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Thysanoptera Species of Selected Plant Communities of the Jaworznickie Hills (Silesian Upland, Poland)

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The paper presents the results of investigations into the thrips fauna of plant communities of the Jaworznickie Hills. The study was conducted in selected forest, shrubby, xerothermic and meadow areas. The relations between thrips and their host plants were also observed. Three main associations of thrips were distinguished on the basis PCA and thrips abundance, species composition, domination structure and ecological elements. 84 species were recorded.

Keywords: Thrips, *Thysanoptera,* local fauna, faunistics.

Most of the research on thrips conducted in Poland has so far been concerned with the qualitative and quantitative composition of thrips fauna in agrocenoses as well as its influence on the growth of cultivated plants and cropping (e.g. Mostowska and Sądej, 1990; Żurańska and Władyko, 1991; Zawirska and Wałkowski, 2000). The dependence of the species composition of thrips fauna on the structure of plant cover has been investigated, among others, by Kucharczyk and Zawirska (1994), who studied xerothermic grass communities of south-eastern Poland, by Kucharczyk and Sęczkowska (1990), who examined dry-ground forests of Roztocze, and by Pokuta (1997), who investigated thermophilous grass communities of Olsztyn area. Relatively little research has been done on thrips living in various plant communities, which encouraged the present study conducted in the Jaworznickie Hills (Silesian Upland, southern Poland) (Kondracki, 2000), an area representative enough to determine relationships between the structure of thrips associations and plant communities.

The Jaworznickie Hills, geologically highly diversified (Dylikowa, 1967), cover an area of 510 km^2, with an average altitude approximating 300 m above sea level. Most habitats potentially suitable for dry-ground forests, beech woods and mixed coniferous forests are now taken over by impoverished xerothermic grasses of the class *Festuco-Bromete,* arable lands and meadows (*Arrhenatherion, Calthion* and *Molinion*), and pastures *(Cynosurion),* which degenerate as a result of drainage and transform into grass phytocenoses (Tokarska-Guzik, 1991).

Material and Methods

Material for the study was collected in selected plant communities of the Jaworznickie Hills in the years of 1998–2000. Detailed analysis was carried out in seven types of plant communities (in 17 areas altogether): I – *Tilio-Carpinetum typicum,* II – *Querco roboris-Pinetum,* III – *Pruno-Crataegetum,* IV – *Trifolio-Agrimonietum,* V – *Koelerio-Festucetum sulcatae,* VI – *Molinietum medioeuropaeum,* and VII – *Arrhenatheretum medioeuropaeum.*

For quantitative analysis, insects were collected from each area with a scoop every 10–14 days from the beginning of May till the beginning of October. One sample consisted of 4 series of 25 strokes each along a transect.

Slides were prepared from collected thrips using methods proposed by Zawirska (1994) and Bisevac (1997). Material was identified to the species level on the basis of Priesner (1964), Schliephake and Klimt (1979) and Zawirska (1994).

Every species of *Thysanoptera* found in the studied area was related to particular ecological and chorological elements.

For particular types of plant communities, Simpson's species diversity coefficient was calculated (Simpson, 1949) from the following formula:

$$I = \sum_{i \pm 1}^{S^*} p_i^2$$

where p_i – fractional contribution of species in the community.

To determine the similarity of species composition in various zoocenoses, Sørensen's coefficient (S_{MS}) was used, calculated from the following formula (Sørensen, 1948):

$$S_{MS} = \frac{2C}{A + B}$$

where S_{MS} – similarity coefficient of compared communities; A – the number of species in one community; B – the number of species in the other community; C – the number of species that occur in both communities.

In order to arrive at a more comprehensive and objective interpretation of the relationships between groups, Sørensen's formula was additionally modified by substituting the number of species with the number of specimens (Górny and Grüm, 1981). In this way the total mathematical similarity between two sets was established, taking into account the number of individual elements, which occurred in both sets.

The results of the analysis of groupings were presented graphically in a dendrogram (Spellerberg, 1991). Moreover, the data were ordered by means of the principal component analysis (PCA) (Kovach, 1998) using *MVSP 3.0* software.

Additional material was also collected using sacks, by shaking selected herbaceous plant species and twigs and branches of shrubs and trees, as well as manually, "on sight".

Results

During the three-year study, 84 thrips species were found in the examined area. As many as 71 species were collected, by scooping of which 53 (22786 specimens) represented the suborder *Terebrantia,* while the remaining 18 (2028 specimens) – the suborder *Tubulifera (Table 1).*

Table 1

Results obtained by various collecting methods

Method / No. of	Samples	Specimens	Species	Species collected only with this method
Scoop	714	24814	71	10
Sacks, shaking, Manually – "on sight"	329	2189	75	13
Total	**1043**	**27003**	**84**	**–**

Thrips and the diversity of plant communities

Table 2 presents the percentage of thrips species in the examined types of plant communities.

Individual thrips species were found in the material with varied frequency. Some were very poorly represented in the material collected by scooping *(Fig. 1).* As many as 13 species were reported from all types of plant communities, these included: *Aeolothrips intermedius, Chirothrips manicatus, Limothrips denticornis, Anaphothrips obscurus, Frankliniella intonsa, Odontothrips loti, Thrips atratus, Thrips flavus, Thrips fuscipennis, Thrips major, Thrips physapus, Thrips tabaci* and *Haplothrips aculeatus.* Three species – *Aeolothrips intermedius, Chirothrips manicatus* and *Frankliniella intonsa* – constituted more than 50% of the collected material. Representatives of 8 species – *Limothrips denticornis, Aptinothrips stylifer, Odontothrips loti, Thrips flavus, Thrips fuscipennis, Thrips tabaci, Haplothrips acanthoscelis* and *Haplothrips aculeatus* – accounted for 30% of the material *(Fig. 2).*

The proportion of thrips species in the examined areas differed with the type of plant community. The largest number of species was reported from shrub communities and xerothermic grasses (43 and 40 species, respectively), the fewest in continental mixed coniferous forest (24 species) *(Fig. 3).*

The largest number of specimens was collected in xerothermic grass communities and fresh meadow communities (6052 and 5515 insects, respectively), while the smallest from continental mixed coniferous forest and subcontinental dry-ground forest (1461 and 1880 insects, respectively) *(Fig. 3).*

Table 2

Dominance [%] of the thysanopterous species in chosen plant communities (scoop method; JH – Jaworznickie Hills; I – *Tilio-Carpinetum typicum,* II – *Querco roboris-Pinetum,* III – *Pruno-Crataegetum,* IV – *Trifolio-Agrimonietum,* V – *Koelerio-Festucetum sulcatae,* VI – *Molinietum medioeuropaeum,* VII – *Arrhenatheretum medioeuropaeum*)

Communities / Species	I	II	III	IV	V	VI	VII
Melanthrips fuscus (Sulzer, 1776)	–	–	–	–	0.02	0.05	–
Aeolothrips albicinctus Haliday, 1836	4.26	1.98	1.72	1.36	1.19	–	–
Aeolothrips ericae Bagnall, 1920	–	–	0.06	–	0.02	–	–
Aeolothrips fasciatus (Linnaeus, 1758)	0.11	–	0.03	–	0.03	–	–
Aeolothrips intermedius Bagnall, 1934	15.32	16.70	11.67	17.92	17.25	25.79	18.50
Aeolothrips melaleucus Haliday, 1852	0.43	–	–	–	0.02	–	0.02
Aeolothrips propinquus Bagnall, 1934	–	–	–	–	–	0.10	–
Aeolothrips versicolor Uzel, 1895	0.80	–	0.08	–	–	–	–
Aeolothrips vittatus Haliday, 1836	1.12	–	–	–	–	–	0.07
Dendrothrips ornatus (Jablonowski, 1894)	–	–	0.53	–	–	–	–
Neohydatothrips gracilicornis (Williams, 1916)	–	–	0.11	–	–	–	–
Chirothrips aculeatus Bagnall, 1927	–	–	0.64	0.49	0.58	–	–
Chirothrips ambulans Bagnall, 1932	–	–	0.03	–	–	–	–
Chirothrips hamatus Trybom, 1895	2.18	1.03	–	–	0.31	–	0.16
Chirothrips manicatus Haliday, 1836	8.14	12.39	32.78	35.07	12.43	3.51	3.79
Limothrips cerealium Haliday, 1836	–	–	–	–	0.61	–	–
Limothrips consimilis Priesner, 1926	–	–	0.19	–	0.28	–	–
Limothrips denticornis Haliday, 1836	2.55	1.37	1.47	1.71	7.42	1.98	1.99
Anaphothrips atroapterus Priesner, 1920	0.05	–	0.11	–	0.10	–	–
Anaphothrips euphorbiae (Uzel, 1895)	–	1.23	0.25	2.13	0.63	–	–
Anaphothrips obscurus (Müller, 1776)	2.82	5.54	3.97	1.82	2.05	1.09	1.54

Table 2 (cont.)

Communities Species	I	II	III	IV	V	VI	VII
Aptinothrips elegans Priesner, 1924	–	–	3.30	1.80	0.38	–	–
Aptinothrips rufus Haliday, 1836	0.27	0.07	–	–	0.02	–	0.38
Aptinothrips stylifer Trybom, 1894	0.16	–	1.00	1.05	11.24	–	–
Belothrips acuminatus Haliday, 1836	–	–	0.06	–	–	–	–
Oxythrips ajugae Uzel, 1895	–	0.68	–	–	–	–	–
Oxythrips bicolor O. M. Reuter, 1879	–	1.85	–	–	–	–	–
Rubiothrips ferrugineus (Uzel, 1895)	–	–	–	0.02	0.02	0.10	0.24
Rubiothrips silvarum (Priesner, 1920)	0.43	–	0.75	0.19	–	–	–
Rubiothrips validus (Karny, 1910)	–	–	–	–	0.03	–	–
Baliothrips dispar Haliday, 1836	–	–	–	–	–	0.30	0.16
Frankliniella intonsa (Trybom, 1895)	0.16	0.07	0.08	0.21	0.07	–	–
Frankliniella tenuicornis (Uzel, 1895)	–	–	0.28	1.33	1.31	1.49	2.36
Stenothrips graminum Uzel, 1895	12.02	23.07	13.51	14.16	14.54	19.36	25.19
Tenothrips frici (Uzel, 1895)	0.27	–	0.08	–	–	–	–
Mycterothrips salicis (O. M. Reuter, 1879)	–	–	–	0.05	–	–	–
Odontothrips biuncus John, 1921	0.11	–	–	–	–	0.05	0.02
Odontothrips confusus Priesner, 1926	–	–	–	–	–	1.29	0.80
Odontothrips loti (Haliday, 1852)	1.33	1.30	1.77	3.46	10.71	1.93	1.54
Platythrips tunicatus (Haliday, 1852)	0.80	0.27	0.44	0.07	0.20	–	–
Rhaphidothrips longistylosus Uzel, 1895	–	–	0.03	–	–	–	–
Taeniothrips inconsequens (Uzel, 1895)	2.82	2.53	0.11	–	–	–	–
Taeniothrips picipes (Zetterstedt, 1828)	–	–	–	–	–	0.10	–
Theilopedothrips pilosus (Uzel, 1895)	–	–	–	–	–	0.20	–

Table 2 (cont.)

Communities Species	I	II	III	IV	V	VI	VII
Thrips angusticeps Uzel, 1895	0.90	–	0.19	0.12	0.13	–	0.18
Thrips atratus Haliday, 1836	9.10	5.68	5.32	2.27	4.10	7.87	8.87
Thrips conferticornis Priesner, 1922	0.11	–	–	–	0.03	–	0.05
Thrips flavus Schrank, 1776	0.48	–	4.10	2.50	0.93	15.45	5.08
Thrips fuscipennis Haliday, 1836	3.99	–	4.30	3.25	1.01	3.07	11.99
Thrips major Uzel, 1895	0.64	2.46	0.72	0.56	0.61	0.79	1.07
Thrips minutissimus Linnaeus, 1758	11.81	2.12	–	–	–	0.30	0.22
Thrips physapus Linnaeus, 1758	0.43	0.14	0.19	0.05	0.33	0.94	3.03
Thrips tabaci Lindeman, 1889	5.69	10.68	1.58	1.96	2.54	5.94	5.40
Bolothrips bicolor (Heeger, 1852)	–	–	–	–	0.05	–	–
Bolothrips dentipes (O. M. Reuter, 1880)	–	–	–	–	–	0.25	0.05
Bolothrips icarus (Uzel, 1895)	–	–	0.06	0.02	0.08	–	–
Haplothrips acanthoscelis (Karny, 1910)	–	–	6.88	4.39	6.35	–	–
Haplothrips aculeatus (Fabricius, 1803)	3.78	3.08	1.14	1.99	2.30	6.24	7.14
Haplothrips crassicornis (John, 1924)	–	–	0.03	–	–	–	–
Haplothrips distinguendus Uzel, 1895	–	–	0.06	–	–	0.54	–
Haplothrips niger (Osborn, 1883)	–	–	–	–	–	–	0.09
Haplothrips propinquus Bagnall, 1933	–	–	–	–	–	0.10	–
Haplothrips setiger Priesner, 1921	–	–	0.06	–	–	–	–
Haplothrips statices (Haliday, 1936)	–	–	–	–	0.07	–	–
Haplothrips subtilissimus (Haliday, 1852)	6.65	5.00	0.28	0.05	0.03	–	–
Hoplandrothrips bidens (Bagnall, 1910)	0.16	–	–	–	–	–	–
Hoplandrothrips williamsianus Priesner, 1923	–	–	0.03	–	–	–	–

Table 2 (cont.)

Species \ Communities	I	II	III	IV	V	VI	VII
Phlaeothrips coriaceus Haliday, 1836	0.11	0.27	–	–	–	–	–
Cephalothrips monilicornis (O. M. Reuter, 1880)	–	–	–	0.02	–	1.19	0.07
Liothrips setinodis (O. M. Reuter, 1880)	0.05	0.48	–	–	–	–	–
Thorybothrips unicolor (Schille, 1910)	–	–	0.03	–	0.02	–	–

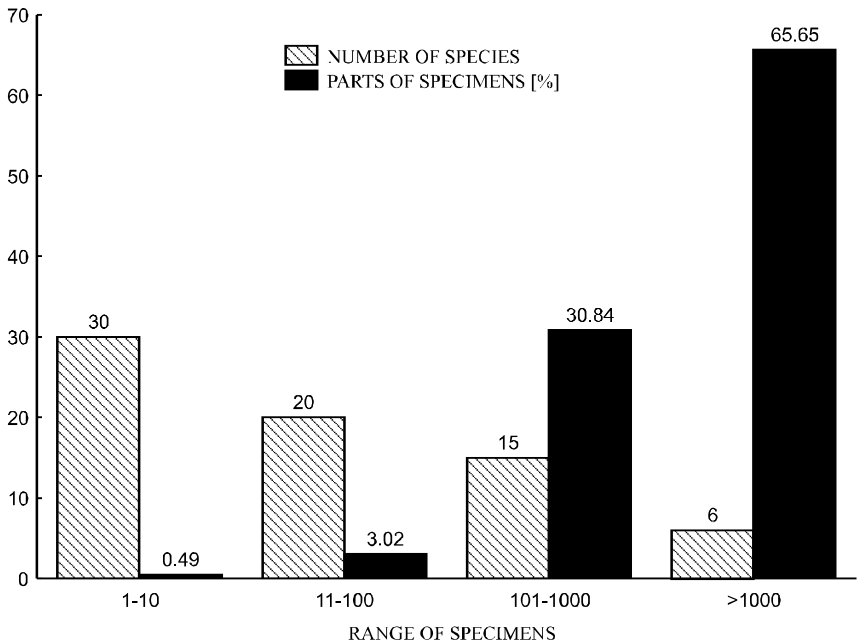

Fig. 1. Species composition and number of specimens

Simpson's species diversity coefficient was found to be the highest in continental dry-ground forest (0.92) and lowest in thermophilous communities in the outskirts of forests (0.82) *(Fig. 4).*

On the basis of Sørensen's similarity coefficient, three groups of thrips were distinguished which inhabit specific types of plant communities. Group A (areas of plant communities I and II) comprises thrips of forest communities; group B (areas of plant communities III, IV and V) includes thrips from the outskirts of forests, shrub communities and xerothermic grasses; and group C (areas of plant communities VI and VII) – thrips found in meadow communities *(Fig. 5).*

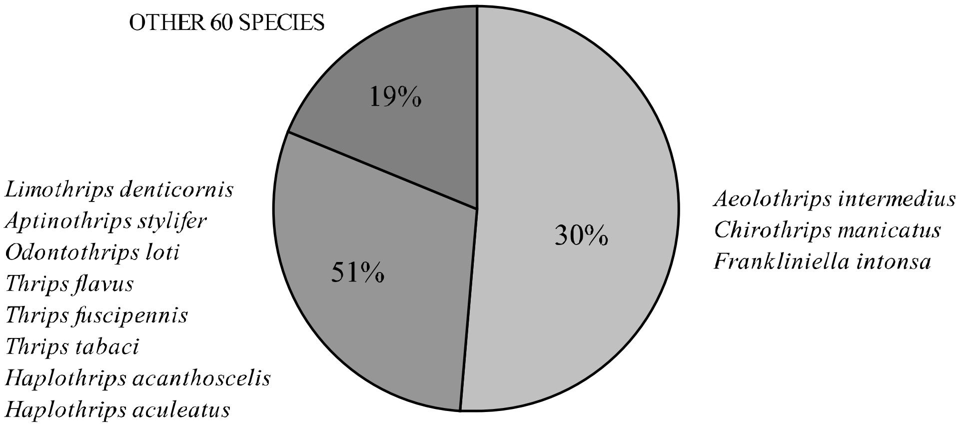

Fig. 2. Domination structure of particular species

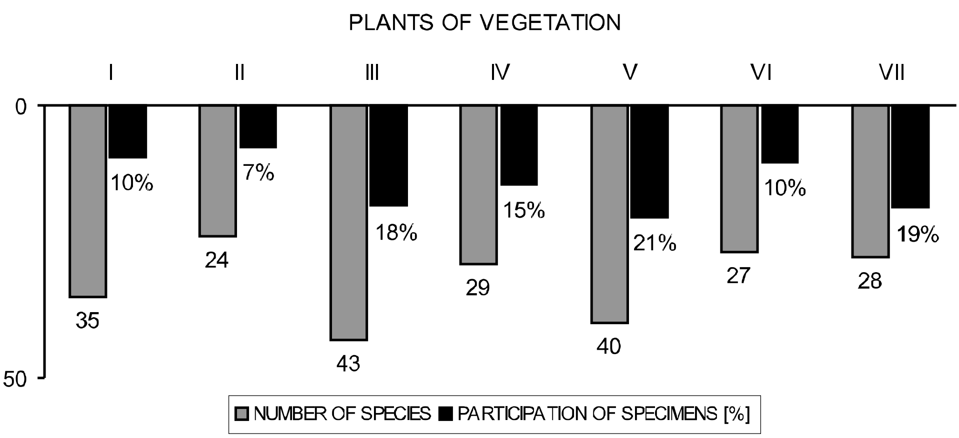

Fig. 3. Number of collected species and percentage of specimens in particular types of plant communities

The principal component analysis (PCA) produced three distinct types of groupings connected with different plant communities and habitats (not shown).

A chorological analysis of the collected species shows that in all groups (A, B, C) the holarctic element (HOL) was prevalent, ranging from 21.7% in group C to 30.3% in group A. The sub-Mediterranean element (SBM), represented by two species *Anaphothrips euphorbiae* and *Aptinothrips elegans,* was found only in forest communities (A) and in xerophilous communities (B), where it ranged from 2.1% to 5.5% *(Fig. 6).*

There were 10 times as many stenotopic species in group A (8.5%) than in group B (0.8%). No such species was found in meadow communities (group C) *(Fig. 7).*

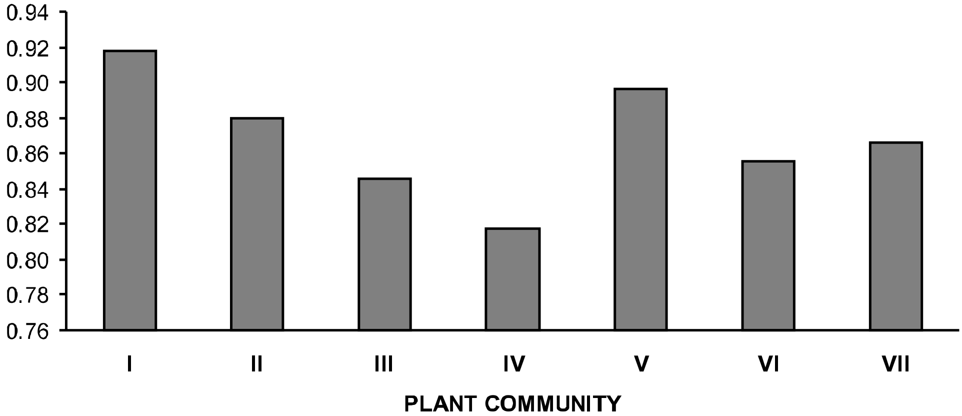

Fig. 4. Simpson's species diversity coefficient

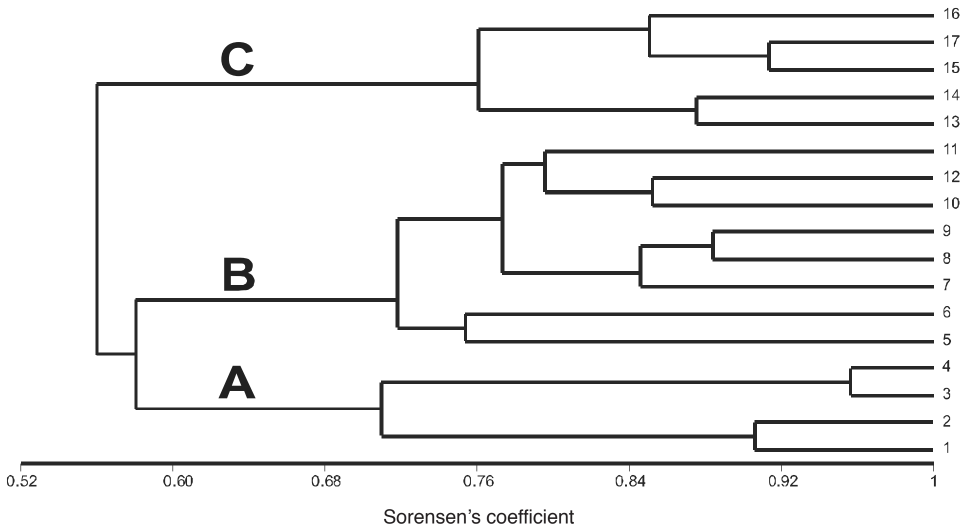

Fig. 5. A dendrogram of the thysanopterous insect communities

An analysis of feeding habits of thrips shows that in all the groups (A, B, C) floricolous species were the most numerous. In group C (meadows) they comprised as much as 60.2% of the thrips fauna. *Gramicolous* species (most numerous in group B, where they constituted 39.1% of the thrips fauna) always dominated folicolous species. Corticolous species, connected with the bark of trees and feeding on fungi, were found only in group A (forests, 5.8% of the fauna) and in group B (with shrubs), where they comprised only 0.8% of the thrips fauna, which is 6 times less than in group A. No such species was found in meadow communities (C) *(Fig. 8).*

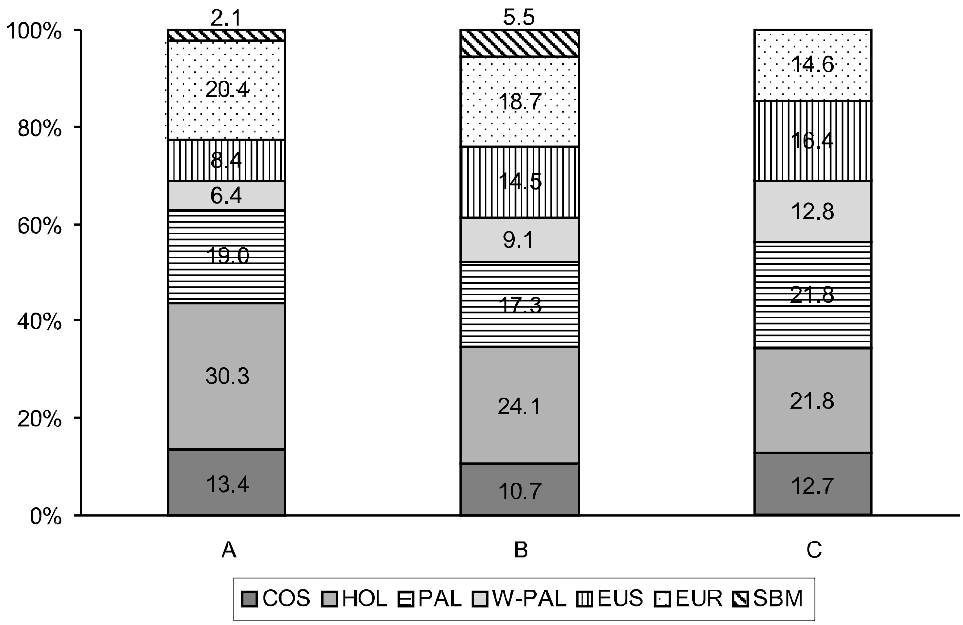

Fig. 6. Chorological elements in the examined plant communities

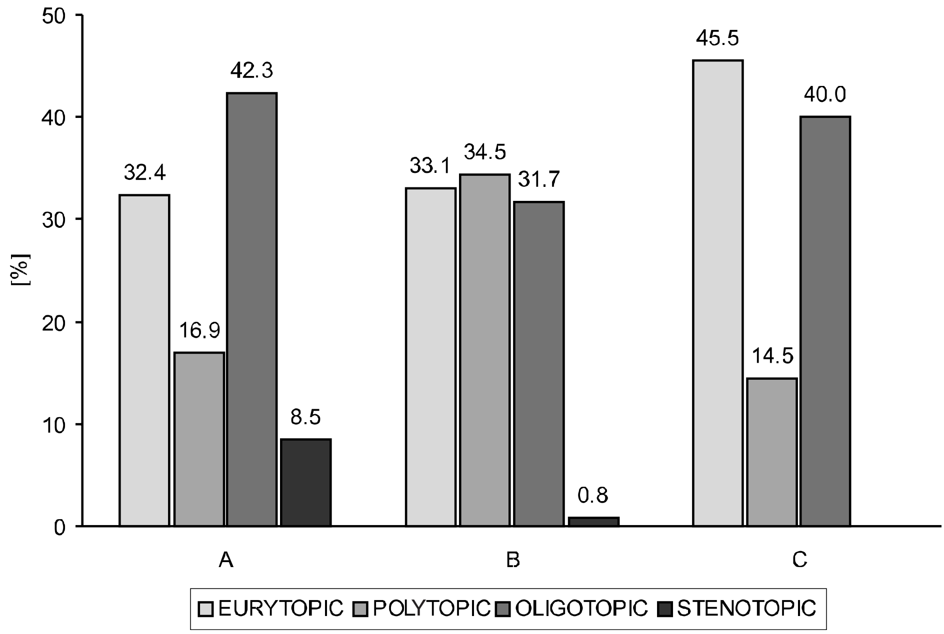

Fig. 7. Ecological elements in the examined plant communities

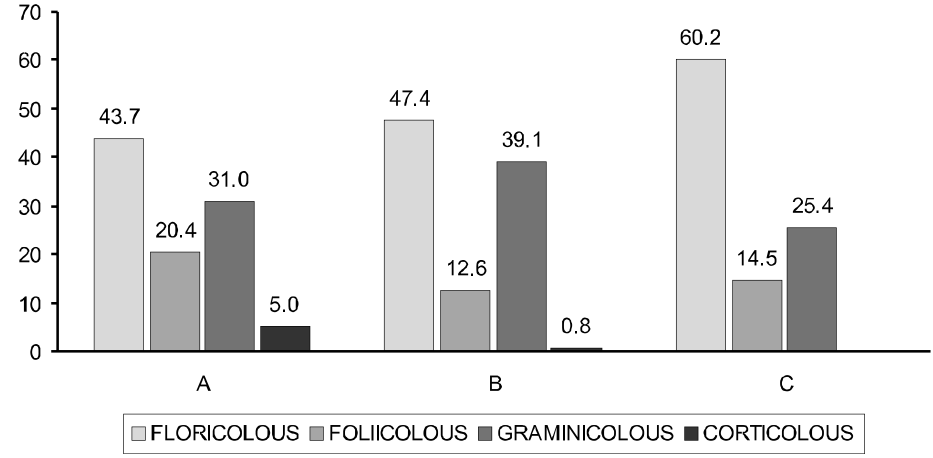

Fig. 8. Ecological elements (feeding area) in the examined plant communities

The highest percentage of species connected with trees was reported from group A (forests) and B (26.8% and 11.4% respectively); however, in group C such species were also present (9.0%). In group C ubiquitous species (56.4%) were the largest group of thrips, although in the other groups they were also well represented (B – 43.0% and A – 40.9%) *(Fig. 9)*.

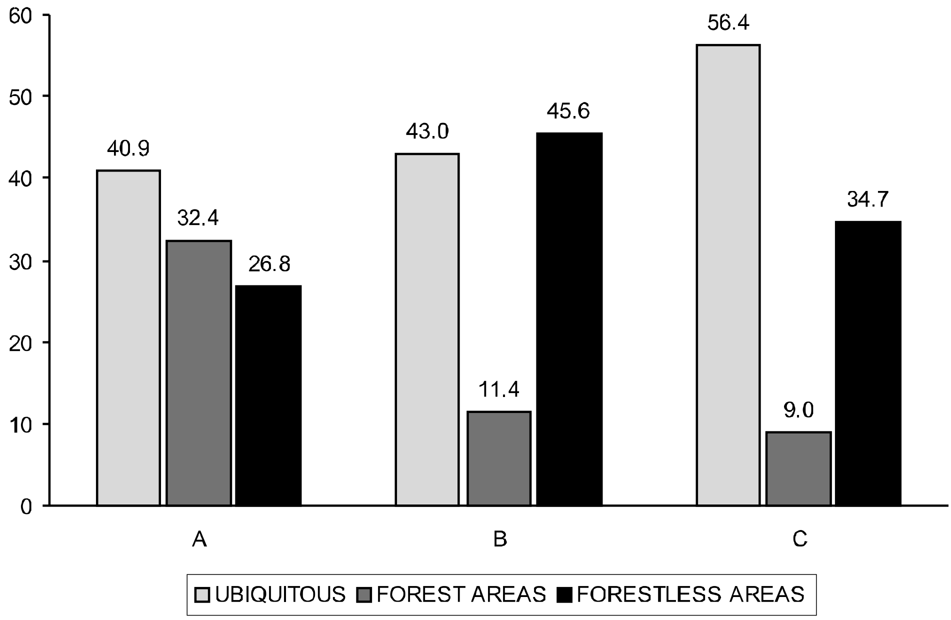

Fig. 9. Ecological elements (occurrence) in the examined plant communities

Most species in all the groups were polyphagous, although in meadow communities the percentage of monophagous species was higher than in groups A and B (9.1%) *(Fig. 10).*

Mesohygrophilous species were predominant in all the groups, ranging from 84.5% in group A to 68.7% in group C. Xerophilous species were relatively frequent in group B (25.8%), while mesohygrophilous species dominated in meadow communities (9.5% in group C) *(Fig. 11).*

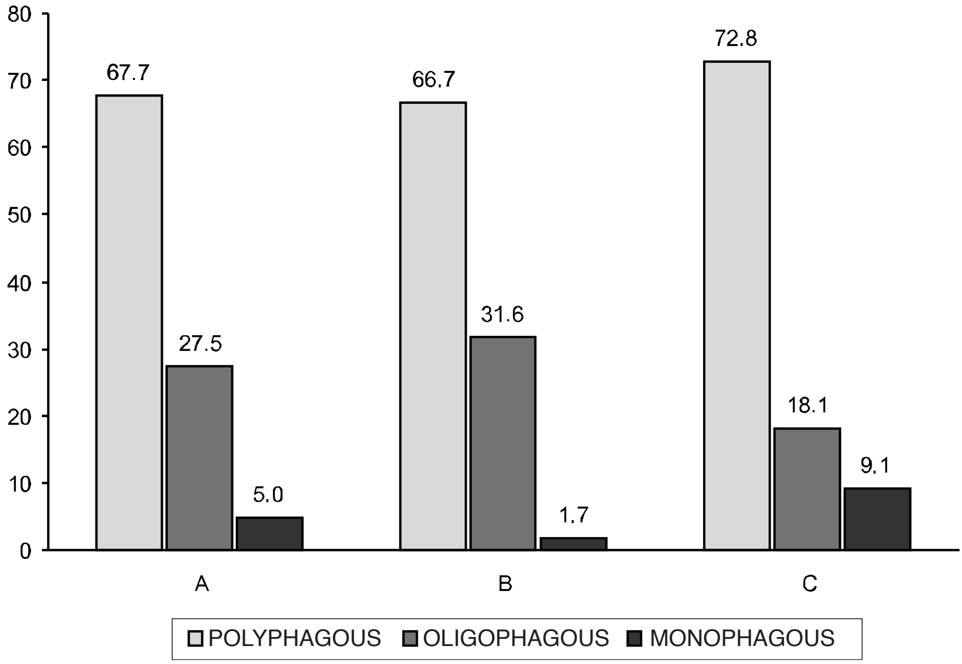

Fig. 10. Ecological elements (feeding preferences) in the examined plant communities

Thrips and the flora of the examined area

Additional material (2189 specimens) was collected from 117 plant species using sacks and by shaking branches of shrubs and trees. In this way 75 thrips species were found, 13 of which were absent from scoop samples (e.g. thrips connected with arborescent plants and with very specific feeding habits): *Dendrothrips degeeri* Uzel, 1895; *Dendrothrips saltatrix* Uzel, 1895; *Frankliniella pallida* (Uzel, 1895); *Iridothrips iridis* (Watson, 1924); *Pezothrips dianthi* (Priesner, 1921); *Ceratothripoides frontalis* (Uzel, 1895); *Thrips hukkineni* Priesner, 1937; *Thrips sambuci* Heeger, 1854; *Thrips validus* Uzel, 1895; *Cryptothrips nigripes* (O. M. Reuter, 1880); *Haplothrips arenarius* Priesner, 1920; *Haplothrips dianthinu* Priesner, 1924; and *Phlaeothrips bispinoides* Bagnall, 1926.

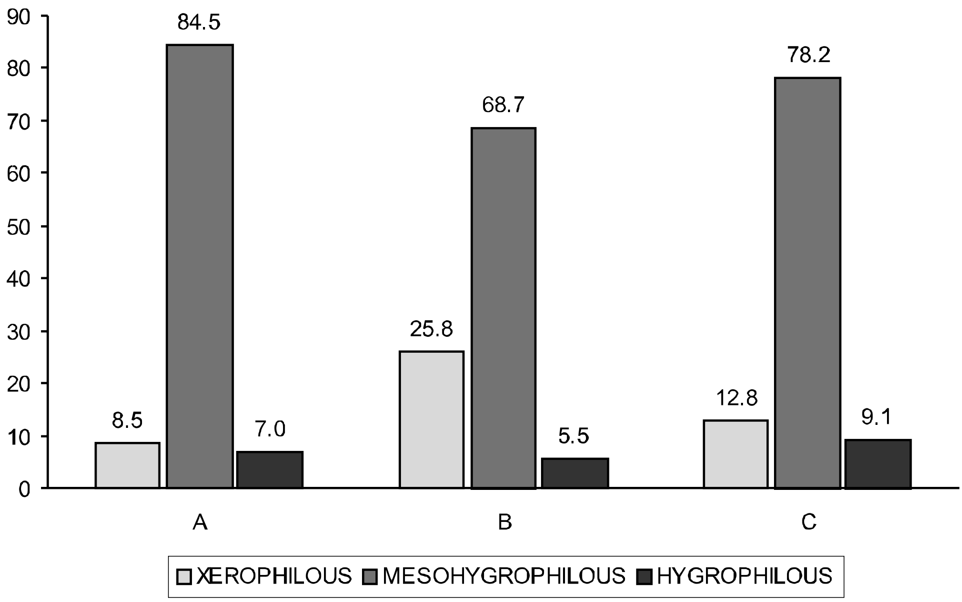

Fig. 11. Ecological elements (site preferences) in the examined plant communities

An analysis of the relationship between thrips species and their host plants in the studied area shows that *Galium mollugo* was the plant most frequently inhabited by the insects, with *Achillea millefolium* and *Cirsium arvense* immediately following *(Table 3).*

The floricolous species *Frankiniella intonsa* proved highly polyphagous – it was reported from more than 80 plant species. Many thrips were found on only one plant species, e.g. *Iridothrips iridis* on *Iris pseudoacorus* and *Pezothrips dianthi* on *Dianthus carthusianorum (Table 4).*

The plants most often inhabited by thrips were species of the families *Poaceae, Asteraceae* and *Fabaceae (Fig. 12).*

Discussion

The study conducted in the area of the Jaworznickie Hills shows that the local *Thysanoptera* fauna is relatively rich (almost 40% of the thrips fauna of Poland; Zawirska, 1988). The most complex species composition of *Thysanoptera* was found in shrub communities (43 species), where apart from *Rhamno-Prunetea* species there were also many plant species typical of neighbouring areas (forest, meadow and xerothermic communities), which was then reflected in the species composition of the thrips fauna of the community (Sierka and Sierka, 2003).

Table 3

Number of thrips species on a particular host plant

Host-plant species	No. of thrips species	Host-plant species	No. of thrips species
Anemone nemorosa	1	*Galium aparine*	2
Caltha palustris	4	*Galium mollugo*	13
Fagus sylvatica	3	*Galium verum*	8
Betula pendula	2	*Sambucus nigra*	3
Carpinus betulus	4	*Knautia arvensis*	7
Dianthus carthusianorum	4	*Scabiosa ochroleuca*	1
Melandrium album	9	*Calystegia sepium*	7
Saponaria officinalis	6	*Convolvulus arvensis*	7
Silene vulgaris	5	*Echium vulgare*	9
Hypericum perforatum	5	*Symphytum officinale*	9
Arabidopsis thaliana	3	*Euphrasia rostkoviana*	2
Berteroa incana	6	*Linaria vulgaris*	10
Cardamine pratensis	4	*Melampyrum arvense*	5
Erysimum cheiranthoides	5	*Plantago lanceolata*	7
Raphanus raphanistrum	9	*Ajuga reptans*	2
Rorippa sylvestris	5	*Betonica officinalis*	6
Sinapis arvensis	3	*Galeobdolon luteum*	5
Euphorbia cyparissias	3	*Glechoma hederacea*	2
Calluna vulgaris	6	*Lamium album*	4
Lysimachia vulgaris	1	*Lamium purpureum*	6
Prunus spinosa	10	*Prunella vulgaris*	5
Rosa canina	10	*Stachys palustris*	6
Sedum acre	6	*Thymus pulegioides*	8
Anthyllis vulneraria	6	*Thymus serpyllum*	6
Chamaecytisus ratisbonensis	4	*Campanula patula*	2
Coronilla varia	8	*Campanula rotundifolia*	5
Lathyrus pratensis	2	*Jasione montana*	5
Lembrotropis nigricans	4	*Anthemis arvensis*	6
Lotus corniculatus	5	*Achillea millefolium*	11
Lupinus polyphyllus	4	*Centaurea cyanus*	1
Medicago falcata	10	*Centaurea jacea*	5
Medicago sativa	7	*Cirsium arvense*	11
Melilotus alba	7	*Cirsium rivulare*	7
Melilotus officinalis	7	*Eupatorium cannabinum*	5
Ononis arvensis	7	*Hieracium murorum*	4
Robinia pseudoacacia	6	*Hypochoeris radicata*	10
Trifolium medium	3	*Inula britannica*	2
Trifolium pratense	6	*Leontodon hispinus*	7
Trifolium repens	3	*Senecio fuchsii*	5
Vicia villosa	8	*Solidago virgaurea*	6
Hippophaë rhamnoides	3	*Sonchus arvensis*	11
Lythrum salicaria	6	*Sonchus oleraceus*	9
Chamaenerion angustifolium	6	*Taraxacum officinale*	5
Oenothera biennis	3	*Tragopogon pratensis*	3
Fraxinus excelsior	2	*Tussilago farfara*	3
Ligustrum vulgare	5	*Iris pseudoacurus*	1

Table 3 (cont.)

Host-plant species	No. of thrips species	Host-plant species	No. of thrips species
Luzula campestris	4	*Festuca rubra*	11
Carex hirta	2	*Holcus lanatus*	9
Carex ericetorum	2	*Holcus mollis*	7
Carex nigra	2	*Molinia coerulea*	4
Agrostis capillaris	4	*Phleum pratense*	6
Arrhenatherum elatius	3	*Poa pratensis*	3
Brachypodium pinnatum	3	*Poa nemoralis*	3
Bromus hordeaceus	5	*Alopecurus pratensis*	7
Bromus erectus	11	*Avenula pubescens*	6
Corynephorus canescens	2	*Calamagrostis epigeios*	8
Deschampsia caespitosa	5	*Dactylis glomerata*	5
Deschampsia flexuosa	7	*Phragmites australis*	8
Festuca gigantea	3		

The species composition and proportion of thrips in the studied area are not typical of stable phytocenoses, since they are associated with plant communities to a considerable extent transformed by antropopressure (Cabała, 1990). Changes in phytocenoses result in a distortion of the related zoocenoses, which may be reflected in decreased number of species, especially those rather rare, and the emergence of one or two dominant species, which prevail in the structure of the group (Trojan, 1992). In the studied area three dominant species were found: *Chirothrips manicatu*s (associated with grasses), *Aeolothrips intermedius* (predacious) and *Frankliniella intonsa* (floricolous).

The value of Simpson's species diversity coefficient is influenced by common species, which occur in dense groupings. The coefficient was highest in dry-ground forests (0.92), which might be attributed to the relatively few common species found in the area and the presence of specialized forms.

The largest number of representatives of various species was found in xerothermic grass communities (21%), where there was a large variety of plant cover and therefore abundance of food.

According to Oettingen (1942), the presence and number of thrips in a given area depend mainly on the type of soil, then on humidity and temperature and, finally, on the presence of a suitable host plant. Physical properties of soil influence humidity conditions, while temperature has a strong impact on physiological composition of sap, on which thrips feed. These factors determine whether a species appears in a particular plant community. If one of the factors is inadequate, the species does not appear.

Sęczkowska (1957) observes that ecological factors (temperature, humidity and soil conditions) may influence the composition of thysanopterous fauna to a considerable extent. However, assuming that these factors are adequate, if there is no suitable host plant, that is if there is no food supply, not only will the number of insects not grow, but there will be no species which develop, breed and feed on this particular plant, except polyphagous, ubiquitous and predacious species.

Table 4

Number of plant species inhabited by a particular thysanopterous species

Thysanoptera species	No. of plant species	*Thysanoptera* species	No. of plant species
Aeolothrips albicinctus	6	*Haplothrips subtilissimus*	2
Aeolothrips ericae	1	*Hoplandrothrips bidens*	1
Aeolothrips fasciatus	2	*Iridothrips iridis*	1
Aeolothrips intermedius	71	*Limothrips cerealium*	7
Aeolothrips melaleucus	2	*Limothrips denticornis*	5
Aeolothrips propinquus	1	*Neohydatothrips gracilicornis*	2
Aeolothrips versicolor	2	*Odontothrips biuncus*	1
Aeolothrips vittatus	1	*Odontothrips confusus*	1
Anaphothrips atroapterus	3	*Odontothrips loti*	7
Anaphothrips euphorbiae	1	*Oxythrips ajugae*	1
Anaphothrips obscurus	7	*Oxythrips bicolor*	1
Aptinothrips elegans	7	*Pezothrips dianthi*	1
Aptinothrips rufus	9	*Phlaeothrips bispinoides*	1
Aptinothrips stylifer	13	*Platythrips tunicatus*	1
Baliothrips dispar	4	*Rubiothrips silvarum*	1
Baliothrips graminum	5	*Rubiothrips validus*	1
Belothrips acuminatus	4	*Taeniothrips inconsequens*	3
Bolothrips bicolor	2	*Taeniothrips picipes*	1
Bolothrips dentipes	1	*Tenothrips frici*	11
Bolothrips icarus	2	*Thrips angusticeps*	13
Cephalothrips monilicornis	4	*Thrips atratus*	31
Ceratothripoides frontalis	2	*Thrips flavus*	38
Chirothrips aculeatus	5	*Thrips fuscipennis*	71
Chirothrips ambulans	2	*Thrips hukkineni*	3
Chirothrips hamatus	3	*Thrips major*	15
Chirothrips manicatus	28	*Thrips minutissimus*	1
Cryptothrips nigripes	1	*Thrips physapus*	12
Dendrothrips degeeri	2	*Thrips sambuci*	1
Dendrothrips ornatus	1	*Thrips tabaci*	43
Dendrothrips saltatrix	2	*Thrips validus*	1
Frankliniella intonsa	81	*Frankliniella pallida*	3
Frankliniella tenuicornis	2	*Haplandrothrips williamsian*	1
Haplothrips acanthoscelis	6	*Haplothrips aculeatus*	36
Haplothrips arenarius	2	*Haplothrips crassicornis*	2
Haplothrips dianthinus	1	*Haplothrips distinguendus*	1
Haplothrips niger	1	*Haplothrips propinquus*	2
Haplothrips setiger	8	*Haplothrips statices*	2

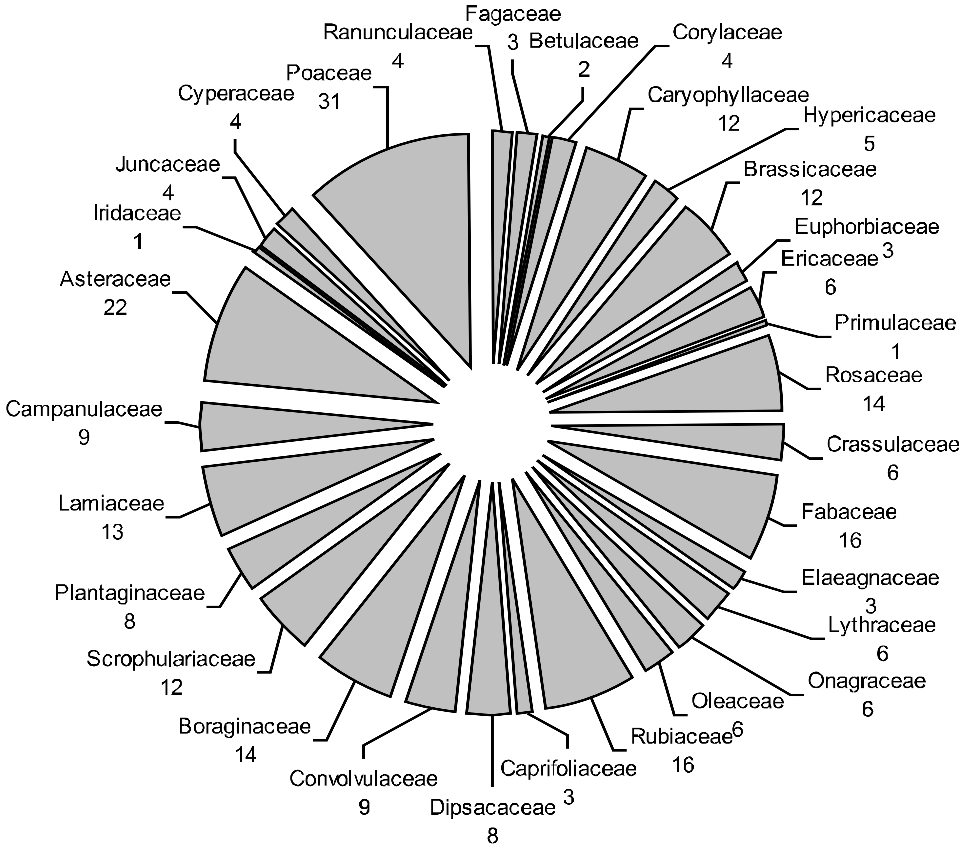

Fig. 12. Number of thrips species on a particular plant family

Undoubtedly, the number of thrips species, in a particular area, depends to a larger extent on the diversity of the plant community while the number of representatives of a species is determined by the weather conditions and other organisms present in the area (Lewis, 1973).

The mathematically calculated pattern of relations presented in the dendrogram and in the PCA graph (not shown) – three groups of thrips (A, B, C) associated with specific plant communities – is reflected in the ecological analysis. This pertains in particular to group A (forests), where there was a considerable proportion of stenotopic species associated with bark and feeding on fungi (e.g. *Hoplandrothrips bidens* and *Phlaeothrips coriaceus*).

Thus, it appears that the type of plant community is the main factor influencing the formation of thrips groupings in the area of the Jaworznickie Hills; however, the development of the plant community depends on many biotic and abiotic factors.

All thysanopterous species, like other animal taxa, have specific ecological, morphological and physiological properties, which enable them to inhabit certain habitats and areas. Moreover, species probably spread to biotopes, which are most similar to their optimum habitats (Lewis, 1973).

The relatively large proportion of the European element in the collected material (up to 20.4% in group A) can be attributed to the geographical position of the studied area (Central Europe). Species representing the sub-Mediterranean (SBM) element (*Anaphothrips euphorbiae* and *Aptinothrips elegans*) were found only in forest communities (A) and xerophilous communities (B), and their percentage was relatively low.

The character of the studied area and examined phytocenoses determined the large proportion of oligotopic species found in the material. Local plant cover has been transformed by anthropopressure; these man-induced changes have impoverished plant communities and are conducive to expansive plant species, which make phytocenoses more uniform.

Almost all known thrips are overground insects. Most species live and feed on live higher plants (Lewis, 1973), which is why so many species found in the area of the Jaworznickie Hills represent floricolous and graminicolous insects. Although trunks and fungi in the examined area provide suitable habitats for the development of many species, the collecting methods used in the present study have shown only small numbers of such insects.

A large part of the examined material comprised species connected with open areas, which is probably related with the proportion of forest surface in the studied area. In forest communities species typical of forest areas were more frequently collected, e.g. *Phlaeothrips bispinoides* and *Hoplandrothrips williamsianus.*

Although most species in the three groups of thrips were mesohygrophilous, xerothermic species were reported more frequently from xerophilous communities (B), where they constituted 25.8% of the thysanopterous fauna. In group C (including damp meadows) there were more hygrophilous species than in the other groups (9.1%), e.g. *Baliothrips dispar.*

Single flowers and inflorescences, which provide suitable habitats for some thysanopterous species, draw insects – a phenomenon observed also on the analyzed plant species, e.g. *Galium mollugo* and *Achillea millefolium.* These plants were home to more than 10 species of thrips.

The study of species composition of thysanopterous fauna of various plant communities in Poland and similarities between insect groups connected with these communities is still under way. Detailed quantitative analyses of *Thysanoptera* contribute to our knowledge of long-term processes and spatial and temporal interactions within thrips fauna. To make such comparisons more reliable, further research on thrips is needed both in other regions of Poland and in Europe.

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