polish Carpathians and from North Poland). *M. analis* NYL. is known from North Poland and the Sudeten Mts. and *M. pyraenea* PÉR. is quoted from the Sudeten Mts.

It is noticeable, that no representative of the xerothermophil fauna of the genus *Megachile* LATR. has as yet been found in the Pieniny Mts. or in other ranges of the Polish Carpathians. The centre of the distribution of those species is South Europe and their occurrence in Central Europe is restricted to discontinued localities which are suited to them. An example of such a type of fauna is *M. pilidens* ALFK., a pontomediterranean species, found in Poland only in the Pieprzowe Mts. and in the Ząbkowice region (Silesia) (NOSKIEWICZ, 1952). Moreover, to this group are referable *M. rotundata* (F.) and

*M. apicalis* Spin. known from Silesia, Central- and North Poland. The former species was reported also from Finland. The presence of these species in the Pieniny Mts. is quite possible.

Table VI

The distribution of the species of the genus *Coelioxys* Latr. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Coelioxys rufescens* Lep. | + | + | + | + | + | + |
| 2. | *Coelioxys alata* Först. | + | | | | | |
| 3. | *Coelioxys aurolimbata* Först. | ? | | + | + | + | + |
| 4. | *Coelioxys quadridentata* (L.) | + | | ? | + | + | + |
| 5. | *Coelioxys lanceolata* Nyl. | + | | | | | |
| 6. | *Coelioxys conoidea* (Ill.) | | | | + | + | + |
| 7. | *Coelioxys elongata* Lep. | + | | + | + | + | + |
| 8. | *Coelioxys mandibularis* Nyl. | | | ? | + | | + |
| 9. | *Coelioxys inermis* (K.) | | | ? | + | + | + |
| 10. | *Coelioxys afra* Lep. | | | | + | + | + |
| 11. | *Coelioxys brevis* Ev. | | | | + | + | + |
| 12. | *Coelioxys ruficaudata* Sm. | | | | + | + | + |

In the table VI is shown that 12 species of the genus *Coelioxys* Latr. have been found in Poland. Of these, only *C. alata* Lep. and *C. lanceolata* Nyl. have been collected in the Pieniny Mts.; the former is distributed chiefly in South Europe, white in Germany and south-eastern Czechoslovakia is restricted to isolated localities in which it has been collected in single specimens; the latter is an Boreal-Alpine element reported from the Alps, Upper Bavaria, Sweden and Finland. The remaining species found in the Pieniny Mts. are: *C. rufescens* Lep., *C. quadridentata* (L.) and *C. elongata* Lep. These species are known from all other distinguished regions of Poland. *C. quadridentata* (L.) is new to the fauna of the Polish Carpathians. *C. rufescens* Lep. and *C. elongata* Lep. occur throughout Europe and the latter is known also from North Africa. *C. quadridentata* (L.) is a taiga element in the fauna of Poland.

It is of interest to note, that *C. aurolimbata* Först. has not as yet been found in the Pieniny Mts. This species, considered by Aerts (1960) to be a southern element, has been collected in Poręba Wielka in the Gorce Mts. (Polish Carpathians).

Most of the remaining species shown in the table VI occur in all distinguished regions of Poland but the Carpathians. These are: *C. conoidea* (Ill.), *C. inermis* (K.), *C. afra* Lep., *C. brevis* Ev. and *C. ruficaudata* Sm. Of these, *C. inermis* (K.) is indigenous to Central Europe and by this reason it may be expected to occur in the Carpathians. The remaining species are indigenous to South Europe and in Central Europe appear only in restricted localities.

*C. mandibularis* Nyl., known in Poland from Silesia and North Poland, is an Boreal-Alpine element and it soccurrence in the Carpathians is very probable.

## 2. The fauna of the *Megachilidae* of the Pieniny Mts. in relation to the fauna of this group of Poland

So far, eighty members of the family *Megachilidae* have been reported from Poland. In all six distinguished regions of Poland there occur, most probably, fourty-four species, which are widely spread in Europe, and some of them are known also from Asia and North Africa. Of these, twenty-six species have been found in the Pieniny Mts., sixteen being reported from other than Pieniny Mts. ranges of the Carpathians, and ten species are expected to occur in these mountains.

The group of the mountain species in Poland comprises two species, namely, *Anthidium montanum* Mor. and *Osmia villosa* Schck. Both are found in the Pieniny Mts. and the former species is known only from the Pieniny Mts. and the Tatra Mts.

There are eight Boreal-Alpine species found in Poland: *Osmia parietina* Curt., *O. inermis* Zett., *O. pilicornis* Sm., *O. maritima* Driese, *Megachile pyrenaea* Pér., *M. nigriventris* Schck., *M. analis* Nyl., *Coelioxys lanceolata* Nyl. and *C. mandibularis* Nyl. Of these, *Osmia parietina* Curt., *Megachile nigriventris* Schck. and *Coelioxys lanceolata* Nyl. have been found in the Pieniny Mts. and the latter species is new to the fauna of Poland.

The last distinguished here group comprises the species which are considered to be southern or south-eastern elements in the fauna of Poland. Of these, the following thirteen species are known also from North Poland: *Chelostoma distinctus* (Stöckh.), *Osmia aurulenta* Pz., *O. tridentata* Duf. et Pér., *O. atrocoerulea* Schill., *O. cerinthidis* Mor., *O. papaveris* Latr., *O. spinulosa* (K.), *Megachile ericetorum* Lep., *Coelioxys aurolimbata* Förster., *C. conoidea* (Ill.), *C. afra* Lep., *C. brevis* Ex. and *C. ruficaudata* Sm. In the Pieniny Mts. have been found *Chelostoma distinctus* (Stöckh.), *Osmia emarginata* Lep., *O. spinulosa* (K.), and *Megachile ericetorum* Lep. In other regions of the Carpathians (Poręba Wielka-region) have been found two species, namely, *Osmia atrocoerulea* Schill. and *Coelioxys aurolimbata* Först. The next group of the thermophilous species comprises those found, in most instances, in Central Poland (chiefly in the Pieprzowe Mts.), in the Nida River Valley, Lublin Upland, in the district of Kraków and in Subcarpathian region. They are as follows: *Anthidium oblongatum* Latr., *Paranthidiellum lituratum* Pz., *Heriades crenulatus* Nyl., *Stelis franconica* Blüthg., *Osmia ononidis* Ferton, *O. emarginata* Lep., *O. bidentata* Mor. and *Megachile pilidens* Alfken. Of these *Anthidium oblongatum* Latr., *Paranthidiellum lituratum* Pz., *Megachile pilidens* Alfken and *Stelis franconica* Blüthg. are found in Silesia; the last species being so far reported exclusively from that region. The three following species are known only from the Pieniny Mts.: *Chelostoma ventralis* Schlett., *Osmia andrenoides* Spin. and *Coelioxys alata* Lep.

### 3. The *Megachilidae* of the Pieniny Mts. in relation to the fauna of this group in the Carpathians

The available data pertaining to the members of the family *Megachilidae* occurring in the Carpathians are very poor. The members of the late Physiographic Comitee of the Polish Academy of Sciences gave some informations concerning the *Megachilidae* of the West Beskidy Mts. (Wierzejski, 1868, 1874; Śnieżek, 1910). The *Megachilidae* of the Tatra Mts. were worked out by Noskiewicz (1920). We have no data on the fauna of the family under consideration regarding the East Beskidy Mts. The *Megachilidae* of the Transylvanian Alps were published by Moscáry (1874) and Moczáry (1947). In addition, in „Fauna Regni Hungariae" we find some data on the species of the *Megachilidae* occurring in the Transylvanian Alps and in Transylvania, as well as in the West Beskidy Mts. Juga and Scobiola (1960) quoted some species of the *Megachilidae* from Transylvania and the foot of the Transylvanian Alps. Unfortunately the data contained in the above papers is too scanty and fragmentary for a complete study on the Carpathian *Megachilidae*. The number of the species of this family occurring in the Carpathians is obviously much richer, as a comparison of the faunas of the areas close to the Carpathians clearly shows. However, a detailed study of the available informations on the *Megachilidae* of the Carpathians allow to have a general idea in this matter and to analyze the species of that group occurring in the Pieniny Mts. with more detail. The following division of the Carpathians into individual ranges is accepted in the subsequent six tables (VII—XII).

I. Pieniny Mts.
II. Tatra Mts.
III. West Beskidy Mts.
IV. East Beskidy Mts.
V. Transylvania
VI. Transylvanian Alps

The presence or the probability of the occurrence of the species in the individual regions are marked as in the tables I—VI.

The table VII shows that four species of the *Megachilidae* occur in the whole of the Carpathians but the Tatra Mts.; these are: *Trachusa serratule* Pz., *Anthidium punctatum* Latr., *A. manicatum* (L.) and *A. strigatum* Latr. — *A. montanum* Mor. is found only in the Pieniny Mts. and the Tatra Mts. Three species are reported from the East Beskidy Mts., in Transylvania and in the Transylvanian Alps: *Anthidium florentinum F.*, *Lithurgus fuscipennis* Lep. and *L. chrysurus* Fonsc. — Five species are found in the South Carpathians; these species, but not *Anthidium moscaryi* Friese, are found also in Podolia: *Anthidium oblongatum* Latr., *A. lituratum* Pz., *A. cingulatum* Latr., *A. interruptum*, *A. moscaryi* Friese.

The data on the members of the genus *Stelis* Pz. occurring in the Carpathians are very fragmentary. All six species which have as yet been found

Table VII

Distribution of the species of the genera *Trachusa* Pz., *Anthidium* F. group and *Lithurgus* LATR. in the Carpathians

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Trachusa serratule* Pz. | + | | + | ? | + | ? |
| 2. | *Anthidium punctatum* LATR. | + | | ? | ? | ? | + |
| 3. | *Anthidium montanum* MOR. | + | + | | | | |
| 4. | *Anthidium manicatum* (L.) | + | | ? | ? | ? | + |
| 5. | *Anthidium oblongatum* LATR. | | | | | | + |
| 6. | *Anthidium florentinum* F. | | | | ? | + | + |
| 7. | *Anthidium cingulatum* LATR. | | | | | | + |
| 8. | *Anthidiellem strigatum* LATR. | + | | + | ? | + | ? |
| 9. | *Paranthidiellum lituratum* Pz. | | | | | | + |
| 10. | *Anthidiellum interruptum* F, | | | | | | + |
| 11. | *Paranthidiellum moscaryi* FRIESE | | | | | | + |
| 12. | *Lithurgus fuscipennis* LEP. | | | | ? | + | + |
| 13. | *Lithurgus chrysurus* FONSC. | | | | ? | + | ? |

are expected to occur in the whole of the Carpathians, since they are widely spread in Europe and some of them are also reported from Asia.

No representative of the genus *Dioxys* LEP. et SERV. has as yet been found in the Carpathians. However, judging by the distribution of the members of that genus in Europe, some of these, especially *D. tridentata* (NYL.), or even *D. juncta* JUR., are expected to occur in the Carpathians.

Table VIII

Distribution of the species of the genus *Stelis* Pz. in the Carpathians

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Stelis signata* (LATR.) | + | | + | ? | + | ? |
| 2. | *Stelis punctulatissima* (K.) | ? | | + | ? | + | ? |
| 3. | *Stelis breviucula* (NYL.) | | | ? | ? | + | + |
| 4. | *Stelis pheoptera* (K.) | ? | | + | ? | + | ? |
| 5. | *Stelis minuta* LEP. et SERV. | ? | | + | ? | ? | ? |
| 6. | *Stelis ornatula* (KLUG.) | + | | ? | ? | ? | ? |

In the table IX it is shown the occurrence of five species of the genera *Heriades* SPIN. and *Chelostoma* LATR. in the Carpathians; these are: *Heriades trunculorum* (L.), *Chelostoma florisomne* (L.), *Ch. maxillosum* (L.), *Ch. distinctum* STÖCKH. and *Ch. nigricorne* NYL. Two species, namely, *Ch. florisomne* (L.) and *Ch. nigricornis* NYL. have been found in the Tatra Mts. The species exclusive to the South Carpathians are four: *Ch. grandis* NYL.,

Table IX

The distribution of the species of the genera *Heriades* SPIN. and *Chelostoma* LATR. in the *Carpathians*

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Heriades trunculorum* (L.) | + | | ? | ? | + | |
| 2. | *Heriades crenulatus* NYL. | | | | ? | + | + |
| 3. | *Chelostoma maxillosum* (L.) | + | | + | ? | + | ? |
| 4. | *Chelostoma campanularum* (L.) | + | + | + | ? | ? | + |
| 5. | *Chelostoma distinctum* STÖCKH. | + | | ? | ? | + | + |
| 6. | *Chelostoma ventralis* SCHLETT. | + | | | | | + |
| 7. | *Chelostoma nigricorne* NYL. | + | + | + | ? | + | + |
| 8. | *Chelostoma grandis* NYL. | | | | | | + |
| 9. | *Chelostoma foveolatus* MOR. | | | | | | + |
| 10. | *Chelostoma handlirschi* SCHLETT. | | | | | | + |
| 11. | *Chelostoma emarginatus* NYL. | | | | | | + |

Table X

The distribution of the species of the genus *Osmia* PZ. in the Carpathians

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Osmia rufa* (L.) | + | | ? | ? | + | ? |
| 2. | *Osmia coerulescens* (L.) | + | | ? | ? | + | ? |
| 3. | *Osmia inermis* ZETT. | | + | | | | |
| 4. | *Osmia bicolor* (SCHRANK) | | | ? | ? | ? | + |
| 5. | *Osmia villosa* SCHCK. | + | + | + | | | |
| 6. | *Osmia aurulenta* (PZ.) | | | ? | ? | + | + |
| 7. | *Osmia andrenoides* SPIN. | + | | | | | + |
| 8. | *Osmia atrocaerulea* SCHILL. | + | | + | ? | ? | + |
| 9. | *Osmia parietina* CURT. | + | | + | | | |
| 10. | *Osmia emarginata* LEP. | | | | | | |
| 11. | *Osmia cerinthidis* MOR. | + | | | ? | + | ? |
| 12. | *Osmia fulvivntris* (PZ.) | + | | + | ? | ? | ? |
| 13. | *Osmia mitis* NYL. | + | | ? | ? | ? | ? |
| 14. | *Osmia parvula* DUF. et PÉR. | + | | ? | ? | | |
| 15. | *Osmia leaiana* (K.) | + | | ? | ? | ? | + |
| 16. | *Osmia leucomelana* (K.) | + | | + | ? | + | ? |
| 17. | *Osmia adunca* (PZ.) | + | | + | ? | ? | ? |
| 18. | *Osmia spinolae* SCHCK. | + | | + | ? | ? | ? |
| 19. | *Osmia spinulosa* (K.) | + | | | | | + |
| 20. | *Osmia bidentata* MOR. | | | | ? | + | ? |
| 21. | *Osmia cephalotes* MOR. | | | | | | + |
| 22. | *Osmia aterrima* MOR. | | | | | | + |
| 23. | *Osmia gallarum* LEP. | | | | ? | + | + |
| 24. | *Osmia rufohirta* LEP. | | | | | | + |
| 25. | *Osmia lepetieri* PÉR. | | | + | | | ? |
| 26. | *Osmia dalmatica* MOR. | | | | | | + |

*Ch. foveolatus* MOR. *Ch. handlirschi* NYL. and *Ch. emarginatus* NYL. *Ch. ventralis* SCHLETT., belonging also to the south-European group of species, has been found in the South Carpathians and in the Pieniny Mts. as well. *Heriades trunculorum* (L.) occurs in North- and Central Europe, and *H. crenulatus* NYL. appears chiefly in restricted localities in South- and Central Europe. The available data indicate that *H. crenulatus* NYL. lives in the Transylvanian Alps, and probably in the East Beskidy Mts. *H. trunculorum* (L.) has as yet been found in the Pieniny Mts. and in the Transylvanian Alps; by this reason the species is to be expected to occur in the Beskidy Mts. It is rather difficult to say anything about the probability of the occurrence of *H. trunculorum* (L.) in the South Carpathians; this species does not appear in South Europe, however, on the other hand, it could have quite favourable conditions to live in the mountainous regions as several other species.

Judging by the table X, the following 11 species of the genus *Osmia* PZ. are distributed throughout the Carpathians but the Tatra Mts.: *Osmia rufa* (L.), *O. coerulescens* (L.), *O. bicolor* (SCHRENCK), *O. aurilenta* (PZ.), *O. atrocaerulea* SCHILL., *O. fulviventris* (PZ.), *O. mitis* NYL., *O. leaiana* (K.), *O. leucomelana* (K.), *O. adunca* (PZ.) and *O. spinolae* SCHCK. — *O. inermis* ZETT. has been found only in the Tatra Mts. There are two species common to the Pieniny Mts. and the West Beskidy Mts.; the former species is known also from the Tatra Mts. Four species occur in the East Beskidy Mts., Transylvania, and in the Transylvanian Alps, these are: *O. aurilenta* (PZ.), *O. bidentata* MOR., and *O. gallarum* SPIN. The following four species are known only from the Transylvanian Alps: *O. cephalotes* MOR., *O. aterrima* MOR., *O. rufohirta* LEP. and *O. dalmatica* MOR. Very noticeable are the species so far found only in the Pieniny Mts. and the Transylvanian Alps, these are: *O. andrenoides* SPIN. and *O. spinulosa* (K.), *O. lepetieri* PÉR. occurring in the Alps and the Pyrenees, was quoted by MOCZÁR (1918) from the Beskidy Mts., however no further records on this species from the Beskidy Mts have as yet been known.

As shown in the table XI only three species of the genus *Megachile* LATR. occur in the Transylvanian Alps, these are: *Megachile bombycinia* (PALL.), *M. policrus* MOR. and *M. pilidens* ALFKEN. The remaining fourteen species occur probably in the whole of the Carpathians. Of these, only three have as yet been found in the Tatra Mts.: *M. nigriventris* SCHCK., *M. willoughbiella* (K.) and *M. ligniseca* (K.). Seven species have been found in the Pieniny Mts., however, some other species are expected to occur in this region.

Three species occur most probably throughout the Carpathians, these are: *Coelioxys rufescens* LEP., *C. aurolimbata* FÖRST. and *C. elongata* LEP. Of these, only *C. rufescens* LEP. is known from the Tatra Mts. and in the Pieniny Mts. have been found *C. rufescens* LEP. and *C. elongata* LEP. — *C. alata* FÖRST., *C. quadridentata* (L.) and *C. lanceolata* NYL. are as yet known only from the Pieniny Mts. (within the Carpathians). *C. alata* FÖRST. is supposed to occur at least in the Transylvanian Alps., since it is a species of southern

Table XI

The distribution of the species of the genus *Megachile* LATR. in the Carpathians

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Megachile analis* NYL. | ? | | + | ? | ? | + |
| 2. | *Megachile circumcincta* (K.) | + | | + | ? | ? | + |
| 3. | *Megachile nigriventris* SCHCK. | + | + | + | ? | ? | ? |
| 4. | *Megachile ericetorum* LEP. | + | | ? | ? | ? | ? |
| 5. | *Megachile lagopoda* (L.) | ? | | + | ? | ? | ? |
| 6. | *Megachile maritima* K. | ? | | + | ? | ? | ? |
| 7. | *Megachile willoughbiella* (K.) | + | + | + | ? | ? | + |
| 8. | *Megachile ligniseca* (K.) | + | + | + | ? | + | ? |
| 9. | *Megachile centuncularis* (L.) | + | | ? | ? | + | ? |
| 10. | *Megachile argentata* F. | | | ? | ? | ? | + |
| 11. | *Megachile versicolor* SM. | + | | ? | ? | ? | + |
| 12. | *Megachile alpicola* ALFK. | ? | | + | ? | + | ? |
| 13. | *Megachile octosignata* NYL. | ? | | + | ? | ? | + |
| 14. | *Megachile rotundata* (F.). | | | ? | ? | + | ? |
| 15. | *Megachile bombycina* PALL.) | | | | | | + |
| 16. | *Megachile pilicrus* MOR. | | | | | | + |
| 17. | *Megachile pilidens* ALFK. | | | | | | + |

Table XII

The distribution of the species of the genus *Coelioxys* LATR. in the Carpathians

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Coelioxys rufescens* LEP. | + | + | + | ? | ? | ? |
| 2. | *Coelioxys alata* FÖRST. | + | | | | | ? |
| 3. | *Coelioxys aurolimbata* FÖRST. | ? | | + | ? | ? | ? |
| 4. | *Coelioxys lanceolata* NYL. | + | | | | | |
| 5. | *Coelioxys quadridentata* (L.) | + | | ? | ? | | |
| 6. | *Coelioxys elongata* LEP. | + | | + | ? | ? | ? |
| 7. | *Coelioxys mandibularis* NYL. | | | | ? | + | ? |
| 8. | *Coelioxys inermis* (K.) | | | | ? | + | ? |
| 9. | *Coelioxys afra* LEP. | | | | ? | ? | + |
| 10. | *Coelioxys brevis* EV. | | | | ? | ? | + |
| 11. | *Coelioxys hemorrhoa* FÖRST. | | | | | | + |
| 12. | *Coelioxys argentata* LEP. | | | | | | + |

type of distribution. The remaining two species are expected to be found in the Beskidy Mts.

The group of species distributed probably in the East Beskidy Mts., Transylvania and the Transylvanian Alps. comprises *C. mandibularis* NYL., *C. inermis* (K.), *C. afra* LEP. and *C. brevis* EV. Two species, namely, *C. hemorrhoa* FÖRST. and *C. argentata* LEP., occur exclusively in the Transylvanian Alps.

#### 4. The *Megachilidae* of the Pieniny Mts. in relation to their fauna in the Carpathians

Judging from the above considerations regarding the individual genera of the *Megachilidae*, the species of this family may be divided into following groups:

1. Species distributed throughout the Carpathians
2. Species found only in the West Beskidy Mts.
3. Species found only in the Tatra Mts.
4. Species found in the Tatra Mts. and the Pieniny Mts.
5. Species of probable distribution in the East Beskidy Mts., Transylvania and the Transylvanian Alps.
6. Species found only in the Transylvanian Alps.
7. Thermophil species found only in the Pieniny Mts. or, in the Pieniny Mts. and the Transylvanian Alps.

Judging by the available data, the Carpathian Range is inhabited by forty-three species of the family under consideration. Of these, six species are found in the Tatra Mts., and twenty-eight species are found in the Pieniny Mts. Moreover, eight further species are known from the West Beskidy Mts. The remaining seven species are supposed to occur in the West Beskidy Mts. All considered here species are widely spread in Europe and Asia.

A rather small group of species is known to be distributed exclusively in the West Beskidy Mts. They are taiga-, mountain- or Boreal-Alpine species being expected to be found in other ranges of the Carpathians. These species are as follows: *Anthidium montanum* MOR., *Osmia inermis* ZETT., *O. villosa* SCHCK., *O. parietina* CURT., *Coelioxys quadridentata* (L.) and *C. lanceolata* NYL.

The next group of the Carpathian species includes twelve species which are distributed probably in the East Beskidy Mts., Transylvania and the Transylvanian Alps. These are thermophil species, having southern or south-eastern range, being as yet found in Transylvania or in the Transylvanian Alps. Because of a similar situation of the East Beskidy Mts. to that of the Transylvania, the above twelve species are supposed to occur in the former region. The occurrence of those species is also probable in Podolia, region of Lvov and Przemyśl, and, moreover is some xerothermic localities in Central Poland. Such an opinion is provided by the evidence of the better known distribution of the species of the genus *Bombus* LATR. in the Carpathians (DYLEWSKA, 1958). Some species of that genus, having their distribution of south-eastern type, show the northern limits of their ranges in Transylvania and in the West Beskidy Mts.

Twenty species of the *Megachilidae* are so far known only from the Transylvanian Alps. These are species confined to the worm regions of South- and South-Eastern Europe. Such a number of species known from the mentioned area is rather little and this is probably due to rather poor data pertaining to the fauna of the Transylvanian Alps.

The most interesting species in the Pieniny Mts. are those found also in the Transylvanian Alps. These are: *Cholostoma ventralis* Schlett., *Osmia andrenoides* Spin., *O. cerinthidis* Mor., *O. spinulosa* (K.) and *Coelioxys alata* Först. Of these, *O. andrenoides* Spin. and *C. allata* Först. have not as yet been found in the Transylvanian Alps. These species characterize the Pieniny Mts. to be a quite exceptional worm and dry region whithin cool range of the West Beskidy Mts.

## 5. A zoogeographic analysis and the origin of the *Megachilidae* of the Pieniny Mts.

An analysis of the zoogeographic elements in the fauna of the Pieniny Mts. throws some light on the origin of that fauna.

The first group of species considered here comprises those with range restricted to Europe and North Africa. Three sub-groups may be distinguished here:

a. Central-European species.

b. European species.

c. Species distributed in Europe and North Africa.

To the first sub-group belongs only one species, namely, *Megachile versicolor* Sm. The second sub-group comprises three species: *Stelis signata* (Latr.), *S. ornatula* (Klug.) and *Coelioxys rufescens* Lep. The third sub-group includes six species as follows: *Anthidium manicatum* (L.), *Chelostoma maxillosum* (L.), *Chelostoma florisomne* (L.), *Osmia adunca* (Pz.), *O. spinolae* Schck. and *Coelioxys elongata* Lep.

The second group is rather rich in species, comprising the *Megachilidae* distributed in both Europe and Asia; some of these occur also in North Africa. The group is divided by the present writer into the following sub-groups:

a. Species distributed in Europe and Central Asia.

b. Species distributed in Europe, Central Asia and North Africa.

c. Species distributed in Europe, Siberia, Central Asia and North Africa.

d. Species distributed in Europe, Asia Minor and North Africa.

e. Species distributed in Central- and East Europe, Central Asia and North Africa.

f. Species distributed throughout the Palaearctic Region.

To the sub-group a. belongs one species, namely, *Megachile centuncularis* (L.). The sub-group b. comprises four species: *Anthidiellum strigatum* Latr., *Osmia coerulescens* (L.), *O. fulviventris* (Pz.). To the sub-group c. is referable *Anthidium punctatum* Latr. *Chelostoma trunculorum* (L.) belongs to the sub-group d. The sub-group e. contains only one species, *Osmia parvula* Duf. et Pér. The sub-group f. comprises also only one species, namely, *Osmia rufa* (L.).

The third group of species comprises taiga-elements. This group is divided into two sub-groups:

a. Species distributed in North- and Central Europe; some of these occur also in the mountainous regions of South Europe.

b. Species of the Boreal-Alpine type of distribution.
The sub-group a. contains nine species. These are: *Trachusa serratule* Pz., *Chelostoma nigricorne* Nyl., *Osmia mitis* Nyl., *O. leaiana* (K.), *O. leucomelana* (L.), *Megachile circumcineta* (K.), *Megachile willoughbiella* (K.), *M. ligniseca* (K.) and *Coelioxys quadridentata* (L.). Three species, namely, *Osmia parietina* Curt., *Megachile nigriventris* Schck. and *Coëlioxys lanceolata* Nyl., are referable to the sub-group b.

Mountain species are represented in the Pieniny Mts. by two members: *Anthidium montanum* Mor. and *Osmia villosa* Schck.

The last group comprises elements of sub-mediterranean, mediterranean and ponto-mediterranean type of distribution. The species referable to this group are six as follows: *Chelostoma ventralis* Schlett., *Ch. distinctum* Stöckh., *Stelis franconica* Blüth., *Osmia andrenoides* Spi., *O. cerinthidis* Mor., *O. spinulosa* (K.), *Megachile ericetorum* Lep., and *Coelioxys alata* Lep.

The above list shows that of thirty-nine species of the *Megachilidae* living in the Pieniny Mts. ten species are indigenous to Europe and nine to the Euro-Asiatic Continent. Of the twenty remaining species, nine are taiga-elements, three Boreal-Alpine elements, two mountain elements and eight species are sub-mediterranean, mediterranean or ponto-mediterranean elements.

The overlapping of the ranges of the Boreal-Alpine, taiga- mountain and southern elements in such a proportionately small area is the foremost character of the fauna of the Pieniny Mts.

The origin of the European species and of the European-Asiatic and taiga-species in Europe was worked out by Reinig (1937) and Holdhaus (1954).

While discussing the species of the south- or south-eastern origin, it is of interest to note, that all three such species found in the Pieniny Mts. are new to the fauna of Poland. Moreover, the Pieniny Mts. are the northernmost peripheries of the ranges of those species.

The remaining species are distributed also in north Poland. Of those *C. aurolimbata* Först. and *O. atrocaerulea* Schill. were reported from the neighbourhood of Poręba Wielka in the Gorce Range (Carpathians) (Śnieżek, 1910). The nearest localities of the southern and south-eastern species are the neighbourhoods of Przemyśl and Szczucin (distr. Tarnów), in Podkarpacie (sub-Carpathian region) (*O. cerinthidis* Mor., *O. ononidis* Ferton, *C. conoidea* [Ill.] and *C. brevis* Ev.); farther localities are in west Podolia (*O. andrenoides* Spin., *Ch. ventralis* Schlett. and *C. alata* Lep.). Judging by the above data, the list of the thermophilous species given on p. 23, as well as by the data of Noskiewicz given for Podolia (1918, 1920—1922, 1929, 1934, 1938) the following groups among those species one can distinguish: 1. species occurring in the Pieniny Mts. and distributed up to north Poland, 2. species known from central Poland, Podkarpacie, Podolia, as well as few species reported also from Silesia, 3. species found in Poland only in the Pieniny Mts., farther known from west Podolia and south-eastern Czechoslovakia. The first group contains species, which, by most of workers, are considered to be the members of the fauna of central and south Europe (AERTS, 1960; JUGA, 1958). One may suppose, that the migrations of these species to Poland have existed in the worm postglacial period from both south-eastern and south-western Europe. The second group has probably come from Podolia and Moravia, as showing some similarities to the fauna of those regions. The species of the third group most probably have come from south-eastern Czechoslovakia where are the nearest localities of these species to those in the Pieniny Mts. The same opinion in this matter said KUNTZE (1934) who supposed the proportionately low region of Magura Spiska Range and the valley of the Poprad River to be the route of the species under consideration. The results of the investigations on the *Megachilidae* of the Pieniny Mts. confirm the opinions of KUNTZE (1934) and KUNTZE & NOSKIEWICZ (1938) pertaining ot the supposed period of the arrival of the species in question to the Pieniny Mts. These species must have come from the south not very long ago, as is indicated by the lack of the endemic species from the Pieniny Mts. and near localities of the members of the fauna in question in the south-eastern Czechoslovakia. A detailed study on the fauna of the Poprad River Valley, Magura Spiska Range and Czechoslovakia may solve, if the ranges of the species discussed are continuous, or the localities of them found in the Pieniny Mts. are isolated ones.

## IV. AN ECOLOGICAL CHARACTERISTICS OF THE *MEGACHILIDAE* OF THE PIENINY MTS.

### 1. The *Megachilidae* in the habitats of the Pieniny Mts.

The presence of each recorded species in the individual habitats (according to the division accepted in the Chapter I.) is shown in the table XIII. The habitats Nos. I and II are in the northern slopes. The southern slopes are divided into the habitats Nos. III—VII. The *Salix* shrubs belt surrounding the foot of the Pieniny Mts. is the habitat No. VIII.

The table XIII clearly shows that all recorded species have been found on the southern slopes. The two commonest species, namely, *Chelostoma maxillosum* (L.) and *Osmia rufa* (L.) have been collected in all habitats in the southern slopes (with exception of the open forest meadows where the former species has not been noted). Both, *Ch. maxillosum* (L.) and *O. rufa* (L.) have been observed at all altitudes. *Ch. maxillosum* (L.) has been collected in the meadows on the top of Trzy Korony; beyond the Pieniny Mts. this species is known from Zakopane. *O. rufa* (L.) has been found near the top of Zamkowa Góra (at Pustelnia) and on the riverside *Salix sp.* shrubs at Krościenko; this species has not as yet been found in other regions of the Carpathians. The presence of the above mentioned two species in the southern slopes of the

Pieniny Mts. and the absence of them from the northern slopes of that region is understandable by reason of their vertical distribution. Forests (I) and meadows (II) of the northern slopes have the climate cooler and are moister and less insolated than the southern slopes, and their altitudes correspond to those of the lower forest-zone in the Tatra Mts., where the species under

Table XIII

The occurrence of the *Megachilidae* in the habitats of the Pieniny Mts.

| No. | Species | I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|---|
| 1. | *Trachusa serratule* Pz. | | | | + | + | + | | |
| 2. | *Anthidium punctatum* LATR. | | | | | + | + | | |
| 3. | *Anthidium montanum* MOR. | | | | | | + | | |
| 4. | *Anthidium manicatum* (L.) | | | | | + | + | | |
| 5. | *Anthidiellum strigatum* Pz. | | | | | + | + | | |
| 6. | *Stelis ornatula* (KLUG.) | | | | | | + | | |
| 7. | *Stelis signata* (LATR.) | | | | | + | | | |
| 8. | *Heriades truncorum* (L.) | | | | | | + | | |
| 9. | *Chelostoma maxillosum* (L.) | | | + | + | + | + | + | |
| 10. | *Chelostoma florisomne* (L.) | | | | | | + | | |
| 11. | *Chelostoma distinctum* STÖCKH. | | | | + | | + | + | |
| 12. | *Chelostoma ventralis* SCHLETT. | | | | | | + | | |
| 13. | *Chelostoma nigricorne* NYL. | | | | | | + | | |
| 14. | *Osmia rufa* (L.) | | | + | | + | | + | + |
| 15. | *Osmia coerulescens* (L.) | | | | | | | | + |
| 16. | *Osmia villosa* SCHCK. | | | | | | + | | |
| 17. | *Osmia andrenoides* SPIN. | | | | + | + | + | | |
| 18. | *Osmia parietina* CURT. | | | | | | | + | |
| 19. | *Osmia cerinthidis* MOR. | | | + | | + | + | + | + |
| 20. | *Osmia fulviventris* (Pz.) | | | | | | + | | |
| 21. | *Osmia mitis* NYL. | | | | | | + | | |
| 22. | *Osmia parvula* DUF. et PÉR. | | | | | | + | | |
| 23. | *Osmia leaiana* (K.) | | | | + | | + | | |
| 24. | *Osmia leucomelana* (K.) | | | | | | + | | |
| 25. | *Osmia adunca* (Pz.) | | | | | | + | | |
| 26. | *Osmia spinolae* SCHCK. | | | | | | + | + | |
| 27. | *Osmia spinulosa* (K.) | | | | | | + | | |
| 28. | *Megachile circumcincta* (K.) | | | | + | + | + | + | + |
| 29. | *Megachile ericetorum* LEP. | | | | | | | | + |
| 30. | *Megachile ligniseca* (K.) | | | + | | | | | |
| 31. | *Megachile nigriventris* SCHCK. | | | | | + | + | | |
| 32. | *Megachile willoughbiella* (K.) | | | + | + | + | + | + | |
| 33. | *Megachile centuncularis* (L.) | | | | + | + | + | | |
| 34. | *Megachile versicolor* SM. | | | | | + | + | | |
| 35. | *Coelioxys rufescens* LEP. | | | | | | + | | |
| 36. | *Coelioxys alata* FÖRST. | | | | | | + | | |
| 37. | *Coelioxys quadridentata* (L.) | | | | | | + | | |
| 38. | *Coelioxys lanceolata* NYL. | | | | | | + | | |
| 39. | *Coelioxys elongata* LEP. | | | | | | + | | |

consideration have not as yet been observed. These factors apparently cause the presence of many other species in the southern slopes of the Pieniny Mts. and the absence of them from the northern slopes. The xerothermophilous species of the south- and south-eastern origin are foremost of those being well established in the southern slopes of the region under consideration.

However, the vertical distribution has no significance with regard to the species appearing in the Tatra Mts. These are as follows: *Anthidium montanum* Mor., *Chelostoma fiorisomne* (L.), *Ch. nigricorne* Nyl., *Osmia villosa* Schck., *Megachile nigriventris* Schck., *M. ligniseca* (K.) and *Coelioxys rufescens* Lep. These species are expected to appear also in the northern slopes of the Pieniny Mts., since they have as yet been captured in that region very rarily (each species is known only from one to four examples). The occurrence of the discussed species in the southern slopes is supposed to be caused by the rich flora and the presence of the screes and rocks which are favourable habitats to the petrophilous species. It is of interest to note that *Anthidium manicatum* (L.) is common in the southern slopes of the Pieniny Mts. being absent from the northern slopes there. This species has not hitherto been known from the Carpathians. *A. manicatum* (L.) has been observed nearly exclusively on *Stachys germanica* L. which is absent from the northern slopes. A nest of this species has been found under stones on the screes of Zamczysko.

A characteristic feature of the distribution of the *Megachilidae* in the Pieniny Mts. is also the connection of the members of that family with the wormest portion of the southern slopes, namely, with rocks and screes (VI). Only four species have not been observed in that habitat, these are: *Osmia coerulescens* (L.), *O. parietina* Curt., *O. atrocaerulea* Schill. and *Megachile eri-*

Table XIV

| Species found in *Festucetum rubre normale* | Species found in *Festucetum rubre piennicum* | Species found in both *Festucetum rubre normale* and *F. r. piennicum* |
|---|---|---|
| 1. *Stelis ornatula* (Klug.) | 1. *Anthidium montanum* Mor. | 1. *Anthidium punctatum* Latr. |
| 2. *Chelostoma ventralis* (Schlett) | 2. *Heriades truncorum* (L.) | 2. *Osmia spinulosa* (K.) |
| 3. *Osmia leucomelana* (K.) | 3. *Chelostoma florisomne* (L.) | 3. *Osmia fulviventris* (Pz.) |
| | 4. *Osmia parvula* Duf. et Pér. | 4. *Osmia mitis* Nyl. |
| | 5. *Osmia adunca* (Pz.) | 5. *Coelioxys rufescens* Lep. |
| | 6. *Osmia villosa* Schck. | |
| | 7. *Coelioxys quadridentata* (L.) | |
| | 8. *Coelioxys lanceolata* Nyl. | |
| | 9. *Coelioxys elongata* Lep. | |
| | 10. *Coelioxys alata* Först. | |

*cetorum* LEP. These species have been found in one or several specimens. *O. coerulescens* (L.), *O. parietina* CURT. and *O. atrocearulea* SCHILL. have been collected in the fields at Sromowce Niżne (VII) and *M. ericetorum* LEP. has been found at a nest in a wooden hut by the Dunajec in Sromowce Niżne(VIII). Of thirty-five species collected on screes, eighteen have been observed exclusively in that habitat. Taking into account the floral complexes established by KULCZYCKI (1927), there arises a question, if these species are equally attached to all habitats, or, perhaps some specially tend to be connected with an individual habitat. The table XIV shows the species of the *Megachilidae* found in the individual floral-complexes growing on rocks, namely, *Festucetum rubre normale* and *Festucetum rubre piennicum*.

Of species observed in *Festucetum rubre normale*, three have been collected only in one or two examples. Of these, *Stelis ornatula* (KLUG.) is a parasite of *O. parvula* DUF. et PÉR. which has been observed in *Festucetum rubre piennicum*; thus neither former nor the latter are characteristic to an individual floral-complex. *O. leucomelana* (K.) is additionally known from other regions of the Carpathians. Because of the above circumstances no of the three discussed species is confined to a special floral-complex. Moreover, these species visit flowers in the two mentioned floral-complexes.

A number of species, found in the Pieniny Mts. and in other regions of the Carpathians, considered here to be confined to the second floral-complex, visit flowers in the two floral-complexes. These are: *Anthidium montanum* MOR., *Chelostoma nigricorne* NYL., *Ch. florisomne* (L.), *Osmia villosa* SCHCK., *O. adunca* (PZ.), *Coelioxys quadridentata* (L.) and *C. elongata* LEP.

The species characteristic to *Festucetum rubre piennicum* are to be found in the remaining ones (they are new to the fauna of the Carpathians) of that complex. *Coelioxys alata* FÖRST. and *C. lanceolata* NYL. have been found each in a unique example. *Heriades truncorum* (L.), visiting *Medicago falcata* L., and *Osmia villosa* SCHCK., collected on *Cirsium sp.*, have their food plants also in the *Festucetum rubre normale*.

The large number of species observed in the habitat under consideration (rocks and screes of Grabczycha and Ostra Skała foremost) is independend of the species of plants growing there. Most probably, the special microclimate and rich flora makes the habitat under consideration to be favourable to numerous species of the *Megachilidae*. The rocks of Grabczycha are undoubtedly one of the warmest localities in the whole of the Pieniny Mts. One of its slopes has south-western exposure. From that place starts the proper gorge of the Dunajec. Here are the screes and rocks of the lowest altitude (in comparison to those lying above the fields and meadows of Sromowce Niżne [VII]) as steep running just from the Dunajec bank. Owing to this fact, the winds blowing chiefly in the top part of the Pieniny Mts., rarely reach the rocks of Grabczycha, which are protected from north (Trzy Korony mass), east (Faćmiech range) and south (forest). Moreover, Grabczycha is partly protected from north by a forested slope on the opposite side of the

Dunajec River. The rocks of Grabczycha has the flora least devastated, being included to the strict reservation. The remaining areas of the habitats V and VI are devasting by agriculture. Thus, not all species collected exclusively on screes and rocks are petrophilous elements, since their absence from the worm meadows (V) is supposed to be caused by the poor flora or even absence of special species of plants.

The remaining species, those collected in screes, have been found also in other habitats. Some of these belong to the fauna confined to work meadows of the southern slopes (V). These are: *Anthidium strigatum* LATR., *A. manicatum* (L.), *Osmia rufa* (L.), *Megachile versicolor* SM. and *M. nigriventris* SCHCK.

A rather large group of species has been found, beyond the above mentioned habitats, also in the glades (IV). They are as follows: *Trachusa serratule* Pz., *Osmia andrenoides* SPIN., *O. leaiana* (K.), *Megachile centuncularis* (K.), *M. circumcineta* (K.) and *Chelostoma distinctum* STÖCKH. The absence of these species from the habitat IV and the presence of several other ones in the habitats IV, V and VI, may be, at least with regard to some commonest species, explained by the absence of special plants. By this reason, *Osmia rufa* (L.) does not appear in glades (IV) where the willow (*Salix sp.*) does not grow. Another example is *Anthidium manicatum* (L.) the nesting of which has been observed under stones on screes (VI); this species, visiting *Stachys germanica* L., one can find that plant in the habitats V and VI. Also *A. strigatum* LATR. collected on *Medicago falcata* L. and *Lotus corniculatus* L., as well as *A. versicolor* SM. found on *Lotus corniculatus* L. and *Salvia glutinosa* L., find those plants at most in very small quantities in the glades of Trzy Korony (IV). On the other hand, *Megachile nigriventris* SCHCK., is to be expected to appear on Kosarzyska (IV), where its food plants grow; this species may appear also in the northern slopes of the Pieniny Mts., since it is known from the Tatra Mts.

The species collected in the habitats IV, V, and VI visit numerous species of plants commonly growing in the Pieniny Mts. especially in great numbers on the meadows and screes of the southern slopes.

The remaining species, namely, *Megachile willoughbiella* K. and *M. ligniseca* (K.), have been found in the habitats IV, V and VI, and in the forest on Faćmiech and in slopes of Trzy Korony (III) as well; in the latter locality the species in question visit flowering *Salvia glutinosa* L. which grows there in large quantities. In spite of the presence of *M. willoghbiella* K. and *M. ligniseca* (K.) in the Tatra Mts., these species have not been found in other habitats in the Pieniny Mts. This is due to the range of *Salvia glutinosa* L. which is restricted to thin shrubberies growing on screes and small meadows. Nevertheless, the occurrence of the species discussed in the northern slopes of the Pieniny Mts. is possible.

## 2. The phenological and biological observations on the *Megachilidae* in the Pieniny Mts.

The activity of the imagines of the *Megachilidae* species in the Pieniny Mts. is observed since the first days of April till mid of September.

The males and females of the *Megachilidae* awake from the winter sleep in accordance with the flowering of willows *(Salix sp.)*. The flowering of willows starts earliest in the fields of Sromowce Niżne (VII), by the river-sides (VIII), in much insolated meadows (V) and in the forests of the southern slopes (III), then in May, in the northern slopes (I and II). The spring breed of the *Apoidea*, that gathering the nectar and pollen on willows, comprises chiefly the members of the genera *Andrena* F., *Nomada* F. and *Bombus* LATR. In that period appears only one representative of the family *Megachilidae*, namely, *Osmia rufa* (L.), which has been observed as early 13. th of April, on *Salix caprea* L. growing in southern slopes. In May and in June *O.*

Table XV

| Genus | Visited plants |
|---|---|
| *Megachile* | *Lotus corniculatus* L.<br>*Coronilla varia* L.<br>*Vicia* L.<br>*Trifolium* L.<br>*Scabiosa* L.<br>*Salvia glutinosa* L. |
| *Osmia* | *Echium vulgaris*<br>*Medicago falcata* L.<br>*Lotus corniculatus* L.<br>*Coronilla varia* L.<br>*Vicia* L.<br>*Taraxacum* L.<br>*Geranium* L.<br>*Leonthodon hispidus* L.<br>*Cirsium* MILL.<br>*Ononis* L. |
| *Anthidium* | *Lotus corniculatus* L.<br>*Medicago falcata* L.<br>*Ononis* L.<br>*Sedum* L.<br>*Stachys germanica* L. |
| *Stelis* | *Lotus corniculatus* L. |
| *Trachusa* | *Lotus corniculatus* L.<br>*Medicago falcata* L. |
| *Chelostoma* | *Campanula* L.<br>*Rannunculus* L. |
| *Heriades* | *Medicago falcata* L. |

*cerinthidis* (MOR.) has been observed also on several other plants as *Taraxacum sp.*, *Anthylis vulneraria* L., *Cerinthe minor* L., *Coronilla varia* L. and *Stellaria holostea* L. — Only in late May appear further species of the group under consideration, these are: *Megachile ligniseca* (K.), *Osmia andrenoides* SPIN., *Chelostoma maxillosum* (L.), *Anthidiellum strigatum* LATR., *Anthidium punctatum* LATR., *Osmia mitis* NYL. and *O. aenea* (L.). It must here be noted that *O. andrenoides* SPIN. is abundant and therefore the present author is able to give surely time of its appearance that is from mid May to mid August. The species appearing in May visit flowering plants of the following genera: *Trifolium* L., *Campanula* L., *Rannunculus* L., *Geranium* L., *Vicia* L. and *Medicago* L. However, most species of the *Megachilidae* have been observed only from the early June, these are: *Trachusa serratule* PZ., *Anthidium manicatum* (L.), *Stelis ornatula* (KLUG.), *Chelostoma distinctum* STÖCKH., *Osmia parietina* CURT., *O. villosa* SCHCK., *O. adunca* (PZ.), *O. leaiana* (K.), *O. atrocaerulea* SCHILL., *O. spinulosa* (K.), *Megachile centuncularis* (L.), *M. versicolor* SM., *M. nigriventris* (K.), *M. circumcineta* (K.), *M. willoughbiella* (K.), *M. ericetorum* LEP., *Coelioxys rufescens* LEP., *C. quadridentata* (L.), *C. lanceolata* NYL. and *C. elongata* LEP. Such a great number of species appearing in June is due to the flowering of several species of plants those visited by the above mentioned species of the *Megachilidae*. The main species of plants visited by the genera of the family under discussion are shown in the table XV.

In July appear two species: *Chelostoma nigricorne* NYL. and *Heriades trunculorum* (L.).

The remainder of species are rarities in the Pieniny Mts. Thus, the following species have been found in July in single examples: *Osmia leucomelana* (K.), *O. fulviventris* (PZ.), *Stelis signata* LATR., *Chelostoma florisomne* (L.) and *Ch. ventralis* SCHLETT.

Only in August have been collected three species, namely, *Anthidium montanum* MOR., *Osmia parvula* DUF. et PÉR. and *Coelioxys alata* FÖRST.

Full data concerning the period of the appearance of the individual species are shown in the plate XVI. The time of the appearance that has been observed in the Pieniny Mts. is marked with an interrupted line. An uninterrupted line marks the time of appearance in various regions of Central Poland quoted by other authors.

The above consideration clearly show that: the available data on the phenology of the *Megachilidae* for Central Poland are too scant to state that the period of their appearance in that region is earlier that in the Pieniny Mts. However, we may make a satisfactory comparison with regard to common and easily observed species. The table XVII shows the phenological data for seven species.

However, most probably, the differences of the appearance period are not longer that two week time and correspond to those observed in flowering of plants visited by the species under consideration.

Table XVI

| No. | Species | Time of appearance | | | | | |
|---|---|---|---|---|---|---|---|
| | | IV | V | VI | VII | VIII | IX |
| 1. | *Trachusa serratule* Pz. | | | | | | |
| 2. | *Anthidium punctatum* LATR. | | | | | | |
| 3. | *Anthidium montanum* MOR. | | | | | | |
| 4. | *Anthidium manicatum* (L.) | | | | | | |
| 5. | *Anthidiellum strigatum* LATR. | | | | | | |
| 6. | *Stelis ornatula* (KLUG.) | | | | | | |
| 7. | *Stelis signata* (LATR.) | | | | | | |
| 8. | *Heriades truncülorum* (L.) | | | | | | |
| 9. | *Chelostoma florisomne* (L.) | | | | | | |
| 10. | *Chelostoma campanularum* (K.) | | | | | | |
| 11. | *Chelostoma distinctum* STÖCKH. | | | | | | |
| 12. | *Chelostoma ventralis* SCHLETT. | | | | | | |
| 13. | *Chelostoma nigricorne* NYL. | | | | | | |
| 14. | *Osmia rufa* (L.) | | | | | | |
| 15. | *Osmia coerulescens* (L.) | | | | | | |
| 16. | *Osmia villosa* SCHCK. | | | | | | |
| 17. | *Osmia andrenoides* SPIN. | | | | | | |
| 18. | *Osmia parietina* CURT. | | | | | | |
| 19. | *Osmia cerinthidis* MOR. | | | | | | |
| 20. | *Osmia fulviventris* (Pz.) | | | | | | |
| 21. | *Osmia mitis* NYL. | | | | | | |
| 22. | *Osmia parvula* DUF. et PÉR. | | | | | | |
| 23. | *Osmia leaiana* (K.) | | | | | | |
| 24. | *Osmia leucomelana* (K.) | | | | | | |
| 25. | *Osmia adunca* (Pz.) | | | | | | |
| 26. | *Osmia spinolae* SCHCK. | | | | | | |
| 27. | *Osmia spinulosa* (K.) | | | | | | |
| 28. | *Megachile circumcincta* (K.) | | | | | | |
| 29. | *Megachile nigriventris* SCHCK. | | | | | | |
| 30. | *Megachile ericetorum* LEP. | | | | | | |
| 31. | *Megachile ligniseca* (K.) | | | | | | |
| 32. | *Megachile willoughbiella* (K.) | | | | | | |
| 33. | *Megachile centencularis* (L.) | | | | | | |
| 34. | *Megachile versicolor* SM. | | | | | | |
| 35. | *Coelioxys rufescens* LEP. | | | | | | |
| 36. | *Coelioxys alata* FÖRST. | | | | | | |
| 37. | *Coelioxys quadridentata* (L.) | | | | | | |
| 38. | *Coelioxys lanceolata* NYL. | | | | | | |
| 39. | *Coelioxys elongata* LEP. | | | | | | |

Secondly, such a comparison completes the phenological data concerning individual species of the *Megachilidae* not only for the Pieniny Mts. but also for Central Poland. This concerns especially species rare in Poland or in the Pieniny Mts. but the more abundant ones as well.

Table XVII

| Species | Time of appearance | |
|---|---|---|
| | Central Poland | Pieniny Mts. |
| *Chelostoma maxillosum* (L.) | IV—VII | V—VIII |
| *Megachile circumcincta* (K.) | V—VIII | VI—VIII |
| *Megachile willoughbiella* (K.) | V—VIII | VI—IX |
| *Coelioxys rufescens* LEP. | V—VII | VI—VIII |
| *Coelioxys quadridentata* (L.) | V—? | VI—VIII |
| *Osmia villosa* SCHCK. | V (only) | VI (only) |
| *Anthidium manicatum* (L.) | IV *)—VII | IV **)—VIII |

*) from early April
**) from mid of April

A complementary information to the appearance period of the *Megachilidae* for Central Poland as a result of the investigation in the Pieniny Mts.:

| | |
|---|---|
| *Anthidium strigatum* Pz. | V—VIII |
| *Anthidiellum punctatum* LATR. | V—VIII |
| *Osmia mitis* NYL. | V—VIII |
| *Trachusa serratule* Pz. | VI—VIII |
| *Chelostoma nigricorne* NYL. | VI—IX |
| *Megachile versicolor* SM. | VI—IX |
| *Coelioxys rufescens* LEP. | V—VIII |
| *Coelioxys quadridentata* (L.) | V—VIII |

Full period of the appearance of the rare species in Central Poland and in the Pieniny Mts.:

| Species | Central Poland | Pieniny Mts. |
|---|---|---|
| *Anthidium montanum* (L.) | VI—VIII | VIII |
| *Osmia aenea* (L.) | V—VI | V |
| *Osmia leaiana* (K.) | VI—VII | VII |
| *Osmia fulviventris* (Pz.) | VI—VII | VII |
| *Chelostoma florisomne* (L.) | V—VII | VII |
| *Megachile ericetorum* LEP. | VI—VII | VI |
| *Coelioxys elongata* LEP. | VI—VIII | VIII |
| *Osmia parvula* DUF. et PÉR. | VI—VIII | VIII |

## IV. A ZOOGEOGRAPHIC CHARACTERISTICS OF THE *APIDAE* IN THE PIENINY MTS. (GENERA: *CLISODON* PATTON, *ANTHOPHORA* LATR., *EUCERA* SCOP., *BOMBUS* LATR. AND *PSITHYRUS* LEP.)

### 1. Species of the genera *Clisodon* PATTON, *Anthophora* LATR. and *Eucera* SCOP. *(Anthophorinae)* in Poland and in the Pieniny Mts.

Of five species of the discussed genera, found in the Pieniny Mts. *Anthophora acervorum* (L.) and *A. aestivalis* (Pz.) are new to the fauna of the Polish Carpathians, the remaining three species were reported from the West Be-

Table XVIII

The distribution of the species of *Clisodon* PATTON, *Anthophora* LATR. and *Eucera* SCOP. in Poland

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Clisodon furcatus* (Pz.) | + | | + | + | + | + |
| 2. | *Anthophora acervorum acervorum* (L.) | + | | ? | + | + | + |
| 3. | *Anthophora aestivalis* (Pz.) | + | | ? | + | + | + |
| 4. | *Anthophora bimaculata* Pz. | ? | | | + | + | + |
| 5. | *Anthophora borealis* MOR. | ? | | ? | + | | |
| 6. | *Anthophora parietina parietina* (L.) | ? | | ? | + | + | + |
| 7. | *Anthophora pubescens* F. | ? | | | + | + | + |
| 8. | *Anthophora retusa retusa* (L.) | ? | | ? | + | + | + |
| 9. | *Anthophora quadrimaculata* (PANZ.) | + | | + | + | + | + |
| 10. | *Eucera interrupta* BAER | ? | | | + | + | + |
| 11. | *Eucera longicornis* (L.) | + | | + | + | + | + |
| 12. | *Eucera tuberculata* F. | | | | + | + | |

skidy Mts. All the species under consideration do not appear in the Tatra Mts. The species found in the Pieniny Mts. are distribute dthroughout Poland. They are known from Europe, Asia and North Africa, with exception for *Anthophora quadrimaculata* Pz. the range of which is restricted to South- and Central Europe.

Five species were found throughout Poland but the Carpathians, these are: *Anthophora bimaculata* Pz., *A. parietina* (F.), *A. pubescens* (F.), *A. retusa* (L.) and *Eucera interrupta* BAER. Of these, only *A. retusa* (L.) is known from Europe, Asia Minor and North Africa, so it is supposed to occur in the Pieniny Mts. The remaining species are southern or south-eastern elements in the fauna of Poland.

*A. borealis* MOR. is a taiga-element in the fauna of Poland, *Eucera tuberculata* F. is a south-European species.

## 2. Distribution of the genera *Clisodon* PATTON, *Anthophora* LATR. and *Eucera* SCOP. *(Anthophorinae)* in the Carpathian Range

Some information concerning the distribution of the subfamily *Anthophorinae* in the Carpathian Range is to be found in the papers of WIERZEJSKI (1874), ŚNIEŻEK (1910), JAQUET (1897, 1900), MOSÇÁRY (1874, 1918) and MOCZÁRY (1947). However, the foremost papers are those by JUGA (1944, 1950, 1954, 1958) who worked out the group under consideration in Roumania. The papers of JUGA makes an attempt on a zoogeographic analysis of thed iscussed genera in the Carpathian Range easier. This also helps us in giving the characters of the Pieniny species in relation to those in the whole of the Carpathian Range. The distribution of the *Anthophorinae* in the Carpathian Range is shown in table XVII. Of thirty-one species recorded from the Carpathian Range, ten species are widely spread, most probably, throughout the region under consideration, being distributed in Europe, Asia and some of these also in North Africa. The largest group, comprising seventeen species, is that of southern and south-eastern species inhabiting the Transylvanian Alps, Transylvania and the East Beskidy Range. Of these, *Anthophora aestivalis* (PZ.), *A. bimaculata* PZ., *Eucera interrupta* BAER and *E. tuberculata* F. appear also in the lowlands of Poland; they belong to the sub-Mediterranean group of species. Moreover, *A. aestivalis* (PZ.) has been found in the Pieniny Mts. what indicates that the occurrence of some other species of this group in the Pieniny Mts. may be expected. Seven species found only in the Tran-

Table XIX

The distribution of the genera *Clisodon* PATTON, *Anthophora* LATR. and *Eucera* SCOP. in the Carpathian RANGE

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Clisodon furcatus* (PZ.) | + | | + | + | + | + |
| 2. | *Anthophora acervorum acervorum* (L.) | + | | ? | ? | ? | + |
| 2a. | *Anthophora acervorum squalens* DOURS | | | | ? | + | ? |
| 3. | *Anthophora aestivalis* (PZ.) | + | | | + | + | ? |
| 4. | *Anthophora biciliata* LEP. | | | | | | + |
| 5. | *Anthophora bimaculata* PZ. | ? | | | ? | ? | + |
| 6. | *Anthophora borealis* MOR. | | | ? | ? | + | ? |
| 7. | *Anthophora crassipes* LEP. | | | | | | + |
| 8. | *Anthophora crinipes* SMITH. | | | | ? | + | + |
| 9. | *Anthophora dufouri* LEP. | | | | | | + |
| 10. | *Anthophora mucida* GRIBODO | | | | | | + |
| 11. | *Anthophora parietina parietina* (F.) | ? | | + | | | |
| 12a. | *Anthophora parietina fulvocinerea* (DOURS) | | | | ? | + | + |
| 12. | *Anthophora podagra* LEP. | | | | + | ? | ? |
| 13. | *Anthophora pubescens* F. | ? | | | + | + | + |
| 14. | *Anthophora retusa retusa* L. | ? | | ? | ? | + | + |
| 15. | *Anthophora robusta* KLUG | | | | | | + |
| 16. | *Anthophora quadrimaculata* (PZ.) | + | | + | + | + | + |
| 17. | *Eucera caspina* MOR. | | | | ? | + | + |
| 18. | *Eucera cinerea* LEP. | | | | + | + | + |
| 19. | *Eucera clipeata* ERICHS. | | | | + | + | + |
| 20. | *Eucera dalmatica* LEP. | | | | ? | + | ? |
| 21. | *Eucera eucnemides* DOURS | | | | ? | + | + |
| 22. | *Eucera excisa* MOSC. | | | | | | + |
| 23. | *Eucera interrupta* BAER. | ? | | | + | + | + |
| 24. | *Eucera longicronis* (L.) | + | | + | + | + | + |
| 25. | *Eucera nigrifacies* LEP. | | | | ? | + | + |
| 26. | *Eucera nitidiventris* MOSC. | | | | + | + | + |
| 27. | *Eucera pollinosa* SMITH | | | | + | + | + |
| 28. | *Eucera parvicornis* MOSC. | | | | + | ? | + |
| 29. | *Eucera seminuda* BRULLÉ | | | | | | + |
| 30. | *Eucera taurica* MOR. | | | | + | ? | + |
| 31. | *Eucera tuberculata* F. | | | | ? | + | + |

sylvanian Alps are south-European elements. It is of interest to note that none of these species has as yet been reported from Podolia. The Podolian members of the *Anthophorinae* belong to a group of species inhabiting the Transylvanian Alps, Transylvania and the East Beskidy Range. Only one subspecies, namely, *Anthophora parietina parietina* (L.), distributed in North- and Central Europe, is restricted in the Carpathian Range to the West Beskidy Range (according to available data). The Transylvanian Alps, Transylvania and probably the East Beskidy Range are in habited by another subspecies, *A. parietina fulvocinerea* (Dours.). *A. aecervorum acervorum* (L.) inhabiting North- and Central Europe, was found at 1900 m. altitude in the Transylvanian Alps (Moscáry, 1918), whereas *A. acervorum squalens* Dours, a south-eastern European subspecies, was found in Transylvania, thus it may be expected to occur in the Transylvanian Alps and the East Beskidy Range.

The data pertaining to the vertical distribution of the south European species in Transylvania are to be found in a paper by Moscáry (1947), however, they are too scanty to give an extensive analysis of that matter. Species on the northern edge of their range, in the mountains, are likely to appear there at low altitudes. On the other hand, species distributed in North- and Central Europe, would probably to be found in the mountainous regions of South Europe. However, such a theory is confirmed in practice by only a few species e.g. *A. acervorum acervorum* (L.) or *E. tuberculata* F. The latter species was found by Moczáry in Transylvania at 300—600 m. altitude. We known that the *Anthophorinae* are absent from the Tatra Mts. The presence of some members of that subfamily proved only in the neighbouring environments of the Tatra Mts., as Zakopane, Gubałówka (foot hills of the Tatra Mts.) and Nowy Targ. These are *Clisodon furcatus* (Pz.), *A. quadrimaculata* (Pz.) and *E. longicronis* (L.).

### 3. A zoogeographic characteristics of the species of the genera *Bombus* Latr. and *Psithyrus* Lep. in the Pieniny Mts.

So far, nineteen species of the genus *Bombus* Latr. and seven species of the genus *Psithyrus* Lep. have been found in the Pieniny Mts. Of members of the genus *Bombus* Latr., two are mountain species, *B. elegans* Seidl and *B. mastrucatus* Gerst. (according to Pittioni, 1942). The former was found by Noskiewicz in the Tatra Mts. (1920), in Gubałówka by Dylewska (1958) and in Raba Wyżna (West Beskidy Range) by Stobiecki. *B. mastrucatus* Gerst. is known from Gubałówka and the Tatra Mts; in the Tatra Mts. the species was observed in the alpine meadows zone. The remaining species of the genera under consideration are widely spread in Europe, Siberia, Asia, and some of these are distributed throughout the Palaearctic Region.

The distribution of the members of the genera *Bombus* Latr. and *Psithyrus* Lep. in the Carpathian Range is shown in table XX. All the species found in the Pieniny Mts. are also known from the West Beskidy Range. Four species, namely, *B. pyrenaeus* Pér., *B. jonellus* (K.), *P. norvegicus* Sp. Schn. and *P. meridionalis* Rich., inhabiting the Tatra Mts. have not as yet been found in the Pieniny Mts. *B. pyrenaeus* Pér. was found also on the top of Babia Góra in the West Beskidy Range (leg. Pawłowski, det. Dylewska). This species does not appear in the low altitudes in the Carpathians. *B. jonellus* K. and *P. norvegicus* Sp. Schn. should be found in the Pieniny Mts., since the former has been found in the region of Krynica (leg. Kapuściński, det. Dylewska) and the latter was reported only from the Czechoslovakian Tatra Mts. — So far, two species known from the West Beskidy Range, namely, *B. laesus* Mor. and *B. muscorum* (F.), have not been found in the Pieniny Mts. The former species is known in Poland from its central and northern regions and the southern slope of Babia Góra (leg. Stobiecki), and the latter is widespread in North- and Central Poland up to Kraków.

Table XX

The distribution of the species of the genus *Bombus* Latr. in the Carpathian Range

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Bombus hortorum* (L.) | + | + | + | + | + | + |
| 2. | *Bombus ruderatus* (F.) | + | | + | ? | ? | ? |
| 3. | *Bombus argillaceus* (Scop.) | | | | ? | + | ? |
| 4. | *Bombus subterraneus* (L.) | + | + | + | + | + | + |
| 5. | *Bombus distinguendus* Mor. | + | + | + | ? | ? | + |
| 6. | *Bombus fragrans* (Pall.) | | | | + | ? | + |
| 7. | *Bombus pomorum* (Panz.) | + | + | + | + | + | ? |
| 8. | *Bombus elegans* Seidl. | + | + | + | + | + | ? |
| 9. | *Bombus mucidus* Gerst. | | | | ? | + | ? |
| 10. | *Bombus agrorum* (F.) | + | + | + | + | + | + |
| 11. | *Bombus humilis* (Ill.) | + | | + | + | + | + |
| 12. | *Bombus muscorum* (F.) | | | | + | ? | + |
| 13. | *Bombus laesus* Mor. | | | + | ? | ? | + |
| 14. | *Bombus ruderarius* (Müll.) | + | + | + | + | + | + |
| 15. | *Bombus silvarum* (L.) | + | + | + | + | + | + |
| 16. | *Bombus equestris* (F.) | + | | + | ? | ? | + |
| 17. | *Bombus bureschi* Pitt. | | | | | | + |
| 18. | *Bombus alpinus* (L.) | | | | | | + |
| 19. | *Bombus confusus* Schck. | + | | ? | + | ? | + |
| 20. | *Bombus lapidarius* (L.) | + | + | + | + | + | + |
| 21. | *Bombus soroeensis* F. | + | + | + | + | + | + |
| 22. | *Bombus jonellus* (K.) | | + | + | ? | + | ? |
| 23. | *Bombus pyrenaeus* Pér. | | + | + | + | ? | + |
| 24. | *Bombus pratorum* (L.) | + | + | + | + | + | + |
| 25. | *Bombus hypnorum* (L.) | + | + | + | + | + | + |
| 26. | *Bombus terrestris* (L.) | + | + | + | + | + | + |
| 27. | *Bombus lucorum* (L.) | + | + | + | + | + | + |
| 28. | *Bombus mastrucatus* Gerst. | + | + | + | + | + | + |

*Bombus argillaceus* Scop., quoted by Wierzejski (1874) and Noskiewicz (1938) from Podolia, may be expected to occur in the East Beskidy Range, since this species is known also from Transylvania. *B. fragrans* (Pall.) was found by Wierzejski at Sambor (West URSS). *B. pomorum* (Panz.) and *B. elegans* Seidl are supposed to appear in the Transylvanian Alps, since the two are reported from the Bucharest region. *B. mucidus* Gerst. was quoted by Knechtel (1955) from Transylvania. *B. jonellus* (K.): I have identified some specimens from the Krynica region (coll. Kapuściński). The male and female specimens of *B. pyrenaeus* Pér. coming from the Czarnohora Mts. have been found among a series of *B. pratorum* (L.) collected by Fudakowski (det. Dylewska). One male from Czarnohora determined in the Fudakowski collection to be *B. terrestris* (L.) obviously belongs to *B. lucorum* (L.) (det. Dylewska).

Table XXI

The distribution of the species of the genus *Psithyrus* Lep. in the Carpathian Range

| No. | Species | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| 1. | *Psithyrus vestalis* (Fourcr.) | + | + | + | ? | ? | + |
| 2. | *Psithyrus bohemicus* (Seidl.) | + | + | + | ? | + | + |
| 3. | *Psithyrus rupestris* (F.) | + | + | + | ? | + | + |
| 4. | *Psithyrus campestris* (Panz.) | + | + | + | + | + | ? |
| 5. | *Psithyrus barbutellus* (K.) | + | + | + | ? | ? | |
| 6. | *Psithyrus maxillosus* (Klug.) | | | | ? | ? | + |
| 7. | *Psithyrus silvestris* (Lep.) | + | + | + | + | | |
| 8. | *Psithyrus norvegicus* Sp. Schn. | | + | | ? | ? | + |
| 9. | *Psithyrus quadricolor* Lep. | + | + | ? | | | |
| 10. | *Psithyrus meridionalis* Rich. | | + | ? | ? | | |

*P. maxillosus* (Klug) was found in the Prague region in Czechoslovakia. *P. quadricolor* Lep. and *P. globosus* Ev. from the Fudakowski collection have been identified by the present author to be obviously members of *P. silvestris* (Lep.).

## 4. The fauna of the genera *Bombus* Latr. and *Psithyrus* Lep. in the Pieniny Mts. in relation to that fauna in the Carpathian Range

The faunistic evidence in the Pieniny Mts. has proved the fauna of the genera *Bombus* Latr. and *Psithyrus* Lep. to be rather similar to that in the West Beskidy Range. All the twenty-two species of the genus *Bombus* Latr. and nine species of the genus *Psithyrus* Lep. that are found in the Carpathian Range appear to be distributed throughout that region, with exception of species with range restricted by the vertical distribution. Thus, *Bombus pyrénaeus* Pér. is absent from the Pieniny Mts., further, some species living in the West Beskidy Range, viz. *B. ruderatus* (F.), *B. humilis* (Ill.), *B. laesus* Mor., *B. equestris* (F.) and *B. confusus* Schck., do not occur in the Tatra Mts. Most species inhabiting the West Beskidy Mts., namely twenty-one species of the genus *Bombus* Latr. and five members of the genus *Psithyrus* Lep., are distributed throughout the Carpathian Range being there the most numerous in species component of its fauna. Four species, viz. *B. ruderatus* (F.), *B. barbutellus* (K.), *P. quadricolor* Lep. and *P. meridionalis* Rich, have as yet been observed only in the West Beskidy Mts. However, these species are expected to occur also in the East Beskidy Mts. and in Transylvania. Thus, they would have a rather similar distribution to that of *B. jonellus* (K.) distributed in the East Beskidy Mts. and in Transylvania. The East Beskidy Mts. and Transylvania were reached by some Pontic, Pontic-Turkmen and European elements which are absent from the West Beskidy Range by reason of the climatic conditions. These are: *B. argillaceus* (Scop.), *B. fragrans* (Pall.), *B. muscorum* (F.) and *P. maxillosus* (Klug.). — *B. bureschi* Pitt. and *B. alpinus* (L.) have as been observed only in the Transylvanian Alps. Knechtel (1955) does not quote *B. alpinus* (L.) from the Transylvanian Alps and its occurrence there is considered by the present author to be rather doubtful. *B. mucidus* Gerst. is as yet known only from the Siebenburg Alps from where was reported by Moscáry (1947); this species is known from the Alps, Jura, the Balkans and from the Pyrenees.

## V. AN ECOLOGICAL CHARACTERISTICS OF THE *APIDAE* OF THE PIENINY MTS.

### 1. Species of the genera *Eucera* Scop., *Clisodon* Patton and *Anthophora* Latr. in the Pieniny habitats

Table XXII

| No. | Species | Habitat | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII |
| 1. | *Eucera longicornis* (L.) | | + | + | + | + | + | + | |
| 2. | *Clisodon furcatus* (Pz.) | | | | + | + | + | + | |
| 3. | *Anthophora quadrimaculata* (Pz.) | | | | | | + | | |
| 4. | *Anthophora aestivalis* Pz. | | | | | | | + | |
| 5. | *Anthophora acervorum* (L.) | | | | + | + | + | + | |

As can see from the table XXII, only one species, *E. longicornis* (L.) has been observed in the northern slope (II). It has been collected in large quantities on *Trifolium* L. in the fields at Sromowce Niżne (VII). *C. furcatus* (Pz.)

and *A. acervorum* (L.) have been taken in screes (VI), meadows (V) and in glades of southern slopes. The former species has been observed on *Campanula* L. and the latter on *Primula elatior* L. and *Taraxacum* L. In spite of the occurrence of these plants in the northern slope of the Pieniny Mts. neither *C. furcatus* (Pz.) nor *A. acervorum* (L.) have been found there. The absence of some species from the northern slope of the Pieniny Mts. can be explained by the vertical distribution of those in the Pieniny Mts. and the Tatra Mts. However, judging by the distribution of *E. longicornis* (L.) which has been found in the northern slope of the Pieniny Mts. and on the top of Gubałówka (Noskiewicz, 1920), the occurrence of this species in the lower-forest-zone of the Tatra Mts. is to be expected. Of the remaining species, *A. quadrimaculata* (Pz.) is supposed to occur in the northern slope of the Pieniny Mts. and in the lower-forest-zone of the Tatra Mts., since this species is reported from the top of Gubałówka.

## 2. The ecological observations on the genera *Eucera* Scop., *Clisodon* Patton and *Anthophora* Latr.

Table XXIII

Phenology of the genera *Eucera* Scop., *Clisodon* Patton and *Anthophora* Latr. *)

| No. | Species | Time of appearance | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | III | IV | V | VI | VII | VIII | IX |
| 1. | *Eucera longicornis* (L.) | | | | | | | |
| 2. | *Clisodon furcatus* (Pz.) | | | | | | | |
| 3. | *Anthophora quadrimaculata* (Pz.) | | | | | | | |
| 4. | *Anthophora aestivalis* Pz. | | | | | | | |
| 5. | *Anthophora acervorum* (L.) | | | | | | | |

*) The period of the occurrence of the individual species in the Pieniny Mts. is marked with a continuous line, that in Central Poland with an interruped line.

We have satisfactory data to state that the time of the appearance of *E. longicornis* (L.) and *C. furcatus* (Pz.) in the Pieniny Mts. is longer for a two weeks period than that in Central Poland (as shown in table XXIII). The available data for the remaining species are too scanty to state any certain opinion.

## 3. The species of the genera *Bombus* Latr. and *Psithyrus* Lep. in the Pieniny habitats

As can see from the table XXIV, eleven species of the genus *Bombus* Latr and six species of the genus *Psithyrus* Lep. have been found on both northern and southern slope of the Pieniny Mts. All these species are most aboundant in the region in question. PITTIONI (1942) considers them to be various forest-steppe elements. Seven species of the genus *Bombus* LATR. and only one member of the genus *Psithyrus* LEP. has been found exclusively in the southern slopes. Most of these species are rarities in the Pieniny Mts. being known from there by only one or few examples. However, such species should also appear in the northern slopes of the Pieniny Mts. as they inhabit forest and meadows, and, moreover, were found in the Tatra Mts. or at their foot region. These are: *B. ruderatus* (F.), *B. distinguendus* MOR., *B. pomorum* (PANZ.), *B. humilis* (ILL.) and *P. quadricolor* LEP. Further species that have been found only in the southern slope are *B. equestris* (F.) and *B. elegans* SEIDL The former is a steno-steppe element (PITTIONI, 1942); it has been found in the Pieniny Mts. only in the fields at Sromowce Niżne (most probably this species does

Table XXIV

Distribution of the species of the genera *Bombus* LAETR. and *Psithyrus* LEP. in the Pieniny Mts.

| No. | Species | Habitat | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII |
| 1. | *Bombus hortorum* (L.) | + | + | + | + | + | + | + | + |
| 2. | *Bombus ruderatus* (F.) | | | + | | | | | |
| 3. | *Bombus subterraneus* (L.) | | | | + | + | | | |
| 4. | *Bombus distinguendus* MOR. | | | | | + | | | |
| 5. | *Bombus pomorum* (PZ.) | | | | | + | | | |
| 6. | *Bombus elegans* SEIDL | | | | + | + | + | + | |
| 7. | *Bombus agrorum* (F.) | + | + | + | + | + | + | + | + |
| 8. | *Bombus humilis* (ILL.) | | | | | + | + | + | |
| 9. | *Bombus ruderarius* (MÜLL.). | | + | | + | + | + | + | |
| 10. | *Bombus silvarum* (L.) | | + | | | + | + | + | |
| 11. | *Bombus equestris* (F.) | | | | | | | + | |
| 12. | *Bombus confusus* SCHCK. | | | | | | | | + |
| 13. | *Bombus lapidarius* (L.) | + | + | + | + | + | + | + | + |
| 14a. | *Bombus soroeensis* F. *soroeensis* F. | | + | + | + | + | + | | |
| 14b. | *Bombus soroeensis proteus* GERST. | | | + | + | + | | | |
| 15. | *Bombus pratorum* (L.) | + | + | + | + | + | | | |
| 16. | *Bombus hypnorum* (L.) | ? | + | + | + | + | + | + | |
| 17. | *Bombus terrestris* (L.) | + | + | + | + | + | + | + | + |
| 18. | *Bombus lucorum* (L.) | | + | + | + | + | + | + | + |
| 19. | *Bombus mastrucatus* GERST. | ? | + | + | + | ? | + | + | |
| 20. | *Psithyrus vestalis* (FOURCR.) | + | + | + | + | | | | |
| 21. | *Psithyrus bohemicus* (SEIDL.) | | + | + | + | + | | | |
| 22. | *Psithyrus rupestris* (F.) | | + | + | + | + | + | | |
| 23. | *Psithyrus campestris* (PZ.) | | + | + | + | + | + | + | |
| 24. | *Psithyrus barbutellus* (K.) | | + | + | + | | | + | |
| 25. | *Psithyrus silvestris* LEP. | | + | + | + | + | + | | |
| 26. | *Psithyrus quadricolor* LEP. | | | | + | | + | | |

not live in the norther slope as confined to xerothermic habitat and not occurring in the Tatra Mts.). The latter species has been found in the southern slope up to the meadows lying on the tops. It should occur also in the northern slopes of the Pieniny Mts. where its parasite occurs, *Psithyrus barbutellus* (K.). Moreover, *B. elegans* SEIDL appears in the upper forest-zone in the Tatra Mts. (NOSKIEWICZ). A rather noticeable species is *B. confusus* SCHENCK. found in a locality at the foot of the Pieniny Mts. Most probably it is absent from the proper range of the Pieniny Mts. (especially with regard to the northern slope), since it has not as yet been found in the lower forest-zone of the Tatra Mts. and in the neighbour regions.

As can be seen from the above considerations, the Pieniny Mts. and their neigh- bour regions show a vertical differentation of the fauna. As an example of this are the two species mentioned, viz. *B. equestris* (F.) and *B. confusus* SCHCK. the range of which in the Pieniny Mts. is not extended beyond the foot of this region, whereas other species appear in the glades, forests and screes. — The reason for the greater number of species appearing in the southern slope is in close relation with the abundance of the individual species in the Pieniny habitats respectively.

It must be noted here that none of the Pieniny species of the genus *Bombus* LATR. is confined to one or two habitats in the region in question (of course with exception of rare species which are discussed above). It is also of interest to note that there are no qualitative differences with regard to the habitats Nos. IV and V. *B. humilis* (ILL.) is an exception here, however, this species should to be found in the habitat IV. On the other hand, the number of observed specimens is rather different with regard to respective habitats.

The number of observed specimens that is shown in the table XXV depends on the season of the year as well as on the number of flowering plants that are visited by the species considered. These two factors are the foremost of those determining the number of specimens of the bumble-bees.

Table XXV

| Habitat | |
|---|---|
| I | 1 specimen every 30—50 m. (observation made chiefly in early spring) |
| II | 1 specimen every 1—15 m. |
| III | 1 specimen every $^1/_2$—6 m. |
| IV | up to 20 specimens in a square meter (observation made in August) |
| V | 1—3 specimens in a square meter in environments rich florally |
| VI | 1 specimens every 1—10 m. |
| VII | 1—3 specimens in a square meter in environments rich florally |
| VIII | 1 specimen every 1—15 m. |

In early spring the *Bombus*-species can be observed chiefly in moist wooded environments where such species as *Salix* L., *Pulmonaria* L., and others are flowering. The quantitative relations of the *Bombus* LATR. fauna in the woods in the northern slopes of the Pieniny Mts. resemble those observed in the Tatra Mts. (DYLEWSKA, 1958). The thick woods in both the Pieniny

Mts. and the Tatra Mts. are poorest in species of the genera *Bombus* LATR. and *Psithyrus* LEP. In July and August the flora in the Pieniny Mts. is richest and the insects considered are most aboundant in specimens. Even the species typical of wooded localities leave the wood and gather in enormous numbers in glades and meadows. The most largest numbers of specimens are observed in the top glades. The growing there reach in this period up to 1 m. of height. I have observed the flowers of *Centaurea* L., *Carduus* L. or *Cirsium* MILL., visited by several males at the same time. The workers and queens gather the nectar chiefly on the leguminous plants such as *Coronilla varia* L., *Medicago falcata* L., *Salvia* L., *Lotus corniculatus* L., *Ononis* L. and others. Fewer of specimens have been observed in the meadows of the southern slopes extending from Nowa Góra to Czorsztyn. This is due to the poor flora growing among the cultivated fields and devasted by the cultivation. It must be noted that on the top of Nowa Góra, which is a strict reservation, up to ten specimens in a square meter have been observed. The number of specimens observed in the habitats Nos. III, IV and VIII depends on the richness of the flora, whereas the fauna of the *Bombus*-species of the northern slopes is rather poor in spite of a considerable number of plants that are visited by the respective insects. Such a phenomenon may be due to the special microclimatic conditions existing in the northern slopes or to the mowing of meadows. Judging by the observations made in the Tatra Mts. the bumble-bees are very hardy to the severe mountain climate. Despite this, the number of specimens of bumble-bees observed in the Tatra Mts. during strong winds, cold days or in poorly lighted environments was much lesser than during the time of suitable atmospherical conditions. Thus we may understand why bumble-bees show preference to the well insolated and warm southern slopes. Moreover, the meadows of the northern slopes are very poor in flora after the mowing, whereas the southern slopes have a considerable number of lightly or uncultivated areas and strictly protected meadows where the insects can feed over the whole time of their appearance. Thus, the lesser number of species that have been observed in the northern slopes of the Pieniny Mts. is understandable. Due to these facts the material collected in the southern slopes is very rich in specimens and shows several rare species found in one or a few specimens each.

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## STRESZCZENIE

Badania nad fauną *Apoidea* Pienin prowadzono w latach od 1957 do 1961. Opracowanie tej grupy w Pieninach było ważne, ponieważ brak takiego w literaturze faunistycznej, a ponadto ze względu na wyjątkowe stanowisko tego pasma w łuku karpackim. Znaleziono tam bowiem nie tylko gatunki szeroko rozsiedlone w Europie, górskie, boreo-alpejskie, lecz także południowe i południowo-wschodnie. W literaturze florystycznej i faunistycznej dyskutowano nad pochodzeniem tych gatunków. PAWŁOWSKI (1924), PAWŁOWSKA (1953) i STACH (1918) uważają gatunki endemiczne znalezione w Pieninach za relikty z plejstocenu, a może nawet z pliocenu. Jednak większość zoologów (KUNTZE 1934, KUNTZE i NOSKIEWICZ, 1938) nie znajduje w Pieninach endemitów i przyjmuje, że napływ gatunków ciepłolubnych odbywał się w ciepłym okresie polodowcowym.

Niniejsza praca zawiera opracowanie dwóch rodzin *Apoidea*, a mianowicie *Megachilidae* i *Apidae*.

Ogółem złowiono w Pieninach 39 gatunków *Megachilidae* (w Polsce znanych jest 80). Nowe dla fauny Polski są: *Chelostoma ventralis* SCHLETT., *Osmia andrenoides* SPIN., *Coelioxys alata* LEP. i *C. lanceolata* NYL. Ponadto wykazano 15 nowych gatunków dla Karpat Polskich. *Megachilidae* reprezentowane są w Pieninach przez dwa gatunki górskie (*Anthidium montanum* MOR. i *Osmia villosa* SCHCK.), trzy boreo-alpejskie (*Osmia parietina* CURT., *Megachile nigriventris* SCHCK. i *Coelioxys lanceolata* NYL.), siedem tajgowych, osiem gatunków o pochodzeniu południowym i południowo-wschodnim, a pozostałe (19) należą do szeroko rozsiedlonych w Europie lub nawet w Azji i w Afryce północnej. Wśród gatunków ciepłolubnych wyróżniono takie, które występują aż po Polskę północną [*Chelostoma distinctum* STÖCKH., *Osmia cerinthidis* MOR., *O. spinulosa* (K.), *Megachile ericetorum* LEP.] oraz znalezione wyłącznie w Pieninach (*Chelostoma ventralis* SCHLETT., *Osmia andrenoides* SPIN. i *Coelioxys* alata LEP.). Najbliższe stanowiska tych ostatnich znajdują się w południowo-wschodniej Czechosłowacji (Słowacja) oraz na Podolu jarowym. Gatunki te przybyły najprawdopodobniej z Czechosłowacji przez obniżenie Karpat w rejonie Magury Spiskiej lub przez dolinę Popradu. Endemitów nie stwierdzono i można przyjąć zgodnie z poglądem KUNTZEGO (1934), że gatunki te dotarły do Pienin w ciepłym okresie polodowcowym. Rozważania nad fauną *Megachilidae* Karpat pozwoliły wyróżnić następujące grupy: 1) zamieszkujące cały łuk Karpat, 2) znane tylko z Beskidu Zachodniego, 3) wyłącznie tatrzańskie, 4) tatrzańsko pienińskie (*Anthidium montanum* MOR.), 5) występujące w Beskidzie Wschodnim, Siedmiogrodzie i Alpach Transylwańskich, 6) wykazane wyłącznie z Alp Transylwańskich, 7) ciepłolubne gatunki wykazane wyłącznie z Pienin i Alp Transylwańskich lub wyłącznie z Pienin (*Osmia andrenoides* SPIN., *Chelostoma ventralis* SCHLETT. i *Coelioxys alata* LEP.). Ostatnia grupa charakteryzuje Pieniny jako środowisko kserotermiczne, wyjątkowe w chłodnym Beskidzie Zachodnim.

Obszar Pienin podzielono na następujące środowiska: I. lasy zboczy północnych, II. łąki zboczy północnych, III. lasy zboczy południowych, IV. polany śródleśne masywu Trzech Koron, V. łąki zboczy południowych, VI. piargi i skałki zboczy południowych, VII. pola i łąki uprawne, leżące u podnóża zboczy południowych, VIII. pierścień wiklin nadrzecznych nad Dunajcem i Krośnicą. Wszystkie gatunki z rodziny *Megachilidae* łowiono po stronie południowej Pienin. [*Osmia rufa* (L.) została znaleziona także u podnóża zboczy północnych (VIII)]. Cechą charakterystyczną rozsiedlenia tej rodziny jest ponadto związek z najcieplejszym środowiskiem, a mianowicie ze skałkami i piargami (Tab. 13). Tylko czterech gatunków nie obserwowano w tym środowisku. Bogactwo gatunków tłumaczy tu specyfika mikroklimatu i bogata flora. 17 gatunków wykazano wyłącznie na piargach i skałkach, najciekawsze z nich są następujące: *Anthidium montanum* Mor., *Chelostoma vetralis* Schlett., *Osmia spinulosa* (K.), *Coelioxys alata* Först. i *C. lanceolata* Nyl. Wyłącznie w środowisku V i VI łowiono cztery gatunki: *Anthidium manicatum* (L.), *A. strigatum* Latr., *Megachile versicolor* Sm., *M. nigriventris* Schck. oraz *Osmia rufa* (L.), którą ponadto znaleziono u podnóża północnych zboczy. Nieobecność tych gatunków w środowisku IV tłumaczy częściowo brak odwiedzanych przez nie roślin. [*Osmia rufa* (L.) — *Salix* sp., *A. manicatum* (L.) — *Stachys germanica* L.]. Nową dla Polski *O. andrenoides* Spin. wraz z pięcioma innymi gatunkami łowiono w środowiskach IV, V i VI. Tylko dwa gatunki [*M. willoughbiella* (K.) i *M. ligniseca* (L.)] występują także w lesie po południowej stronie Pienin.

Najwcześniej, bo już w kwietniu pojawia się w Pieninach *Osmia rufa* (L.). Następnie dopiero w drugiej połowie maja siedem gatunków, a między nimi *Osmia andrenoides* Spin. (pełny okres jej pojawu trwa od połowy maja do połowy sierpnia). Większość gatunków (20) obserwuje się w czerwcu, co jest związane z porą zakwitania roślin żywicielskich. Nieliczne gatunki obserwowano jeszcze we wrześniu (Tab. 15).

Na 31 gatunków z rodziny *Apidae* złowionych w Pieninach, pięć przypada na rodzaje *Clisodon* Patton (1), *Anthophora* Latr. (3) i *Eucera* Scop. (1). W Polsce wykazano 12 gatunków z tych rodzajów. Gatunki znalezione w Pieninach należą do szeroko rozsiedlonych w Europie, Azji i Afryce północnej, zasiedlają one najprawdopodobniej cały łuk karpacki, nie znaleziono ich jednak w Tatrach. W Pieninach odwiedzają rośliny wyłącznie po stronie południowej, z wyjątkiem *Eucera longicornis* (L.), obserwowanej także po stronie północnej. Gatunek ten wobec tego może być znaleziony w dolnym reglu Tatr. Gatunki z wymienionych rodzajów pojawiają się w Pieninach w drugiej połowie kwietnia [*Eucera longicornis* (L.)], a są jeszcze aktywne w sierpniu [*Clisodon furcatus* (Pz.), *Anthophora quadrimaculata* (Pz.)]. Pozostałe 26 gatunków z tej rodziny przypada na rodzaje *Bombus* Latr. (19) i *Psithyrus* Lep. (7). Dwa z nich to gatunki górskie (*B. elegans* Seidl. i *B. mastrucatus* Gerst.), a pozostałe są szeroko rozsiedlone w Europie, Syberii, na wielkich przestrzeniach w Azji lub w całej Palearktyce. Wszystkie gatunki wykazane w Pieninach zasiedlają cały łuk karpacki, przy czym uboższe są od Beskidu Zachodniego o wysokogórskiego *B. pyrenaeus* Pér. oraz cztery inne gatunki. 11 gatunków trzmieli i 6 gatunków trzmielców łowiono po obu stronach (północnej i południowej) głównej grani Pienin. Większość pozostałych gatunków może być znaleziona także na zboczach północnych. Tylko dwa gatunki [*B. equestris*

(F). i *B. confusus* Schck.] są związane z najcieplejszą partią Pienin. Pierwszy to element wyłącznie stepowy (Pittioni 1942), a drugi znany dotąd z Niżu Polski, Beskidu Wschodniego i Alp Transylwańskich. Duże różnice w ilościowym nasileniu fauny trzmielowej obserwuje się w poszczególnych środowiskach pienińskich. Najbogatsze w trzmiele i trzmielce okazały się polany śródleśne masywu Trzech Koron (IV), gdzie notowano w sierpniu do 20 okazów na 1 m², a najuboższe lasy zboczy północnych, w których tylko wiosną obserwuje się nieliczne trzmiele (co 30—50 m jeden okaz).

Pozostałe rodziny *Apoidea* zostaną opracowane przy udziale prof. dra J. Noskiewicza.


РЕЗЮМЕ

Исследования фауны *Apoidea* Пенин проводились с 1957 по 1961 г. Изучение этой группы в Пенинах было важным ввиду недостатка такового в фаунистической литературе, кроме того из-за исключительного положения этого пояса в карпатской дуге. Наряду с видами широко распространенными в Европе, как горные, бореально-альпийские, найдены там также виды южные и юговосточные. О происхождении этих видов велась дискуссия в флористической и фаунистической литературе. Pawłowski (1924), Pawłowska (1953) и Stach (1918) эндемические виды найденные в Пенинах считают реликтами из плейстоцена либо даже из плиоцена. Однако, большинство зоологов (Kuntze, 1934, Kuntze и Noskiewicz 1938) не находят эндемиков в Пенинах и считают, что наплыв теплолюбивых видов происходил во время теплого поледникового периода.

Настоящая работа содержит изучение двух семейств *Apoidea* а именно *Megachilidae* и *Apidae*.

В общем поймано в Пенинах 39 видов *Megachilidae* (в Польше известны 80 видов). Новыми для фауны Польши являются: *Chelostoma ventralis* Schlett., *Osmia andrenoides* Spin., *Coelioxys alata* Lep. и *C. lanceolata* Nyl. Кроме того отмечено 15 видов новых для Карпат Польских. *Megachilidae* представлены в Пенинах двумя горными видами (*Anthidium montanum* Mor. и *Osmia villosa* Schck., тремя бореально-альпийскими (*Osmia parietina* Curt., *Megachile nigriventris* Schck. и *Coelioxys lanceolata* Nyl.), семью таежными, восьмью видами южного и юговосточного происхождения, а остальные виды (19) принадлежат к широко распространенным в Европе либо даже в Азии и северной Африке. Среди теплолюбивых видов выделены такие, которые доходят даже к северной части Польши [*Chelostoma distinctus* (Stöckh.), *Osmia cerinthidis* Mor. *O. spinulosa* (K.) *Megachile ericetorum* Lep.]. Ближайшие местоположения последних видов находятся в юговосточной Чехославакии (Словакия) и в яровом Подолье. Вероятнее всего виды эти пришли из Чехословакии благодаря обнижению Карпат в районе Магуры Спижской и долины Попрада. Эндемиков не отмечено и можно принять, согласно

взглядам Кунце (1934), что виды эти распространились в Пенинах в теплом последниковом периоде. Анализ фауны *Megachilidae* Карпат дал возможность автору выделить следующие группы: 1) заселяющие целую дугу Карпат, 2) известные только для Западного Бескида, 3) исключительно татренские, 4) татро-пенинские *Anthidium montanum* Mor. 5) выступающие в Восточном Бескиде, Семиграде и Альпах Трансильванских, 7) теплолюбивые виды отмеченные исключительно в Пенинах и Альпах Трансильванских либо исключительно в Пенинах (*Osmis andrenoides* Spin., *Chelostoma ventralis* Schlett. и *Coelioxys alata* Lep.). Последняя группа характеризует Пенины как исключительно ксеротермическую среду в холодном Западном Бескиде.

Территория Пенин разделена на следующие среды: I. Леса северных склонов, II. луга северных склонов, III. леса южных склонов, IV. средилесные поляны массива Трех Корон, V. луга южных склонов, VI. осыпи и утесы южных склонов, VII. возделываемые поля и луга лежащие у подножья южных склонов, VIII. пояс прибрежных ив над Дунайцем и Красницей. Все виды из семейства *Megachilidae* были пойманы на южной стороне Пенин. [*Osmia rufa* (L,)] найдена также у подножья северных склонов (VIII). Характерной чертой расселения этого семейства является также связь с наиболее теплой средой, именно с осыпями и утесами (табл. 13). В этой среде не встречались только лишь четыре вида. Богатство видов объясняется здесь спецификой микроклимата и богатой флорой. 17 видов отмечены исключительно на осыпях и утесах, из них наиболее интересными являются: *Anthidium montanum* Mor., *Chelostoma ventralis* Schlett., *Osmia spinulosa* (K.) *Coelioxys alata* Först. и *C. lanceolata* Nyl. Исключительно в среде V и VI отловлены были четыре вида: *Anthidium manicatum* (L.), *A. strigatum* Latr. *Megachile versicolor* Sm., *M. nigriventris* Schck. и *Osmia rufa* (L.), которая была найдена также у подножья северных склонов. Отсутствие этих видов в среде IV объясняется частично отсутствием посещаемых ими растений: [*Osmia rufa* (L.) — *Salix* L. *A. manicatum* (L.) — *Stachys germanica* L.]. Новый для Польши *O. andrenoides* Spin. вместе с пятью другими видами отлавливались в средах IV, V и VI. Только два вида [*M. willoughbiella* (K.)] и *M. ligniseca* (L.) выступают также в лесу на южной стороне Пенин.

Раньше других, а именно уже в апреле, появляется в Пенинах *Osmia rufa* (L.). Затем только во второй половине мая появляются семь видов, а среди них *Osmia andrenoides* Spin. (польный период его появления длится с половины мая до половины августа). Большинство видов (20) наблюдается в июне, что связано с периодом зацветания растений на которых они кормятся. Немногочисленные виды отмечены еще в сентябре (табл. 15). Из 31 видов семейства *Apidae* пойманных в Пенинах, пять приходится на роды *Clisodon* Patton (1), *Anthophora* Latr. (3) и *Eucera* Scop. (1). В Польше отмечено 12 видов принадлежащих к указанным родам. Виды найденные в Пенинах принадлежат к широко распространенным в Европе, Азии и северной Африке. Заселяют они вероятнее всего целую карпатскую дугу, однако не найдены в Татрах. В Пенинах растения посещаются ими исключительно с южной стороны, только *Eucera longicornis* (L.) встречается также и на северной стороне. Поэтому вид этот может быть найден и в нижних частях леса Татр (regio montana inferior). Виды перечисленных родов появляются в Пенинах во второй половине апреля [*Eucera longicornis* (L.)] и остаются активными еще в августе [*Clisodon furcatus* (Pz.), *Anthophora quadrimaculata* (Pz.)]. Остальные 26 видов этого семейства приходятся на роды *Bombus* Latr (19) и *Psithyrus* Lep. (7). Два из них это горные виды (*B. elegans* Seidl. и *B. mastrucatus* Gerst.) а остальные широко распространены в Европе, Сибири, на больших пространствах Азии либо в целой Палеарктике. Все виды отмеченные в Пенинах заселяют целую карпатскую дугу, при чем фауна Пенин беднее фауны Западного Бескида на *B. pyrenaeus* Per. и четыре других вида. 11 видов *Bombus* Latr. и 6 видов *Psithyrus* Lep. были отловлены на обеих сторонах (северной и южной) главной грани Пенин. Большинство остальных видов могут быть найдены также и на северных склонах. Только два вида [*B. equestris* (F.) и *B. confusus* (Schck.)] связаны с наиболее теплой частью Пенин. Первый из них это исключительно степной элемент (Pittioni, 1942), а второй-известный до сих пор из Польской Низменности, Восточного Бескида и Альп Трансильванских. Большие различия в количественном изобилии фауны шмелей наблюдаются в отдельных пенинских средах. Неиболее богатые представителями родов *Bombus* и *Psithyrus* оказались средилесные поляны массива Трех Корон (IV), где в августе отмечено до 20 особей на 1 м$^2$, а найболее бедными(-)леса северных склонов, в которых лишь весной встречаются единичные шмели (один экземпляр на 30—50 м). Остальные семейства *Apoidea* будут обработаны совместно с проф. др И. Носкевичем.

Plate XIV

Fig. 1. Southern slope of Trzy Korony Mt. (982 m. alt.) (habitats nos. III, V and VI), below it Wielka Polana at Sromowce Niżne (habitat no. VIII), with fields and cultivated meadows above .

Fig. 2. Meadows of the northern slope of Trzy Korony Mt. (habitat no. II) in part covered by a wood of the *Fagetum carpaticum*-type (habitat no. I).

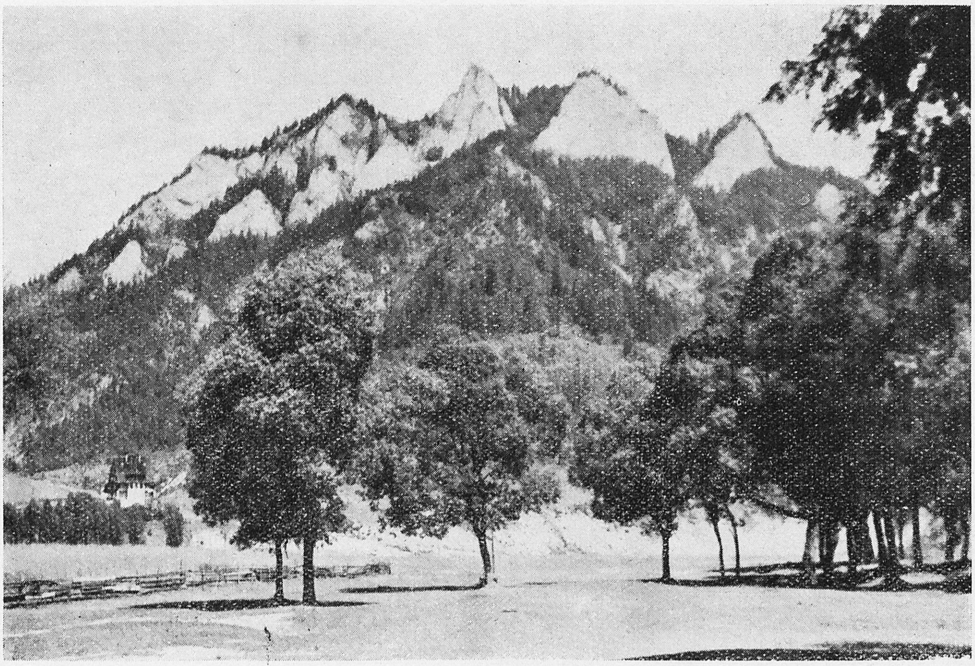

Fig. 1

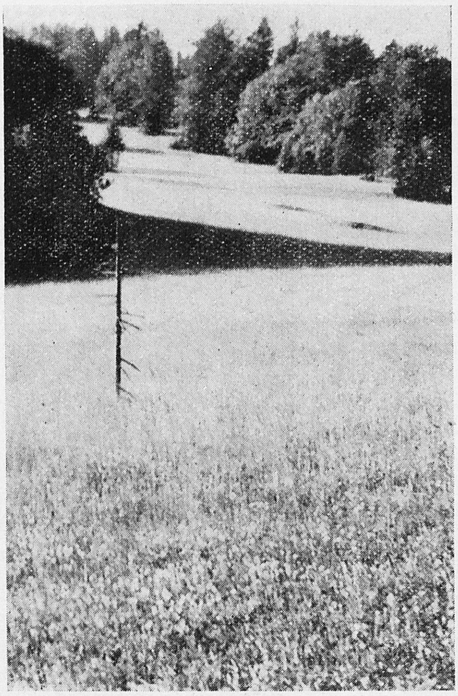

Fig. 2

Plate XV

Fig. 3. Kosarzyska. A glade in the Trzy Korony massif (habitat no. IV).

Fig. 4. Pod Nowe. A xerocline over Sromowce Niżne with screes (habitat no. VI) and well insolated grassy spots with flora of the *Festucetum rubre normale*-type.

Fig. 3

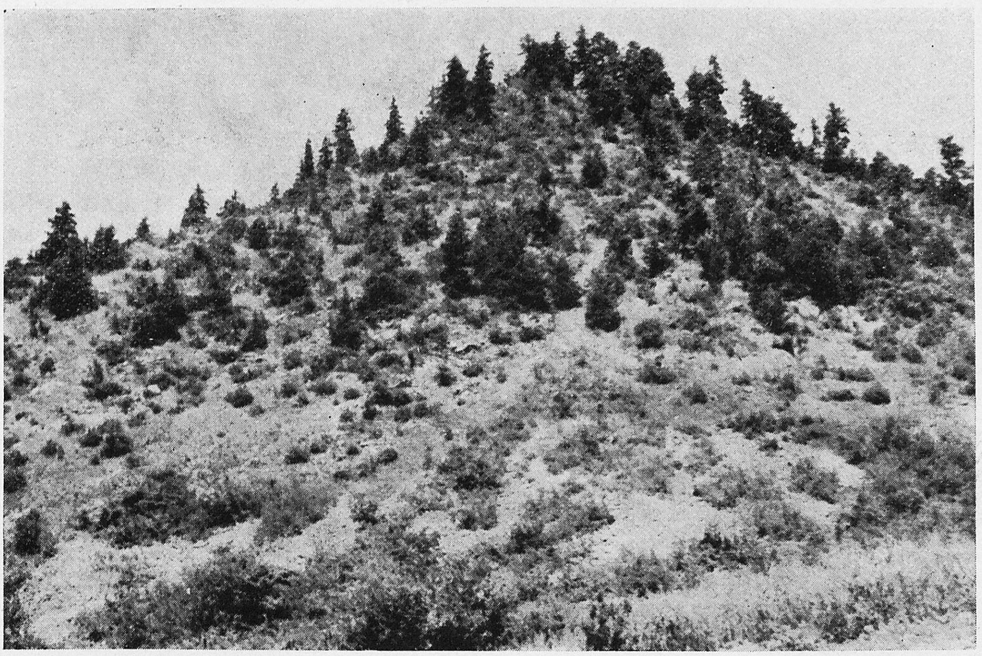

Fig. 4

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