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# THE INFLUENCE OF DIFFERENTIATED NATURAL AND AGROTECHNICAL ECOLOGICAL CONDITIONS ON THE NUMBER OF SPECIES IN SEGETAL COMMUNITIES AND THEIR MEAN NUMBER IN THE PHYTOSOCIOLOGICAL RELEVÉ

# WPŁYW ZRÓŻNICOWANYCH NATURALNYCH I AGROTECHNICZNYCH WARUNKÓW EKOLOGICZNYCH NA LICZBĘ GATUNKÓW W ZBIOROWISKACH SEGETALNYCH ORAZ ICH ŚREDNIĄ LICZBĘ W ZDJĘCIU FITOSOCJOLOGICZNYM

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**Streszczenie.** O zróżnicowaniu florystycznym zbiorowisk segetalnych i liczbie gatunków w zbiorowiskach segetalnych oraz ich liczbie w zdjęciu fitosocjologicznym decyduje wiele naturalnych czynników przyrodniczych oraz agrotechnicznych. Istotnym naturalnym czynnikiem są warunki glebowe. Wraz ze wzrostem troficzności gleby i jej uwilgotnienia liczba gatunków się zwiększa. W wariancie typowym *Arnoserido-Scleranthetum* i *Papaveretum argemones* liczba gatunków jest najmniejsza – waha się od 37 do 62. Znacznie więcej (od 56 do 79) jest ich w wariancie z *Juncus bufonius* obu zespołów na glebach okresowo nadmiernie uwilgotnionych. Również średnia ich liczba w zdjęciu fitosocjologicznym kształtuje się podobnie. W wariancie typowym obu zespołów średnia wartość waha się od 16 do 25. Na glebach żyźniejszych o odczynie zasadowym, wytworzonych z glin i utworów pyłowych, liczba taksonów w *Aphano-Matricarietum* i *Lathyro-Melandrietum* jest znacznie większa – waha się od 76 do 89. W wariancie typowym *Aphano-Matricarietum* jest ich trochę mniej, w porównaniu z wariantem z *Mentha arvensis*. Liczba gatunków w wariancie typowym kształtuje się odpowiednio w zakresie od 77 do 84, a wariancie z *Mentha arvensis* – od 86 do 87. Podobne zależności występują w przypadku średniej liczby gatunków w zdjęciu. Płaty zbiorowisk *Aphano-Matricarietum* są bogate florystycznie. Średnia liczba gatunków w zdjęciu jest znaczna – wynosi w przypadku wariantu typowego 27, a zdecydowanie większa jest w przypadku płatów wariantu z *Mentha arvensis* – waha się od 33 do 36. Zbliżone relacje między glebą a liczbą gatunków w zbiorowisku i ich średnią w zdjęciach fitosocjologicznych występują także w obrębie agrofitocenoz upraw okopowych. Najuboższe florystycznie jest *Digitarietum ischaemi*, znacznie bogatsze *Echinochloo-Setarietum*, a najbogatsze są fitocenozy *Galinsogo-Setarietum*, *Lamio-Veronicetum politae* i *Oxalido-Chenopodietum polyspermi*. O liczbie gatunków decyduje także rzeźba terenu. Zbiorowiska występujące w obniżeniu charakteryzują się większą liczbą gatunków i średnią ich liczbą w zdjęciu niż zbiorowiska zasiedlające zbocza i wierzchowiny. Na liczbę gatunków w zbiorowisku istotny wpływ wywiera działalność agrotechniczna. Zbiorowiska segetalne w uprawach ekologicznych są znacznie bogatsze florystycznie (liczba gatunków waha się od 32 do 58), w porównaniu z uprawami intensywnymi konwencjonalnymi, w których jest ich znacznie mniej – od 13 do 24. Podobne są relacje w przypadku średniej liczby gatunków w zdjęciu. Istotnym czynnikiem agrotechnicznym, decydującym o liczbie gatunków, jest nawożenie mineralne, organiczne oraz wapnowanie. Gnojowica ogranicza liczbę gatunków w zbiorowiskach; więcej występuje ich na poletkach wapnowanych i nawożonych obornikiem.

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**Key words:** cultivated plants, ecological farming, intensive agriculture, liming, mean number species in relevé, mineral and organic fertilization, number of species, segetal communities, soil units.

**Słowa kluczowe:** jednostki glebowe, liczba gatunków, mineralne i organiczne nawożenie, rolnictwo ekologiczne, rolnictwo intensywne, rośliny uprawne, średnia liczba gatunków w zdjęciu, wapnowanie, zbiorowiska segetalne.

## INTRODUCTION

As the measure of community abundance, the number of species is taken, and the number of vital forms, forms of growth, taxonomic groups, and also the strategy of species life are taken as the measure of its diversity. The full characteristic of abundance and diversity of plant cover should embrace the analysis of flora and vegetation as well as intrapopulation and interpopulation genetic variability (Falińska 2004). A reliable indicator of floristic abundance of communities occurring on surfaces of multifarious biotops is also a mean number of species in phytosociological relevés

The kind of communities, including segetal ones and their composition, conditions a series of natural and agrotechnical ecological factors related to the activity of a human being. One of the most important natural factors responsible for the species abundance of the community is soil, its type and subtype and mainly its granulometric composition, soil pH, moisture content and fertility shaped by the content of humus and nutrients (Borowiec et al. 1974, 1975, 1980; Borowiec and Kutyna 1980, 1981; Kutyna 1988, 1999; Anioł-Kwiatkowska 1990; Hołdyński 1991; Sobisz 1997; Skrzyczyńska and Marciniuk 2002). Thienemann (1939) states that the number of species in water habitats on the land depends on their abundance of biogenes. This theory can be transposed to land habitats, also including the area of biotops of segetal communities. The more fertile the soils, the more species occur in segetal communities within their area. A significant natural factor responsible for the number of species is also the relief of the terrain and its elements: depression, slope (exposure and inclination) and slope top of postglacial elevations (Kutyna and Niedźwiecki 1996, Kutyna 1997) and river valleys (Wójcik 2001). An important anthropogenic factor, shaping species abundance, is the economic system (ecological and intensive conventional agriculture). Intensive agrotechnique limits the number of species in the community (Kutyna et al. 2007; Kutyna and Leśnik 2000). A very important anthropogenic factor responsible for floristic abundance of communities and for the number of species is the fallowing of arable lands. Definitely more species can be found in communities in fallow fields as compared to agrophytocenoses in the area of plants cultivation. Lack of competition between segetal species and field plants for space, nutrients, light and water increases the number of species in multi-year fallow fields (Kutyna et al. 2006). A significant factor shaping the number of species in segetal communities is also agrotechnical treatment (mineral fertilization, application of manure and slurry, soil liming) and the kind of field plant (Borowiec et al. 1981, 1985, 1986a, b; Borowiec and Kutyna 1988).

## MATERIAL AND METHODS

To prepare the present study a series of works were used: Borowiec and Kutyna (1985, 1988), Borowiec et al. (1985, 1986a, b), Kutyna (1988, 1994, 1997, 1999), Kutyna and Leśnik (2000), Kutyna et al. (2006, 2007), Kutyna and Niedźwiecki (1996). They were the source of the information concerning the number of species in segetal communities and the mean numbers of species in phytosociological relevés in the analysed agrophytocenoses. In the discussion the analytical phytosociologocal tables were used, included in the works by: Warcholińska (1978, 1982), Pawlak (1981), Szmeja (1989), Anioł-Kwiatkowska (1990), Hołdyński (1991), Trzcińska-Tacik (1996), Sobisz (1997), Wójcik (2001), Skrzyczyńska and Marciniuk (2002), Anioł-Kwiatkowska and Nowak (2006), Towpasz and Barabasz-Krasny (2006), Trąba and Ziemińska-Smyk (2006) and Ziemińska-Smyk (2006). In the definite majority of works by the mentioned authors two of the discussed parameters are lacking, hence the number of species in the distinguished communities were determined and the mean number of taxa in the relevé was calculated on the basis of their presence in individual phytosociological relevés.

## RESULTS AND DISCUSSION

On the basis of the chosen publications the influence of soil on the number of species in the communities and their mean number in the phytosociological relevé was determined. The least number (37 taxa) is characteristic of the typical variant of *Arnoserido-Scleranthetum* association, the phytocenoses of which settle on total dry and warm sands - loose sand and slightly loamy sand of acid and strongly acid reaction in the western part of Gorzów Valley and its adjacent areas (Kutyna 1988) – Table 1. The mean number of the species in the phytociological relevé is also small (16 taxa) and indicates that these are floristically poor communities. Whereas phytocenoses of the variant from *Juncus bufonius* association occur on more fertile soils, temporarily excessively moist – 9 Dz pgl·pl and 9 M ps·pl – they are richer, their structure is made up of 56 species (Table 1). It is also confirmed by the mean number of species in the phytosociological relevé which is 22 (Table 1). The factor responsible for the larger number of species in vegetation patches of the variant from *Juncus bufonius* as compared to the typical variant, is not the granulometric composition, which is approximate, but its differentiated moisture content (Kutyna 1988). Larger moisture content of the soil substrate as well as its kind and type (muck-mineral soils and degraded black earths) are conducive to the development of hygrophilous species. Siciński (2003) confirms our observations, indicating that the typical variant of this community is characterized by a smaller number of species and richer is the variant which additionally is characterized by a contribution of taxa, mainly hygrophilous ones. Pawlak (1979) also found a small number of species (22), she noticed on average 14 taxa in the relevé in the discussed community. Warcholińska (1978) registered 46 taxa and a small mean number of species – 14 in phytocenoses of the typical variant of this association (Table 2).

Table 1. The number of species and mean number of species in relevé in segetal communities of cereals and root crops in differentiated soil conditions
Tabela 1. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach segetalnych zbóż i upraw okopowych na tle zróżnicowanych warunków glebowych

| Communities in cereal crops<br>Zbiorowiska w uprawach zbóż | Number of relevès<br>Liczba zdjęć fitosocjologicznych | Dominant soil units<br>Dominujące jednostki glebowe | Number of species in plant communities<br>Liczba gatunków w zbiorowiskach | Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu |
|---|---|---|---|---|
| *Arnoserido-Scleranthetum* | | | | |
| variant type – wariant typowy | 16 | 7 Bw pl, 7 Bw ps•pl | 37 | 16 |
| variant with – wariant z *Juncus bufonius* | 10 | 6 M ps•pl, 9 M(Dz) ps•pl | 56 | 22 |
| *Papaveretum argemones sperguletosum* | | | | |
| variant type – wariant typowy | 20 | 6 Bw ps:pl, 5 Bw pgl•ps | 62 | 25 |
| variant with – wariant z *Juncus bufonius* | 11 | 9 Dz pgl•ps, 6 M ps•pl | 79 | 34 |
| *Papaveretum argemones typicum* | | | | |
| variant type – wariant typowy | 20 | 5 Bw pgl:ps, 5 Bw pgl:gl | 71 | 24 |
| variant with – wariant z *Juncus bufonius* | 11 | 9 Dz (F) pgl•ps | 77 | 33 |
| *Aphano-Matricarietum sperguletosum* | | | | |
| variant type – wariant typowy | 21 | 4 Bw (A) pgl•gl, 5 Bw pgl:gl | 84 | 27 |
| variant with – wariant z *Mentha arvensis* | 15 | 9 Dz (F) pgl:gl | 87 | 33 |
| variant with – wariant z *Vicia tetrasperma* | 11 | 2(4) Bw płz:płi, 2 Bw gl | 76 | 27 |
| *Aphano-Matricarietum typicum* | | | | |
| variant type – wariant typowy | 13 | 4 Bw pgm:gl, 2 B gl | 77 | 27 |
| variant with – wariant z *Mentha arvensis* | 15 | 8 D(F) glp, 2 B glp•gl | 86 | 36 |
| variant with – wariant z *Vicia tetrasperma* | 10 | 2 B glp•gl | 73 | 28 |
| *Aphano-Matricarietum consolidetosum* | 15 | 3 B glp•gl, 2 B gl, 3 B gl•gś | 89 | 32 |
| *Lathyro-Melandrietum* | 20 | 3 B płi, 3 B glp•gl, 2 B płz•płi | 86 | 33 |
| Communities in root crops<br>Zbiorowiska w uprawach okopowych | | | | |
| *Digitarietum ischaemi* | 20 | 7 Bw pl, 7 Bw ps•pl | 38 | 14 |
| *Echinochloo-Setarietum sperguletosum* | | | | |
| variant with – wariant z *Digitaria ischaemum* | 16 | 6 Bw ps:pl, 5 Bw pgl•ps | 53 | 18 |
| variant type – wariant typowy | 20 | 5 Bw pgl:gl, 4 Bw płz:płi, 4 A pgl•gl | 81 | 24 |
| variant with – wariant z *Mentha arvensis* | 10 | 9 Dz pgl•ps, 6 M ps•pl | 80 | 32 |
| *Echinochloo-Setarietum typicum* | | | | |
| variant type – wariant typowy | 11 | 5 Bw pgl:ps | 75 | 25 |
| variant with – wariant z *Mentha arvensis* | 15 | 9 Dz (F) pgl•ps | 78 | 30 |
| *Galinsogo-Setarietum* | 13 | 6 M ps•pl, 9 Dz pgl•ps, 5 F pgl•pl | 85 | 30 |
| *Lamio-Veronicetum politae* | | | | |
| variant with – wariant z *Matricaria maritima* subsp. *inodora* | 20 | 2(3) B gl | 96 | 32 |
| variant type – wariant typowy | 11 | 2 B płz•płi, 3 B płi | 83 | 31 |
| variant with – wariant z *Lathyrus tuberosus* | 16 | 3 B płi, 2 B płz•płi, 3 B glp | 72 | 31 |
| *Oxalido-Chenopodietum polyspermi typicum* | 18 | 8 F(D) glp•gl | 86 | 35 |
| *Oxalido-Chenopodietum polyspermi setarietosum viridis* | 12 | 9 M•pl, 9 F pgl•pl | 81 | 33 |

Explanations of soil units – Objaśnienia jednostek glebowych: soil agricultural complexes – kompleksy glebowo-rolnicze: 2 – good wheat complex – pszenny dobry, 3 – defective wheat complex – pszenny wadliwy, 4 – very good rye complex – żytni bardzo dobry, 5 – good rye complex – żytni dobry, 6 – weak rye complex – żytni słaby, 7 – very weak rye complex – żytni bardzo słaby, 8 – cereal-fodder strong complex (mainly for wheat) – zbożowo--pastewny mocny, 9 – cereal-fodder weag complex (mainly for rye) – zbożowo-pastewny słaby. Types and sub-types of soil – Typy i podtypy gleb: Bw – leached and acid brown soils – gleby brunatne wyługowane i kwaśne, B – proper brown soils – gleby brunatne właściwe, D – proper meadow black earths – czarne ziemie właściwe, Dz – degraded meadow black earths – czarne ziemie zdegradowane, F – alluvial soils – mady, M – muck-mineral soils – gleby murszowo-mineralne. Soil species – Gatunki gleb: pl – loose sand – piasek luźny, ps – slightly loamy sand – piasek słabogliniasty, pgl – light loamy sand – piasek gliniasty lekki, pgm – heavy loamy sand – piasek gliniasty mocny, gl – light loam – glina lekka, glp – silty light loam – glina lekka pylasta, gś – medium loam – glina średnia, płz – common silt – pył zwykły, płi – clayey silt – pył ilasty, • – subsoil lies shallow (up-to 50 cm) – podłoże zalegające płytko (do 50 cm), **:** – subsoil lies medium deeply (50–100 cm) – podłoże zalegające na średniej głębokości (50–100 cm).

Source – Źródło: Kutyna (1988).

Table 2. The number of species and mean number of species in relevé in community *Arnoserido-Scleranthetum* by various authors
Tabela 2. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Arnoserido-Scleranthetum,* według różnych autorów

| Associations, subassociations, variants<br>Zespoły, podzespoły, warianty | Balcerkiewicz and i Pawlak (1979) | | | Warcholińska (1978) | | | Warcholińska (1982) | | | Anioł-Kwiatkowska (1990) | | | Sobisz (1997) | | | Ziemińska-Smyk (2006) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. |
| *Arnoserido-Scleranthetum* | | | | | | | | | | | | | | | | | | |
| variant type – wariant typowy | 3 | 22 | 14 | 15 | 46 | 14 | 5 | 34 | 19 | | | | 12 | 41 | 14 | 9 | 29 | 15 |
| variant with – wariant z *Mentha arvensis* | | | | | | | 5 | 44 | 28 | | | | | | | | | |
| *Arnoserido-Scleranthetum typicum*<br>Hills – Wzgórza Dalkowskie | | | | | | | | | | 13 | 37 | 9 | | | | | | |
| *Arnoserido-Scleranthetum teesdaleetosum*<br>Hills – Wzgórza Ostrzeszowskie | | | | | | | | | | 20 | 49 | 12 | | | | | | |
| *Arnoserido-Scleranthetum myosotetosum* | | | | | | | | | | | | | | | | | | |
| variant type – wariant typowy | | | | | | | | | | | | | 7 | 39 | 15 | | | |
| variant with – wariant z *Mentha arvensis* | | | | | | | | | | | | | 13 | 57 | 20 | | | |

Explanations – Objaśnienia: n.r. – number of relevés – liczba zdjęć fitosocjologicznych, n.s. – number of species in community – liczba gatunków w zbiorowisku, m.n. – mean number of species in relevé – średnia liczba gatunków w zdjęciu fitosocjologicznym.

In another work, including areas adjacent to Skierniewice she confirmed that this community is also floristically poor (Warcholińska 1982). The typical variant is characterized by the presence of 34 species, and their mean number in the relevé amounts to 19. The moist variant from *Mentha arvensis* is floristically richer (44 taxa) and the number of species in individual relevés is larger, on average it amounts to 28. In the protection zone of The Roztocze National Park Ziemińska-Smyk (2006) registered 29 species in phytocenoses of the association and on average their number amounts to 15. According to Anioł-Kwiatkowska (1990) *Arnoserido-Scleranthetum* association belongs to the poorest floristically in the area of Trzebnicki Hills in Silesian Lowlands. In 13 patches of *A.-S. typicum* subassociation 37 taxa are found and the mean number of the species in the relevé amounts only to 9 (Dalkowskie Hills, Silesian Lowlands). Patches of *A.-S. teesdaleetosum* subassociation in the area of Ostrzeszowskie Hills (Silesian Lowlands) are slightly richer. The structure of the subassociation is made up of 49 taxa, and the mean number of the species in the relevé is 12 (Table 2). Sobisz (1997) also noted floristic poverty in agrophytocenoses in Krajeńskie Lakeland in West Pomerania. He registered 41 taxa in *Arnoserido-Scleranthetum typicum* in the typical variant, and their mean number amounts to 14. He also recorded approximate parameters in *A.-S. myosotetosum* phytocenoses, in which 39 species occur in the typical variant, and the mean number of taxa equals 15. Their number is slightly larger in the variant from *Mentha arvensis* – 57 and 20, respectively (Table 2).

Significantly richer floristically is *Papaveretum argemones* association. On total sands and on loamy sands lying on loam, they occur in larger amounts in comparison with *Arnoserido-Scleranthetum* community. These soils are settled by phytocenoses of the sub-associations – *Papaveretum argemones sperguletosum* and *P. a*. *typicum*. The number of species in the variant from *Juncus bufonius* in both subassociations is larger as compared with the typical variant. Within the range of both syntaxa in the typical variant – 62 and 71 species were registered, respectively, and slightly more in the variant from *Juncus bufonius* – 79 and 77 (Table 1). Their mean number in the relevé amounts to 25 and 24 (typical variant) and is much larger – 34 and 33 taxa in the variant from *Juncus bufonius* (Table 1). A significant influence on such a result has the moisture content of the soil, conducive to the development of hygrophilous species. Similar relations were observed within *Arnoserido-Scleranthetum* syntaxon. Within the range of both subassociations differences can also be observed in the number of species resulting from a different reaction of soils. A smaller number of taxa was registered in *P. a. sperguletosum* subassociation (62 taxa) as compared with *P. a*. *typicum* (71 species) – Table 1. Phytocenoses of the first community settle mainly on soils of strongly acid and acid reaction, patches of the other occur on soils of neutral reaction. In this case it should be assumed that the factor responsible for the differentiated number of species in the vegetation patches is the reaction. On soils of acid or very acid reaction their number is smaller, and in these phytocenoses, acidophilous species dominate, and the development of others is considerably limited by acidity.

Skrzyczyńska and Marciniuk (2002) registered 58 species in *Papaveretum argemones*. Their number in the relevés varies from19 to 28, and on average it amounts to 23. An approximate number of species in this syntaxon was also observed by Anioł-Kwiatkowska and Nowak (2006) in the area of "Mount Saint Anne" Landscape Park in Opole Silesia (Table 3).

Table 3. The number of species and mean number of species in relevé in community *Papaveretum argemones* by various authors
Tabela 3. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Papaveretum argemones,* według różnych autorów

| Source – Źródło | Number of relevés Liczba zdjęć | Number of species in community Liczba gatunków w zbiorowisku | Mean number of species in relevé Średnia liczba gatunków w zdjęciu |
|---|---|---|---|
| Warcholińska (1978) | 20 | 63 | 20 |
| Warcholińska (1982) | 5 | 36 | 22 |
| Skrzyczyńska and – i Marciniuk (2002) | 10 | 58 | 23 |
| Anioł-Kwiatkowska and – i Nowak (2006) | 6 | 55 | 22 |
| Kutyna and – i Leśnik (2006) | 10 | 45 | 26 |
| Towpasz and – i Barabasz-Krasny (2006) | 7 | 71 | 21 |
| Ziemińska-Smyk (2006) | 10 | 40 | 23 |

The mean number (22 species) in the relevé is approximate to the values determined by Kutyna (1988) and Skrzyczyńska and Marciniuk (2002). The approximate values of the discussed parameters were also registered by Kutyna and Leśnik (2006). In *Papaveretum argemones* phytocenoses settled on furrows of new forest cultivation, the structure of the association is made up of 45 taxa, and their mean number is 26 (Table 3). Towpasz and Barabasz-Krasny (2006) observed slightly richer floristcally *Papaveretum argemones* phytocenoses in the area of the Czarnorzecko-Strzyżowski Landscape Park (the Subcarpathia). They registered 71 taxa in them, similarly to the results obtained by Kutyna (1988), and their mean number in the relevé is smaller and amounts to 21 (Table 3). In the community distinguished in the vicinity of Sulejów (Central Poland) by Warcholińska (1978) there are a little more species – 63, and their mean number in the relevé amounts to 20. In the area adjacent to Skierniewice (Central Poland) Warcholińska (1982) observed a small number of taxa (36) in *Papaveretum argemones* community, and the mean number of species in the relevé is 22 (Table 3). In the protection zone of The Roztocze National Park (Lublin Upland) Ziemińska-Smyk (2006) determined approximate values of indices for the parameters observed by Warcholińska (1982). In these phytocenoses 40 species are found, and their mean number amounts to 23 taxa in the relevé (Table 3). Szmeja (1989) distinguished 3 *Papaveretum argemones* subassociations in the area Elbląg Elevations (Gdańsk Seashore). She registered most species in *Papaveretum argemones consolidetosum* (94 taxa), their mean number in the relevé is large and amounts to 33, slightly less – 88 in *P.a. typicum* (on average – 27 species), and in *P.a. gageetosum* the number of species is the smallest – 68, and their mean number in the relevé is 28 (Table 4).

Table 4. The number of species and mean number of species in relevé in subassociations *Papaveretum argemones* by various authors
Tabela 4. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w podzespołach *Papaveretum argemones*, według różnych autorów

| Associations, subassociations, variants<br>Zespoły, podzespoły, warianty | Anioł-Kwiatkowska (1990) | | | Sobisz (1997) | | | Szmeja (1989) | | |
|---|---|---|---|---|---|---|---|---|---|
| | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. |
| *Papaveretum argemones scleranthetosum* | | | | | | | | | |
| Hills – Wzgórza Ostrzeszowskie | 20 | 50 | 12 | | | | | | |
| Hills – Wzgórza Dalkowskie | 25 | 100 | 19 | | | | | | |
| variant type – wariant typowy | | | | 24 | 86 | 20 | 24 | 86 | 20 |
| *Papaveretum argemones typicum* | | | | | | | 17 | 88 | 27 |
| Hills – Wzgórza Dalkowskie | 18 | 77 | 15 | | | | | | |
| Hills – Wzgórza Ostrzeszowskie | 11 | 32 | 11 | | | | | | |
| variant type – wariant typowy | | | | 13 | 57 | 21 | | | |
| variant with – wariant z *Mentha arvensis* | | | | 8 | 65 | 27 | | | |
| *Papaveretum argemones consolidetosum* | | | | | | | 13 | 94 | 33 |
| *Papaveretum argemones gageetosum* | | | | | | | 12 | 68 | 28 |

Explanations as in Table 2 − Objaśnienia zob. tab. 2.

Very differentiated numbers of species in the community were observed by Anioł--Kwiatkowska (1990) in *Papaveretum argemones* subassociations in the area of Trzebnicki Hills. The number of species in phytocenoses *P.a. scleranthetosum* varies from the smallest (50 taxa) in the area of Ostrzeszowskie Hills to the largest (100) in the area of Dalkowskie Hills. Their mean number is also differentiated and it amounts to 12 – Ostrzeszowskie Hills and 19 Dalkowskie Hills (Table 4). Phytocenoses *P.a. typicum* are slightly poorer floristically as compared to the previous subassociation (Table 4). The smallest number of species was registered by Anioł-Kwiatkowska (1990) in the area of Ostrzeszowskie Hills (32 taxa), and the largest (77 species) on the surfaces of Dalkowskie Hills. The mean number of species was also smaller on the patches of this subassociation. It varied from 15 (Dalkowskie Hills.) to 11 (Ostrzeszowskie Hills) (Table 4). Sobisz (1997) registered a differentiated number of species in phytocenoses of *Papaveretum argemones*. Much richer are the patches of the typical variant of *P.a. scleranthetosum* (86 taxa) as compared to *P.a. typicum* community (57 in the typical variant and 65 from *Mentha arvensis*). The mean number of species in the relevé is the largest (27 taxa) in the moist variant of the community. Comparing the data obtained by the mentioned authors it should be mentioned that the richest floristically are phytocenoses of this association in the area of Elbląg Elevations (Szmeja 1989) – Table 4 and they are approximate to the parameters shown by Kutyna (1988) – Table 1.

*Aphano-Matricarietum* phytocenoses are characterized by a larger number of species as compared with the two earlier discussed communities. A significantly larger number of species was recorded in *Aphano-Matricarietum* subassociations. Most of them occur in the variant from *Mentha arvensis* in the area of *Aphano-Matricarietum sperguletosum* and *A.-M. typicum* subassociations, 87 and 86 taxa, respectively (Table 1). Also *A.-M. consolidetosum* subassociation is characterized by considerable floristic richness. Its structure is made up of 89 species. Their number on vegetation patches of the typical variant is not much smaller – 77 and 84. Phytocenoses of all *Aphano-Matricarietum* subassociations and *Lathyro-Melandrietum*

association occur on fertile soils formed from clays and silty soils (2Bw gl, 2B gl, 3B płi and 3B glp·gl). On the basis of the presented data it should be stated that the kind of soil and its properties (particularly its moisture content and reaction) and also its definitely better fertility resulting from abundance in nutrients as compared with the soils from previous communities, are responsible for the structure and floristic composition of the communities and for the number of taxa. Large value of the mean number of species in the phytosociological relevé prove the significant floristic richness of the phytocenoses of this association. The most numerous are patches of the variant from *Mentha arvensis*, and also *A.-M. consolidetosum* and *Lathyro-Melandrietum* phytocenoses. The mean number of taxa in the relevé is large and it varies from 32 to 36 (Table 1).

What is more, very approximate parameters are characteristic of *Aphano-Matricarietum* phytocenoses found in winter cereals and root crops in the area of Elbląg Elevations. In patches of *A.-M. scleranthetosum* Szmeja (1989) registered 87 species in growing of cereals and 95 in root crops. Their mean number in the relevé is also very large – 35 in growing of cereals and 36 in root crops. Approximate parameters are also characteristic of *A.-M. typicum* phytocenoses (Table 5).

Table 5. The number of species and mean number of species in relevé in community *Aphano-Matricarietum* by various authors
Tabela 5. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Aphano-Matricarietum,* według różnych autorów

| Associations, subassociations, variants<br>Zespoły, podzespoły, warianty | Anioł-Kwiatkowska (1990) | | | Sobisz (1997) | | | Szmeja (1989) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | | n.r. | n.s. | m.n. |
| *Aphano-Matricarietum sperguletosum* | | | | | | | | | | |
| variant type – wariant typowy | | | | 16 | 76 | 23 | | | | |
| variant with – wariant z *Mentha arvensis* | | | | 14 | 74 | 25 | | | | |
| *Aphano-Matricarietum scleranthetosum* | 10 | 77 | 21 | | | | a | 10 | 87 | 35 |
| | | | | | | | b | 10 | 95 | 36 |
| *Aphano-Matricarietum typicum* | | | | | | | a | 10 | 97 | 34 |
| | | | | | | | b | 10 | 77 | 31 |
| variant type – wariant typowy | 13 | 68 | 18 | 14 | 57 | 20 | | | | |
| variant with – wariant z *Mentha arvensis* | | | | 10 | 66 | 24 | | | | |
| *Aphano-Matricarietum delphinietosum* | | | | | | | | | | |
| variant type – wariant typowy | | | | 7 | 62 | 27 | | | | |
| variant with – wariant z *Mentha arvensis* | | | | 5 | 65 | 32 | | | | |
| *Aphano-Matricarietum lathyretosum* | 15 | 87 | 21 | | | | | | | |
| *Lathyro-Melandrietum* | 17 | 83 | 16 | | | | | | | |

a – cereal crops – uprawy zbóż, b – root crops – uprawy okopowe. Other explanations as in Table 2 − Pozostałe objaśnienia zob. tab. 2.

These results are to a considerable extent the same as those obtained by Kutyna (1988) – Table 1. Balcerkiewicz and Pawlak (1977) also observed significant floristic richness within the range of *Matricario-Alchemilletum* phytocenoses (synonym *Aphano-Matricarietum*) in rape growing in Szczecin Pomerania. Patches of the association are characterized by the presence of 82 taxa, their mean number in the phytosociological relevé being lower (26 species) as compared with the aforementioned phytocenoses (Table 6).

Table 6. The number of species and mean number of species in relevé in communities *Aphano--Matricarietum* (A) and *Lathyro-Melandrietum* (B) by various authors
Tabela 6. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach *Aphano-Matricarietum* (A) i *Lathyro-Melandrietum* (B), według różnych autorów

| Source – Źródło | | Number of relevés Liczba zdjęć | Number of species in community Liczba gatunków w zbiorowisku | Mean number of species in relevé Średnia liczba gatunków w zdjęciu |
|---|---|---|---|---|
| Pawlak (1979) | A | 18 | 82 | 26 |
| Pawlak (1981) | | 28 | 96 | 25 |
| | | 53 | 116 | 21 |
| Balcerkiewicz and – i Pawlak (1977) | | 45 | 82 | 26 |
| Towpasz and – i Barabasz-Krasny (2006) | B | 5 | 76 | 37 |

Identical parameters are characteristic of the phytocenoses distinguished by Pawlak (1979) in Lubuskie Lakeland in the vicinity of Lubniewice. She also registered approximate values in her phytosociological study in the area of the village of Kłodzino (Pawlak 1981). Phytocenoses of the association are floristically rich. She observed in them the presence of 96 and 116 taxa, whereas their mean number in the relevés is slightly smaller – 21 and 25 species (Table 6). The discussed parameters are shaped differently on the edges of fields in the northern part of Krajeńskie Lakeland (Sobisz 1997). *A.-M. sperguletosum* phytocenoses are characterized by a distinctly larger number of species as compared to *A.-M. typicum*. In patches of A.-*M. sperguletosum* Sobisz (1997) recorded 74 to 76 taxa, and their mean number varies from 23 to 25 (Table 5). These values are smaller in *A.-M. typicum* and *A.-M. delphinietosum* (Table 5). Anioł-Kwiatkowska (1990) observed differentiated floristic abundance of the association in the area of Trzebnicki Hills. The largest number of species – 68 and their mean number in the relevé – 18, are characteristic of *A.-M. typicum* phytocenoses. She registered slightly larger parameters – 77 and 21, respectively, in *A.-M. scleranthetosum*. Out of the distinguished by her communities, the richest are patches of *A.-M lathyretosum* phytocenoses (87 taxa), but individual relevés are not abundant in species, which is reflected in their mean number amounting to only 21 (Table 5). Floristically rich are also *Lathyro-Melandrietum* phytocenoses in the area of Dalkowskie Hills. Anioł- Kwiatkowska (1990) registered in them 83 taxa (Table 5), and Towpasz and Barabasz-Krasny (2006) observed 76. Vegetation patches in Trzebnicki Hills include, on average, 21 taxa in the relevé, whereas phytocenoses in the area of Czarnorzecko-Strzyżowski Landscape Park are very rich (on average 37 species) – Table 6.

Similar relations between the soil and the number of species in the community and their mean number in the phytosociological relevé occur within the area of agrophytocenoses of root crops. *Digitarietum ischaemi*. phytocenoses belong to the poorest floristically. Their structure consists of 38 taxa, and the mean number of species in the relevé is also

small – 14 (Table 1). In the area of Twardogórskie and Dalkowskie Hills, Anioł-Kwiatkowska (1990) observed a slightly larger number of species, 45 and 53, respectively, in agrophytocenoses of root crops, and the mean number of species is also a bit larger – 16 and 19 taxa (Table 7). Similar results are presented by Balcerkiewicz and Pawlak (1990) – Table 7.

Table 7. The number of species and average number of species in relevé in communities *Digitarietum ischaemi* and *Echinochloo-Setarietum* by various authors
Tabela 7. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach *Digitarietum ischaemi* i *Echinochloo-Setarietum,* według różnych autorów

| Associations, subassociations Zespoły, podzespoły | | Anioł-Kwiatkowska (1990) | | | Balcerkiewicz and – i Pawlak (1990) | | | Trąba and – i Ziemińska-Smyk (2006) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. |
| *Digitarietum ischaemi* | | | | | 20 | 60 | 12 | | | |
| Hills Wzgórza | Dalkowskie | 7 | 53 | 19 | | | | | | |
| | Twardogórskie | 7 | 45 | 16 | | | | | | |
| *Echinochloo-Setarietum typicum* | | | | | | | | 38 | 102 | 27 |
| Hills Wzgórza | Żarskie | 20 | 92 | 17 | | | | | | |
| | Trzebnickie | 11 | 92 | 23 | | | | | | |
| | Twardogórskie | 16 | 79 | 17 | | | | | | |
| | Dalkowskie | 20 | 75 | 16 | | | | | | |
| | Ostrzeszowskie | 21 | 74 | 18 | | | | | | |
| Lowering – Obniżenie Ścinawskie | | 24 | 82 | 19 | | | | | | |
| *Echinochloo-Setarietum digitarietosum* | | | | | | | | 15 | 65 | 13 |
| Hills Wzgórza | Dalkowskie | 13 | 56 | 15 | | | | | | |
| | Ostrzeszowskie | 8 | 62 | 19 | | | | | | |
| *Echinochloo-Setarietum sperguletosum* | | | | | | | | 24 | 66 | 14 |

Explanations as in Table 2 − Objaśnienia zob. tab. 2.

*Echinochloo-Setarietum* communities are much richer floristically (Table 1). *Echinochloo-Setarietum sperguletosum* and *E.-S. typicum* subassociations and phytocenoses of their variants, except for the variant from *Digitaria ischaemum,* are characterized by an approximate number of species ranged between 75 and 81 taxa. The definitely smaller number of species – 53 was registered by Kutyna (1988) in *Digitaria ischaemum* variant of *E.-S. sperguletosum* subassociation. The mean number of taxa in patches of the typical variant of both subassociations is approximate and it varies from 24 to 25. Significantly larger values are characteristic of the patches from *Mentha arvensis*. Their number amounts to 30–32 species (Table 1). A larger number of species in the majority of *Echinochloo-Setarietum* subassociations both in *E.-S. typicum*, *E.-S. sperguletosum* and *E.-S. digitarietosum* were observed by: Anioł-Kwiatkowska (1990), Sobisz (1997), Trzcińska-Tacik (1996), Towpasz and Barabasz-Krasny (2006), Szmeja (1989), Trąba and Ziemińska-Smyk (2006). The number of taxa in the majority of communities exceeded 60, and most frequently this number

varied from 75 to 102 (Tables 7 and 8). Slightly fewer species, from 62 to 65, occur in *E.-S. digitarietosum* sub-association. Phytocenoses of this syntaxon relate, to a significant degree, to the poorest community of *Digitarietum ischaemi*. The mean number of species in the relevé is differentiated. A slightly smaller number of taxa in the relevé is characteristic of patches of *Echinochloo-Setarietum digitarietosum*. From15 to 19 taxa were observed in them. In *E.-S. typicum* they are in a slightly larger number, from16 to 23. Particularly abundant patches of the association were registered by Szmeja (1989) – Table 8.

Table 8. The number of species and mean number of species in relevé in community *Echinochloo--Setarietum* by various authors
Tabela 8. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Echinochloo-Setarietum,* według różnych autorów

| Source – Źródło | Number of relevés Liczba zdjęć | Number of species in community Liczba gatunków w zbiorowisku | Mean number of species in relevé Średnia liczba gatunków w zdjęciu |
|---|---|---|---|
| Towpasz and – i Barabasz--Krasny (2006) | 5 | 60 | 24 |
| Trzcińska-Tacik (1996) | 10 | 82 | 24 |
| Sobisz (1997) | | | |
| variant type – wariant typowy | 7 | 52 | 21 |
| variant with – wariant z *Mentha arvensis* | 17 | 74 | 23 |
| Szmeja (1989) | 14 | 95 | 30 |

The richest floristicaly associations of root crops are: *Galinsogo-Setarietum*, *Lamio--Veronicetum politae* and *Oxalido-Chenopodietum polyspermi*. The number of species in *Galinsogo-Setarietum* is significant – 85 taxa, and their mean number is large and amounts to 30 (Table 1). Approximate values were registered by Sobisz (1997) and Pawlak (1981) – Table 9. A slightly smaller number of taxa (from 52 to 92) is observed in the area of Trzebnicki Hills (Anioł-Kwiatkowska 1990), and their mean number varies from 17 to 22 (Table 9).

The structure of *Lamio-Veronicetum politae* is made up of a very differentiated number of species. Their values in the community vary from 72 to 96, their very large number occurs in individual patches of vegetation (31–32) – Table 1. Significant is also their presence in the community according to the descriptions by Sobisz (1997), Trąba and Ziemińska-Smyk (2006), Szmeja (1989), Hołdyński (1991) and Towpasz and Barabasz-Krasny (2006). The number of species in this syntaxon is, in most cases, larger than in the phytocenoses characterized by Kutyna (1988) – Table 1. Mostly, these numbers exceed 100 taxa and are within the range from 70 to 118. The mean number of species in the relevé is also large – the values vary from 25 to 33 (Table 10). Phytocenoses of these associations occur mainly on very fertile soils of alkaline reaction created from clays and silty soils (2B gl, 3B płi, 3B glp, 2B płz·płi).

Table 9. The number of species and mean number of species in relevé in community *Galinsogo--Setarietum* by various authors
Tabela 9. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Galinsogo-Setarietum,* według różnych autorów

| Associations, variants Zespoły, warianty | | Anioł-Kwiatkowska (1990) | | | Sobisz (1997) | | | Pawlak (1981) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. | n.r. | n.s. | m.n. |
| *Galinsogo-Setarietum* | | | | | | | | 18 | 84 | 24 |
| Hills Wzgórza | Trzebnickie | 13 | 92 | 22 | | | | | | |
| | Dalkowskie | 12 | 63 | 17 | | | | | | |
| | Żarskie | 9 | 56 | 17 | | | | | | |
| variant type – wariant typowy | | | | | 22 | 83 | 22 | | | |
| variant with – wariant z *Mentha arvensis* | | | | | 22 | 93 | 29 | | | |

Explanations as in Table 2 − Objaśnienia zob. tab. 2.

Table 10. The number of species and mean number of species in relevé in community *Lamio--Veronicetum politae* by various authors
Tabela 10. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Lamio--Veronicetum politae,* według różnych autorów

| Source – Źródło | Number of relevés Liczba zdjęć | Number of species in community Liczba gatunków w zbiorowisku | Mean number of species in relevé Średnia liczba gatunków w zdjęciu |
|---|---|---|---|
| Sobisz (1997) | | | |
| variant type – wariant typowy | 25 | 79 | 25 |
| variant with – wariant z *Mentha arvensis* | 19 | 98 | 30 |
| Trąba and – i Ziemińska-Smyk (2006) | 46 | 103 | 28 |
| Towpasz and – i Barabasz-Krasny (2006) | 13 | 104 | 29 |
| Hołdyński (1991) | 12 | 70 | 28 |
| Szmeja (1989) | 23 | 118 | 33 |

Also *Oxalido-Chenopodietum polyspermi*. phytocenoses are formed on very fertile soils situated in river valleys (alluvial soils, black earths and mineral-muck soils), on soils of the structural units: 8F(D) glp·gl and 9M·pl and 9F pgl·pl. They are characterized, like the patches from the previous phytocenon, by significant floristic richness in the root crops. Kutyna (1988) registered in them from 81 to 86 taxa in this community, and in the relevé there are on average from 33 to 35 species (Table 1). Very approximate values are characteristic of phytocenoses of the association in the submontane area in which Wójcik (2001) observed their significant number. It varies from 82 to 95 taxa, whereas slightly smaller is their mean number in the relevé (from 25 to 29) – Table 11, as compared to the results presented by Kutyna (1988) – Table 1. Approximate values of parameters in the association were also observed by Sobisz (1997), Anioł-Kwiatkowska (1990), Trzcińska--Tacik (1996), Towpasz and Barabasz-Krasny (2006) – Table 11.

Table 11. The number of species and maen number of species in relevé in community *Oxalido--Chenopodietum polyspermi* by various authors
Tabela 11. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowisku *Oxalido-Chenopodietum polyspermi,* według różnych autorów

| Source – Źródło | Number of relevés Liczba zdjęć | Number of species in community Liczba gatunków w zbiorowisku | Mean number of species in relevé Średnia liczba gatunków w zdjęciu |
|---|---|---|---|
| Wójcik (2001) | | | |
| Pogórze Wielickie | 22 | 95 | 29 |
| Beskid Sądecki | 13 | 83 | 26 |
| Beskid Wyspowy | 24 | 82 | 25 |
| Sobisz (1997) | 8 | 90 | 38 |
| Anioł-Kwiatkowska (1990) | 8 | 81 | 26 |
| Trzcińska-Tacik (1996) | 10 | 73 | 29 |
| Towpasz and – i Barabasz--Krasny (2006) | 6 | 75 | 38 |

A very significant influence on the number of species in communities has the type of soil, i.e. its genesis. Alluvial soils (valley sands, light alluvial soils) are more fertile than the same soils of post-glacial origin, which is confirmed by the number of species which are more numerous in the communities of rye growing in alluvial soils (Kutyna 1999) – Table 12.

Table 12. The number of species and average number of species in relevé in communities of rye growing on soils of alluvial and post-glacial origin
Tabela 12. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach uprawy żyta na glebach pochodzenia aluwialnego i polodowcowego

| Gleby – Soil genesis | alluvial – aluwialne | | | postglacial – polodowcowe | | |
|---|---|---|---|---|---|---|
| Soil units – Jednostki glebowe | 7 ps·pl | 6 ps:pl | 5 pgl·pl | 7 Bw ps·pl | 6 Bw ps:pl | 5 Bw pgl·pl |
| Number of relevès Liczba zdjęć fitosocjologicznych | 20 | 20 | 20 | 20 | 20 | 20 |
| Number of species of communities Liczba gatunków w zbiorowiskach roślinnych | 58 | 78 | 91 | 51 | 57 | 78 |
| Mean number of species in relevé Średnia liczba gatunków w zdjęciu fitosocjologicznym | 17 | 24 | 26 | 15 | 18 | 23 |

Explanations of soil units as given under Table 1 – Objaśnienia jednostek glebowych pod tab. 1.
Source – Źródło: Kutyna (1999).

An important anthropogenic factor responsible for species abundance in segetal communities is the system of the use of arable lands (ecological and biodynamic farms and conventional intensive farms). In field communities of ecological farms there are definitely more species as compared to the fields of farms of intensive use. In the fields of ecological farms the number of species in individual syntaxa varies: in *Aphano-Matricarietum* association from 33 to 34 (winter wheat) and from 44 to 45 (spring wheat), and in *Veronico--Fumarietum officinalis* association from 32 to 34 (potato) – Table 13.

Table 13. The number of species and mean number of species in relevé in communities of cultivation in fields used in a system of ecological and intensive conventional farming
Tabela 13. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach upraw na polach użytkowanych w systemie rolnictwa ekologicznego i intensywnego konwencjonalnego

| Farming system<br>Systemy użytkowania pól | | Ecological farming<br>Rolnictwo ekologiczne | | | Intensive agriculture<br>Rolnictwo intensywne | | |
|---|---|---|---|---|---|---|---|
| Communities – Zbiorowiska | cultivated plants<br>rośliny uprawne | number of relevès<br>liczba zdjęć fitosocjologicznych | number of species<br>liczba gatunków | mean number of species in relevé<br>średnia liczba gatunków w zdjęciu fitosocjologicznym | number of relevès<br>liczba zdjęć fitosocjologicznych | number of species<br>liczba gatunków | mean number of species in relevé<br>średnia liczba gatunków w zdjęciu fitosocjologicznym |
| Community of aliance – Zbiorowisko związku *Aperion spicae-venti* | | | | | 10 | 13 | 5 |
| *Aphano-Matricarietum sperguletosum* | winter wheat<br>pszenica ozima | 8 | 33 | 19 | – | – | – |
| *Aphano-Matricarietum typicum* | | 7 | 34 | 20 | – | – | – |
| *Aphano-Matricarietum sperguletosum* | spring wheat<br>pszenica jara | 7 | 45 | 19 | | | |
| *Aphano-Matricarietum typicum* | | 8 | 44 | 22 | | | |
| Community of class – Zbiorowisko klasy *Stellarietea mediae* | spring barley<br>jęczmień jary | | | | 10 | 18 | 8 |
| *Veronico-Fumarietum officinalis sperguletosum* | potato plant<br>ziemniaki | 5 | 34 | 22 | | | |
| *Veronico-Fumarietum officinalis typicum* | | 5 | 32 | 22 | | | |
| Community of order – Zbiorowisko rzędu *Polygono-Chenopodietalia* | | | | | 10 | 24 | 13 |
| Organic biodynamic farming in Juchowo – Rolnictwo biologiczno-dynamiczne w Juchowie | spring wheat<br>pszenica jara | | | | | | |
| 2Bw gl•gś | | 12 | 50 | 24 | | | |
| 8D gl•gś | | 10 | 58 | 32 | | | |

Explanations of soil units as given under Table 1 – Objaśnienia jednostek glebowych pod tab. 1.
Source – Źródło: Kutyna and – i Leśnik (2000), Kutyna et al. – i in. (2007).

A large number of species in the fields of ecological farms results from small coverage of field crop (from 47.0 and – 57.3%) and considerable coverage of weeds (from 51.7 – 69.7%). In the fields used intensively used, the mean coverage of field crop varies from 84.0 to 95.5%, and the weed coverage from 5 to 14% (Kutyna et al. 2007). The number of species in the intensive cultivation is not large and it varies from 13 (winter wheat) in an "impoverished" community from *Aperion spicae-venti* alliance to 18 (spring barley) in the community of *Stellarietea mediae* class and 24 (potato) – in the impoverished community of *Polygono-Chenopodietalia* order (Table 13). A large number of species in the community was also

observed within spring wheat crops in a biological-dynamic farm in West Pomerania in Juchów (Kutyna and Leśnik 2000) and in Jesionów (Pyrzyce Lowland) (Kutyna and Leśnik 2007). This analysis shows that it is not the soil (in both systems of using the fields, the soils formed from light loam occur), but agrotechnique that is responsible for the number of species, mainly rates of mineral fertilizing and application of herbicides which drastically limit the development of species in segetal communities .

The results obtained by Kutyna et al. (2007) confirm the results of the studies carried out by many authors, including Stupnicka-Rodzynkiewicz and Hochół (2000) and Skrzyczyńska and Rzymowska (2000). The latter authors registered in ecological crops 68 species in phytocenoses of rye crops and 64 in spring cereals, whereas fewer in the area of conventional farms, 48 and 52, respectively (Table 14).

Table 14. The number of species and mean number of species in relevé in communities of cultivation in fields used in a system of ecological and intensive conventional farming by various authors
Tabela 14. Liczba gatunków i ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach w obrębie upraw w gospodarstwach ekologicznych i intensywnych konwencjonalnych, według różnych autorów

| Ecological farming Rolnictwo ekologiczne | | | | Intensive conventional farming Gospodarstwa konwencjonalne | Cultivated plants Rośliny uprawne | Source – Źródło |
|---|---|---|---|---|---|---|
| n.r. | | 10 | | 12 | rye – żyto | Skrzyczyńska and – i Rzymowska (2000) |
| n.s. | | 68 | | 48 | | |
| m.n. | | 22 | | 16 | | |
| n.r. | | 13 | | 10 | spring cereals zboża jare | |
| n.s. | | 64 | | 52 | | |
| m.n. | | 19 | | 17 | | |
| n.r. | | 12 | | 14 | rye – żyto winter wheat pszenica ozima | Trzcińska-Tacik (2000) |
| n.s. | | 94 | | 72 | | |
| m.n. | | 31 | | 23 | | |
| n.r. | 9 | 9 | 9 | 9 | experiment without cultivated plants eksperyment bez roślin uprawnych | Balcerkiewicz and – i Pawlak (2000) |
| n.s. | 50 | 57 | 62 | 30 | | |
| m.n. | 23 | 35 | 36 | 8 | | |

Explanations as in Table 2 − Objaśnienia zob. tab. 2.

The mean number of species in the phytosociological relevé was also smaller in patches of segetal vegetation within conventional cultivation (Table 14). Larger differences in relation to the discussed parameters were also recorded by Trzcińska-Tacik (2000). Phytocenoses of ecological crops are richer (94 taxa) as compared with conventional farms (72 species). It is also confirmed by their mean number in the phytosociological relevé (Table 14). The largest differences in relation to the discussed indices were observed by Balcerkiewicz and Pawlak (2000). The number of species in communities of ecological cultivation was nearly 100% larger as compared with phytocenoses of conventional cultivation, and the mean number in the relevé was four times larger (Table 14).

A significant anthropogenic factor responsible for species abundance of segetal communities is also periodical or constant abandonment of arable fields, i.e. their fallowing (Kutyna et al. 2006). The number of species in segetal communities and their mean number in the relevé within cultivated fields and in adjacent to them fallows on the same soils, are very differentiated. In communities on multi-year fallows their number is larger than in the cultivated fields, and the difference in the number of taxa is significant and it varies from 38 – 3B gl(pgm) to 81 – 5Bw pgl:gl (Table 15).

Table 15. The number of species and mean number of species in relevé in communities in fields (a) and in multi-year fallows (b) in differentiated soil units
Tabela 15. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach na polach (a) oraz wieloletnich odłogach (b) na tle zróżnicowanych jednostek glebowych

| Soil units – Jednostki glebowe | | 7Bw ps·pl | 6Bw ps:pl | 5Bw pgl:gl | 2B gl(pgm) | 3 Bgl(pgm) | 8 D gl | 9M ps·pl |
|---|---|---|---|---|---|---|---|---|
| Number of relevès<br>Liczba zdjęć fitosocjologicznych | a | 17 | 18 | 21 | 16 | 19 | 15 | 17 |
| | b | 16 | 17 | 20 | 20 | 19 | 16 | 11 |
| Number of species of community<br>Liczba gatunków w zbiorowisku | a | 60 | 66 | 78 | 69 | 104 | 87 | 103 |
| | b | 120 | 114 | 159 | 144 | 142 | 150 | 148 |
| Difference in numbers of species<br>Różnica w liczbie gatunków (b–a) | | 60 | 48 | 81 | 75 | 38 | 63 | 45 |
| Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu fitosocjologicznym | a | 15 | 15 | 21 | 19 | 27 | 28 | 30 |
| | b | 27 | 24 | 29 | 33 | 33 | 35 | 38 |
| Difference in mean numbers of species in relevés<br>Różnica w średniej liczbie gatunków w zdjęciu fitosocjologicznym (b–a) | | 12 | 9 | 8 | 14 | 6 | 7 | 8 |

Explanations of soil units as given under Table 1 – Objaśnienia jednostek glebowych pod tab. 1.
Source – Źródło: Kutyna et al. – i in. (2006).

Also the difference in the mean number of taxa in the phytosociological relevé is similar. It is larger on multi-year fallows and varies from 24 on 6Bw ps:pl to 38 on 9M ps:pl. The factor responsible for the number of species is also the time that passes from the moment of the abandonment of the arable land (Kutyna 1994, 1997). Communities on the three year old fallows within the slope top and the slope compared with one year old ones are characterized by a larger number of species than in the cultivation of spring barley adjacent to the fallows (Table 16). More species also occur independently of time of fallowing on depressions (from 126 to 138) than on the slope top and on the slopes (from 71 to 98) – Table 16. Soils that occur on the depression are characterized by a definitely stronger trophic character and the moisture content (Kutyna i Niedźwiecki 1996). The relief of the terrain significantly affects the number of species.

Table 16. The number of species and maen number of species in relevé in communities in fallows and in cultivation of spring barley in differentiated soil conditions and diverse land relief
Tabela 16. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach na odłogach i w uprawie jęczmienia jarego na tle zróżnicowanych warunków glebowych i rzeźby terenu

| Kind of fallow – Rodzaj odłogu | Source Źródło | One-year fallow Odłóg jednoroczny | | Spring barley Jęczmień jary | |
|---|---|---|---|---|---|
| Elements of land relief Elementy rzeźby terenu | Kutyna and – i Niedźwiecki (1996) | top and slope wierzchowina i zbocze | downslope obniżenie | top and slope wierzchowina i zbocze | downslope obniżenie |
| Soil units – Jednostki glebowe | | 2 B glp | 2 D glp | 2 B glp | 2 D glp |
| Number of relevès Liczba zdjęć fitosocjologicznych | | 30 | 15 | 15 | 12 |
| Number of species of communities Liczba gatunków w zbiorowiskach | | 88 | 93 | 50 | 56 |
| Mean number of species in relevé Średnia liczba gatunków w zdjęciu fitosocjologicznym | | 34 | 37 | 20 | 25 |
| Elements of land relief Elementy rzeźby terenu | Kutyna (1997) | top and slope wierzchowina i zbocze | downslope obniżenie | top and slope wierzchowina i zbocze | downslope obniżenie |
| Soil units – Jednostki glebowe | | 2 B glp•gl | 2 D glp•gl | 2 B glp•gl | 2 D glp•gl |
| Number of relevès Liczba zdjęć fitosocjologicznych | | 30 | 15 | 30 | 15 |
| Number of species of communities Liczba gatunków w zbiorowiskach | | 59 | 61 | 28 | 39 |
| Mean number of species in relevé Średnia liczba gatunków w zdjęciu fitosocjologicznym | | 34 | 37 | 16 | 24 |
| Kind of fallow – Rodzaj odłogu | Kutyna (1997) | one-year fallow odłóg jednoroczny | | three-years fallow odłóg trzyletni | |
| Elements of land relief Elementy rzeźby terenu | | top and slope wierzchowina i zbocze | downslope obniżenie | top and slope wierzchowina i zbocze | downslope obniżenie |
| Soil units – Jednostki glebowe | | 7 Bw pl, 7 Bw ps•pl | 2 B gl | 6 Bw ps:pl | 2 B gl |
| Number of relevès Liczba zdjęć fitosocjologicznych | | 16 | 16 | 18 | 14 |
| Number of species of communities Liczba gatunków w zbiorowiskach | | 71 | 138 | 98 | 126 |
| Mean number of species in relevé Średnia liczba gatunków w zdjęciu fitosocjologicznym | | 21 | 37 | 24 | 30 |

Explanations of soil units as given under Table 1 – Objaśnienia jednostek glebowych pod tab. 1.
Source – Źródło: Kutyna and – i Niedźwiecki (1996); Kutyna (1997).

A very important anthropogenic ecological factor responsible for the abundance of segetal communities is mineral and organic fertilization and soil liming. On the same soils (loamy sands lying on clay) the number of species is differentiated depending on the kind and the rate of fertilization. Only a few results of numerous studies on segetal communities within multi-year fertilizing experiments have been presented (Borowiec et al. 1985). The smallest number of species in the community was observed in rye growing (8 species) in the plot fertilized exclusively with nitrogen (120 kg · $ha^{-1}$). Also in the remaining field crops at the same kind and rate of fertilization the number of species is limited. Multi-year exclusive application of fertilization with nitrogen leads to strong soil acidity, which results in the decreased number of species in the community.

Table 17. The number of species and mean number of species in relevé in communities of different field plants in various fertilising combinations
Tabela 17. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w obrębie zbiorowisk różnych roślin uprawnych na tle kombinacji nawożeniowych

| Treatments – Kombinacje | | | N | NK | NP | NPK | 0 | K | P | PK | Ca | CaK | CaP | CaPK | NCa | NKCa | NPCa | NPKCa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rye – Żyto | F | number of species in relevé<br>liczba gatunków w zdjęciu | 18 | 24 | 22 | 34 | 34 | 32 | 32 | 29 | 40 | 38 | 38 | 37 | 29 | 29 | 31 | 32 |
| Spring barley<br>Jęczmień jary | F | | 10 | 11 | 12 | 12 | 18 | 14 | 12 | 20 | 20 | 22 | 21 | 20 | 19 | 19 | 18 | 20 |
| | F + M | | 11 | 11 | 15 | 11 | 21 | 22 | 24 | 21 | 23 | 20 | 24 | 20 | 17 | 16 | 17 | 16 |
| White mustard<br>Gorczyca biała | F | | 18 | 25 | 24 | 32 | 28 | 31 | 31 | 31 | 34 | 34 | 36 | 37 | 33 | 30 | 30 | 34 |
| Potato plant<br>Ziemniak | F | | 14 | 15 | 19 | 21 | 19 | 15 | 20 | 18 | 23 | 25 | 26 | 27 | 24 | 21 | 19 | 18 |
| | F+S | | 16 | 14 | 21 | 21 | 26 | 17 | 23 | 21 | 24 | 22 | 23 | 26 | 21 | 21 | 24 | 22 |
| Rye – Żyto | F | mean number of species in relevé<br>średnia liczba gatunków w zdjęciu | 8 | 9 | 10 | 12 | 13 | 12 | 13 | 14 | 18 | 18 | 18 | 18 | 12 | 12 | 15 | 12 |
| Spring barley<br>Jęczmień jary | F | | 7 | 7 | 9 | 9 | 11 | 9 | 6 | 11 | 12 | 12 | 11 | 12 | 11 | 7 | 10 | 10 |
| | F + M | | 7 | 7 | 8 | 5 | 13 | 13 | 13 | 13 | 14 | 11 | 14 | 12 | 8 | 8 | 6 | 8 |
| White mustard<br>Gorczyca biała | F | | 12 | 11 | 16 | 16 | 17 | 17 | 17 | 17 | 18 | 19 | 21 | 20 | 18 | 16 | 19 | 19 |
| Potato plant<br>Ziemniak | F | | 7 | 7 | 9 | 10 | 10 | 9 | 9 | 9 | 11 | 12 | 11 | 13 | 11 | 9 | 10 | 8 |
| | F+S | | 8 | 8 | 9 | 10 | 12 | 9 | 9 | 9 | 12 | 12 | 12 | 12 | 11 | 10 | 12 | 11 |

Explanations – Objaśnienia: F – fertilizer – nawożenie mineralne, F + M – fertilizer + manure – nawożenie mineralne + obornik, F+S – fertilizer + straw – nawożenie mineralne + + słoma.
Source – Źródło: Borowiec et al. – i in. (1985).

An increased number of taxa (34) was registered in rye growing in the control plot and with NPK, and the largest in the plot exclusively limed (Ca – 2200 kg · $ha^{-1}$ every four years). In communities of the remaining field crops the number of species on this combination is also the largest. On combinations with mineral fertilizing and liming (CaK, CaP, CaPK, NPCa and NPKCa) the number of species is also large and it varies in growing of rye from 29 to 38, spring barley from 17 to 24, white mustard from 30 to 37 and potatoes from 18 to 27 (Table 17). There are similar relations with regard to the mean number of species in the vegetation register (Table 17).

The structure of communities consists of a differentiated number of species depending on the field plant an fertilizing (Borowiec et al. 1981). In segetal communities a different number of species was observed in particular cultivation areas within the same fertilizing variant. The number of species in communities of winter wheat, spring barley and potato crops in particular variants of fertilizing was differentiated. The most species were registered in winter wheat growing, and their number varies from 17 (control) to 32 (25 t · $ha^{-1}$ of manure + + 1.5 t · $ha^{-1}$ $CaCO_3$) – Table 16. The smallest number was observed in potato growing within all the levels of fertilizing (Table 18).

Table 18. The number of species and mean number of species in relevé in communities of different types of cultivation in differentiated mineral fertilising combinations
Tabela 18. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach różnych upraw na tle zróżnicowanych kombinacji nawożeniowych

| Treatmens of fertilizations<br>Kombinacje nawożeniowe | Cultivated plants – Rośliny uprawne | Number of species<br>Liczba gatunków | Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu |
|---|---|---|---|
| 0 | winter wheat – pszenica ozima | 17 | 10 |
| | spring barley – jęczmień jary | 20 | 11 |
| | potato plant – ziemniak | 15 | 9 |
| 6 t · $ha^{-1}$ $CaCO_3$ every four year<br>co 4 lata | winter wheat – pszenica ozima | 22 | 12 |
| | spring barley – jęczmień jary | 21 | 12 |
| | potato plant – ziemniak | 17 | 9 |
| 1,5 t · $ha^{-1}$ $CaCO_3$ every year<br>co roku | winter wheat – pszenica ozima | 26 | 13 |
| | spring barley – jęczmień jary | 20 | 13 |
| | potato plant – ziemniak | 15 | 9 |
| $N_{110}P_{70}K_{140}$ | winter wheat – pszenica ozima | 20 | 11 |
| | spring barley – jęczmień jary | 19 | 12 |
| | potato plant – ziemniak | 18 | 10 |
| NPK + 1,5 t · $ha^{-1}$ $CaCO_3$ | winter wheat – pszenica ozima | 24 | 14 |
| | spring barley – jęczmień jary | 18 | 12 |
| | potato plant – ziemniak | 14 | 9 |
| 25 t · $ha^{-1}$ manure – obornika | winter wheat – pszenica ozima | 25 | 15 |
| | spring barley – jęczmień jary | 22 | 14 |
| | potato plant – ziemniak | 17 | 10 |
| 25 t · $ha^{-1}$ manure – obornika<br>+1,5 t · $ha^{-1}$ $CaCO_3$ | winter wheat – pszenica ozima | 32 | 16 |
| | spring barley – jęczmień jary | 25 | 16 |
| | potato plant – ziemniak | 21 | 11 |

Source – Źródło: Borowiec et al. – i in. (1981).

Table 19. The number of species and average number of species in relevé in communities of different types of cultivation in differentiated mineral fertilising combinations with manure

Tabela 19. Liczba gatunków oraz średnia liczba gatunków w zdjęciu fitosocjologicznym w zbiorowiskach różnych upraw na tle zróżnicowanego nawożenia mineralnego oraz w połączeniu z obornikiem

| Cultivated plants<br>Rośliny uprawne | | With-out manure – Bez obornika | | | | | With manure – Z obornikiem | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | level of NPK treatment – poziom nawożenia NPK | | | | | level of NPK treatment – poziom nawożenia NPK | | | | |
| | | 0 | 0,5 | 1,0 | 1,5 | 2,0 | 0 | 0,5 | 1,0 | 1,5 | 2,0 |
| Winter wheat<br>Pszenica ozima | number of species in relevé<br>liczba gatunków w zdjęciu | 27 | 29 | 26 | 25 | 25 | 26 | 29 | 26 | 25 | 18 |
| Jęczmień jary<br>Spring barley | | 22 | 27 | 19 | 23 | 20 | 27 | 25 | 26 | 19 | 20 |
| White mustard<br>Gorczyca biała | | 37 | 32 | 29 | 29 | 24 | 33 | 30 | 29 | 32 | 27 |
| Potato plant<br>Ziemniak | | 20 | 13 | 16 | 17 | 15 | 18 | 19 | 14 | 15 | 11 |
| Winter wheat<br>Pszenica ozima | mean number of species in relevé<br>średnia liczba gatunków w zdjęciu | 11 | 14 | 13 | 11 | 11 | 13 | 14 | 11 | 10 | 9 |
| Spring barley<br>Jęczmień jary | | 11 | 12 | 11 | 11 | 10 | 12 | 10 | 11 | 10 | 10 |
| White mustard<br>Gorczyca biała | | 20 | 19 | 17 | 17 | 15 | 19 | 17 | 17 | 16 | 15 |
| Potato plant<br>Ziemniak | | 10 | 7 | 8 | 7 | 7 | 8 | 8 | 8 | 7 | 6 |

Explanations – Objaśnienia: Dose of – Dawki – NPK: level – poziom – 0,5 = winter wheat – pszenica ozima, spring barley – jęczmień jary – $N_{20}P_{20}K_{20}$ kg · ha$^{-1}$; level – poziom – 1,0 = $N_{50}P_{50}K_{50}$ kg · ha$^{-1}$; level – poziom – 1,5 = $N_{60}P_{60}K_{60}$ kg · ha$^{-1}$; level – poziom – 2,0 = $N_{80}P_{80}K_{80}$ kg · ha$^{-1}$; white mustard – gorczyca biała – level – poziom – 0,5 = $N_{40}P_{30}K_{40}$ kg · ha$^{-1}$; level – poziom – 1,0 = $N_{80}P_{60}K_{80}$ kg · ha$^{-1}$; level – poziom – 1,5 = $N_{120}P_{90}K_{120}$ kg·ha$^{-1}$; level – poziom – 2,0 = $N_{160}P_{120}K_{160}$ kg · ha$^{-1}$; potato plant – ziemniak – level – poziom – 0,5 = $N_{40}P_{20}K_{64}$ kg · ha$^{-1}$; level – poziom – 1,0 = $N_{80}P_{52}K_{128}$ kg · ha$^{-1}$; level – poziom – 1,5 = $N_{120}P_{78}K_{192}$ kg · ha$^{-1}$; level – poziom – 2,0 = $N_{160}P_{104}K_{256}$ kg · ha$^{-1}$.

Source – Źródło: Borowiec et al. – i in. (1986).

Table 20. The number of species and mean number of species in relevé in communities of rye crops in fertilising with manure and slurry and in mixed fertilization
Tabela 20. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach uprawy żyta na tle nawożenia obornikiem, gnojowicą i nawozem mieszanym

| Applied fertilizers<br>Warianty nawożeniowe | Experiment with manure on poor sandy soil 5 Bw ps:gl<br>Doświadczenie z obornikiem na glebie 5 Bw ps:gl | | | | | | | | | Experiment with slurry on very poor sandy soil 6 A ps·pl:gl<br>Doświadczenie z gnojowicą na glebie 6 A ps·pl:gl | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | mineral fertilizers<br>nawożenie mineralne | manure applied – obornik | | | | | | mineral fertilizers<br>nawożenie mineralne | swine slurry – gnojowica trzody chlewnej | | | | | cattle slurry – gnojowica bydlęca | | | | |
| | | | every four year<br>co 4 lata | | | every year<br>co roku | | | | 50% N as slurry and 50% as mineral fertilizers<br>50% N w gnojowicy i 50% N w nawozach mineralnych | 75% N as slurry and 25% as mineral fertilizers<br>75% N w gnojowicy i 25% N w nawozach mineralnych | 100% N as slurry<br>100% N w gnojowicy | 150% N as slurry<br>150% N w gnojowicy | 200% N as slurry<br>150% N w gnojowicy | 50% N as slurry and 50% as mineral fertilizers<br>50% N w gnojowicy i 50% N w nawozach mineralnych | 75% N as slurry and 25% as mineral fertilizers<br>75% N w gnojowicy i 25% N w nawozach mineralnych | 100% N as slurry<br>100% N w gnojowicy | 150% N as slurry<br>150% N w gnojowicy | 200% N as slurry<br>200% N w gnojowicy |
| | | $N_{80} P_{40} K_{50}$ kg · ha$^{-1}$ | +CaO | +CaO and loam – i glina | | +CaO | +CaO and loam – i glina | $N_{80} P_{70} K_{80}$ kg · ha$^{-1}$ | | | | | | | | | | | |
| Number of relevès<br>Liczba zdjęć fitosocjologicznych | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | 12 | 12 | 12 | 12 | | 12 | 12 | 12 | 12 |
| Number of species in variant<br>Liczba gatunków w wariancie | 22 | 29 | 18 | 24 | 28 | 19 | 22 | 20 | 31 | 9 | | 6 | 9 | 10 | 9 | | 8 | 7 | 9 | 8 | 7 |
| Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu | 18 | 14 | 17 | 20 | 24 | 15 | 17 | 18 | 11 | 5 | | 3 | 4 | 4 | 4 | | 4 | 4 | 4 | 4 | 3 |

Explanations of soil units as given under Table 1 – Objaśnienia jednostek glebowych pod tab. 1.
Source – Źródło: Borowiec et al. – i in. (1986).

The influence of the kind of a field plant on the number of species in the community was also noticed in an experiment with a differentiated level of mineral fertilizing without manure and with its application (Borowiec et al. 1986a). The most species were recorded in white mustard on combinations both with mineral fertilizing and linked with manure. The number of species varies from 24 to 32 in the plots with mineral fertilizing and from 27 to 30 in the plots with mineral and manure fertilizing. The largest number of species is found in phytocenoses in the control plot – 33 and 37 taxa respectively. Definitely smaller numbers of species were registered in potato growing. Similar relations were observed with regard to to the mean number of species in the vegetation register at the sites of the experiment (Table 19).

A very significant agrotechnical factor responsible for the number of species in the community is mineral fertilizing and the application of manure or slurry and liming, and also liming with admixture of clay (Borowiec et al. 1986a, b). In the control variant and with mineral fertilization and the application of manure and liming the number of species was significant and it varied from 18 to 31 (Table 20). Whereas the application of slurry significantly limits the number of species which varied from 7 to 10 taxa (Table 20). The number of species in these variants was limited by very large coverage of the field plant, from 95 to 100%. The mean number of species in the phytosociological relevé is similar to the number of species in the communities within the mentioned variants of fertilizing.

The level of agrotechnique carried out in farms is also responsible for species abundance of segetal communities (Borowiec and Kutyna 1985). In the fields of ex-State Agricultural Farms intensive agrotechnique was used (herbicides and significant rates of mineral fertilizers were applied). It limited the number of species in the communities. In the fields of private farms (less intensive agrotechnique), on the same soils more species were observed. In the communities of rye growing 92 species were observed in the fields of ex-State Agricultural Farms and 117 in the private farmers fields, in winter wheat 85 and 102, respectively, in spring cereals 80 and 112, in potatoes 89 and 94, and in winter rape 78 and 89 (Table 21).

Table 21. The number of species and average number of species in relevé in communities of different types of cultivation in fields of post-PGR cooperatives (A) and individual farmers (B)
Tabela 21. Liczba gatunków oraz ich średnia liczba w zdjęciu fitosocjologicznym w zbiorowiskach różnych upraw na polach byłych państwowych gospodarstw rolnych (A) i rolników indywidualnych (B)

| Cultivated plants<br>Rośliny uprawne | Number of relevès<br>Liczba zdjęć fitosocjologicznych | Number of species in communities (A)<br>Liczba gatunków w zbiorowisku (A) | Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu | Number of relevès<br>Liczba zdjęć fitosocjologicznych | Number of species in communities (B)<br>Liczba gatunków w zbiorowisku (B) | Mean number of species in relevé<br>Średnia liczba gatunków w zdjęciu |
|---|---|---|---|---|---|---|
| Rye – Żyto | 56 | 92 | 19 | 72 | 117 | 20 |
| Winter wheat – Pszenica ozima | 57 | 85 | 18 | 72 | 102 | 18 |
| Spring cereals – Zboża jare | 67 | 80 | 15 | 98 | 112 | 17 |
| Potato plant – Ziemniak | 90 | 89 | 19 | 90 | 94 | 20 |
| Winter rape – Rzepak ozimy | 32 | 78 | 16 | 41 | 89 | 16 |

At present, a significant part of the ex-State Agricultural Farms fields are characterized by intensive agrotechnque, presumably the number of species in communities in this system of growing is limited. The mean number of species in the relevé, in general, does not show a larger difference, their values are approximate (Table 21).

## CONCLUSIONS

1. A series of natural and agrotechnique factors are responsible for floristic differences and the number of species in segetal communities.
2. A significant natural factor shaping the number of species and their mean number in the relevé s are differentiated soil conditions. Along with an increase in their trophic character and moisture content the number of taxa in phytocenoses grow and also the vegetation patches of these phytocenons are more abundant.
3. An important element responsible for the number of species and their mean number in the patches is the relief of terrain. Communities occurring in the depression are characterized by their larger number and diversity than phytocenoses settled on the slopes and the top.
4. The number of species in the community is significantly affected by the kind of agrotechnique activity. Segetal communities in crops of ecological and extensive conventional farms are much richer floristically and the number of species in them is larger as compared to communities of intensive conventional crops.
5. A significant agrotechnique factor responsible for the number of species is mineral and organic fertilizing, and liming. Slurry limits the number of species in communities, whereas there are much more of them in limed and fertilized with manure plots.

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**Abstract.** Floristic differentiation, the number of species in segetal communities and the mean number of species in relevé depend on a series of natural and agrotechnical factors. Differentiated soil conditions are a significant natural factor. Along with an increase in the trophic character of a soil and its moisture content the number of species in communities grows. In a typical variant of segetal communities (*Arnoserido-Scleranthetum*, *Papaveretum argemones*) on soils formed from loose sand and slightly loamy sand the number of species is the smallest and it varies from 37 to 62. There are much more species (from 56 to 79) in the variant with *Juncus bufonius* of both associations on soils temporalily moist excessively. The mean value of the species number in relevé varies from 16 to 25 in a typical variant of both associations. On more fertile soils of alkaline reaction, formed from loam and silty soils, the number of species in communities (*Aphano-Matricarietum* i *Lathyro-Melandrietum*) is considerably larger and it varies from 76 to 89. In a typical of segetal communities *Aphano-Matricarietum* there are a little less species comparing to the *Mentha arvensis* one. The number of species ranges from 77 to 84 in a typical variant and from 86 to 87 in a *Mentha arvensis* one. The similar dependency also occurs in respect to mean number of species in relevé. The *Aphano-Matricarietum* communities are floristically rich. The mean number of species in relevé is relatively high and for a typical variant is 27, but far greater is for *Mentha arvensis* variant and varies from 33 to 36. The similar dependency between soil conditions and the number of species in segetal communities as well as the mean number of species in relevé occurs at segetal communities of tuber crops. The floristically poorest community is *Digitarietum ischaemi*, the *Echinochloo-Setarietum* community is richest and the *Galinsogo-Setarietum*, *Lamio-Veronicetum politae* and *Oxalido-Chenopodietum polyspermi* communities are the most richest ones. An important factor responsible for the number of species is also land relief. Communities occurring in depressions are characterised

by a larger number of species and greater diversity than the communities on slopes and slope tops. The number of species in a community also depends on agrotechnical activity. Segetal communities in ecological cultivation are much richer floristically (the number of species ranges from 32 to 58). They also contain a larger number of species than those in the intensive conventional cultivation, where the number of species varies from 13 to 24. The similar dependency also occurs in respect to mean number of species in relevé. Significant agrotechnical factor responsible for the number of species are mineral and organic fertilisation and liming. Slurry limits the number of species in communities, whereas they occur in a larger number in communities in limed and manured fields.