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**SILENO INFLATAE-LINARIETUM MINORIS HERBICH 1993
– CALCIPHILIOUS WEEDS COMMUNITY
IN THE KULAWA RIVER VALLEY
(ZABORSKI LANDSCAPE PARK)**

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ABSTRACT. The paper presents results of studies on interesting calciphilous weeds association that have evolved on lacustrine chalk in Kulawa river valley, in west part of the Zaborski Landscape Park.

Key words: segetal communities, calcifilous habitats, *Chaenorhinum minus*

Introduction, aim and methods

Segetal calcifilous vegetation in Pomerania is distributed insularly on soils rich in calcium carbonate (**Borowiec et al.** 1974, **Szmeja** 1987, **Herbich** 1993). Among calciphilous weeds, there are rare species connected with traditional growing of root plants and cereals. Their occurrence in agrophytocenoses is worth noting, for the acreage of large-size cropland has increased in recent years with the use of herbicides, which is the main factor of segetal vegetation disappearance. The objective of the study is to describe a rare association of cereal crop weeds found on the Pomeranian deposits of lacustrine chalk.

The field work was carried out in the valley of the Kulawa river in 2006. At that time, attention was paid, among others, to specific segetal vegetation occurring within cereal crops. Plant community has developed there, which for the first time was described by **Herbich** (1993) within the area of the Ostrzycko-Raduńskie Troughs (the Kashubian Lakeland) as the plant association *Sileno inflatae-Linarietum minoris* Herbich 1993.

To provide documentary evidence of the association, 10 phytosociological relevés were taken with the method of Braun-Blanquet, of which nine are presented in Table 1. From the surface soil, a soil sample was collected, in which pH as well as calcium carbonate content were measured with the Scheibler's method (Drzymala et al. 1982). The names of taxa were adopted after Mirek et al. (2002), while syntaxonomic affiliation according to Matuszkiewicz (2005).

Table 1

Sileno inflatae-Linarietum minoris Herbich 1993 in Kulawa river valley
Sileno inflatae-Linarietum minoris Herbich 1993 w dolinie rzeki Kulawy

Successive No. – Nr kolejny	1	2	3	4	5	6	7	8	9
Date – Data (2006)	15.07.	15.07.	15.07.	9.07.	9.07.	9.07.	9.07.	9.07.	9.07.
Area of record (m ²) Powierzchnia zdjęcia (m ²)	60	20	50	100	80	50	60	40	40
Slope (°) Nachylenie terenu (°)	5	5	2	10	10	10	2	2	2
Cover of cultivated plants (%) Pokrycie roślin uprawnych (%)	35	30	25	50	50	60	40	50	50
Cover of weeds (%) Pokrycie chwastów (%)	70	70	85	50	65	50	60	50	50
Cultivated plants – Rośliny uprawne									
<i>Avena sativa</i>	.	.	+	2.2	2.1	+	1.2	1.1	1.1
<i>Triticosecale</i>	.	.	.	+	2.1	3.3	2.3	3.3	3.3
<i>Papaver somniferum</i>	.	.	.	+	1.1	+	+	+	+
<i>Hordeum vulgare</i>	3.3	3.3	2.2	.	.	.	.	.	.
<i>Pisum sativum</i>	.	.	.	.	.	+	+	.	.
Ch.Ass. <i>Sileno inflatae-Linarietum minoris</i>									
<i>Chaenorhinum minus</i>	1.1	1.1	3.3	2.1	2.2	2.1	2.1	1.1	1.1
<i>Silene vulgaris</i>	1.1	2.2	1.1	+	.	.	.	.	.
Ch.D.O. <i>Polygono-Chenopodietalia</i>									
<i>Fumaria officinalis</i>	+	1.1	2.2	1.1	+	+	+	.	.
<i>Lamium amplexicaule</i>	+	+	1.1	+	+	+	+	.	.
<i>Euphorbia helioscopia</i>	+	+	1.1	+	+	+	.	.	.
<i>Stellaria media</i>	+	+	+	+	.	.	.	.	.
<i>Veronica polita</i>	.	.	+	.	.	+	.	+	+
<i>Anchusa arvensis</i>	.	.	.	.	+	.	+	+	+
<i>Raphanus raphanistrum</i>	.	.	.	+	+	+	.	.	.
<i>Polygonum aviculare</i>	.	.	+	+	+	.	.	.	.

Table 1 – cont.

Successive No. – Nr kolejny	1	2	3	4	5	6	7	8	9
Ch.O. Centauretalia cyani									
<i>Anthemis arvensis</i>	.	.	.	+	+	+	+	+	+
<i>Papaver argemone</i>	.	.	.	.	r	+	+	+	+
<i>Centaurea cyanus</i>	+	.	.	.	.	+	+	.	.
<i>Vicia villosa</i>	+	+	.	+	.	.	.	.	.
Sporadic species – Gatunki sporadyczne: <i>Vicia tetrasperma</i> 4(+)									
Ch.D.Cl. Stellarietea mediae									
<i>Anagallis arvensis</i>	+	1.1	+	1.1	1.1	1.1	2.1	1.1	1.1
<i>Viola arvensis</i>	1.1	1.1	2.2	+	+	.	.	+	+
<i>Tussilago farfara</i>	+	+	.	.	.	+	+	+	+
<i>Myosotis arvensis</i>	.	.	.	+	+	.	+	+	+
<i>Lactuca seriola</i>	.	+	.	+	+	+	.	.	.
<i>Galeopsis speciosa</i>	.	+	+	.	.	.	.	.	.
<i>Fallopia convolvulus</i>	.	.	+	.	+	.	.	.	.
Sporadic species – Gatunki sporadyczne: <i>Galeopsis tetrachit</i> 1(+), <i>Atriplex patula</i> 4(+), <i>Senecio viscosus</i> 4(+), <i>Thlaspi arvense</i> 5(+)									
Ch.Cl. Mollinio-Arrhenatheretea									
<i>Potentilla anserina</i>	.	.	.	.	1.1	1.1	+	+	1.1
<i>Agrostis gigantea</i>	.	.	.	.	+	+	+	+	+
<i>Achillea millefolium</i>	.	.	.	+	.	+	+	.	.
<i>Potentilla reptans</i>	.	.	.	+	+	.	.	.	.
Sporadic species – Gatunki sporadyczne: <i>Daucus carota</i> 4(+), <i>Festuca rubra</i> 5(+), <i>Trifolium dubium</i> 5(+), <i>Ranunculus repens</i> 6(+)									
Ch.D.Cl. Artemisietea									
<i>Linaria vulgaris</i>	.	+	+	+	.	.	+	+	+
<i>Artemisia vulgaris</i>	.	.	.	.	.	+	+	1.1	1.1
<i>Cirsium arvense</i>	.	.	.	+	+	.	.	+	+
<i>Echium vulgare</i>	.	.	.	+	+	.	.	.	.
<i>Eupatorium cannabinum</i>	.	.	+	.	+	.	.	.	.
Sporadic species – Gatunki sporadyczne: <i>Anchusa officinalis</i> 4(+)									
Ch.Cl. Agropyretea vulgaris									
<i>Elymus repens</i>	.	.	.	+	+	+	+	+	+
<i>Equisetum arvense</i>	.	.	+	+	.	.	.	+	+
<i>Convolvulus arvensis</i>	.	.	.	.	+	+	+	.	.

Table 1 – cont.

Successive No. – Nr kolejny	1	2	3	4	5	6	7	8	9
Others – Inne									
<i>Medicago lupulina</i>	1.1	+	+	+	2.1	1.1	1.1	1.1	1.1
<i>Arenaria serpyllifolia</i>	1.1	1.1	2.2	+	.	.	+	+	+
<i>Hypericum perforatum</i>	.	.	.	.	3.1	+	+	.	.
<i>Capsella bursa-pastoris</i>	.	.	.	1.1	+	.	+	.	.
Sporadic species – Gatunki sporadyczne: <i>Erodium cicutarium</i> 3(+), <i>Acinos arvensis</i> 4 (+), <i>Anthemis tinctoria</i> 4(+), <i>Erigeron acris</i> 4(+), <i>Herniaria glabra</i> 5(+), <i>Mentha arvensis</i> 5(+), <i>Galium aparine</i> 6 (+)									

Study area

The valley of the Kulawa river is situated in the north-western part of the Tuchola Forest sandur. It takes up the floor of a subglacial trough with meridional course and of a length of c. 7.5 km. Within it, three lakes are situated: the Great Głuche and the Small Głuche Lakes and Lake Sieczonek, as well as three small water basins in the alimentation area, at the river's headwater (Fig. 1).

On the valley's slopes and terraces, elevated c. 30 m above the river level, deposits of lacustrine chalk are located, where soils of lacustrine rendzina type developed (**Prusinkiewicz** and **Noryskiewicz** 1975). In several places, outcropping beds of carbonate rock are visible, which was won locally on small scale. The plant cover of the valley is very much diversified – there developed, among others, communities of alluvial meadows, rushes, transitional mires and alluvial forest. The surface features cause habitats of thermocalciphilous plants, e.g. dry swards with xerothermic species (*Festuco-Brometea* class) or of hydrocalciphilous ones, i.e. lime peat-bogs (*Caricion davallianae* alliance) to border quite often upon each other. The edges of the valley are overgrown with pine coniferous forests.

Some fragments of the valley are under agricultural use. At present, there are, among others, three meadow complexes with an area of over 10 ha and fields with spring and winter cereals, and buckwheat and beet-roots crops. The total area of these fields does not exceed 4 ha.

The patches of the examined association are situated in cereal crops – of barley and of a mixture of triticale and oats, located on the slopes at the north-eastern shore of the Small Głuche Lake and at the eastern shore of the Great Głuche Lake (Fig. 1). The area of these fields is inclined from 2° to 10° westward and lies from 2 to 7 m over lake's water level. This habitat can be considered as a fresh one, due to large porosity of lime (**Prusinkiewicz** and **Noryskiewicz** 1975), which favours soil retention of ground water penetrating from areas lying above.

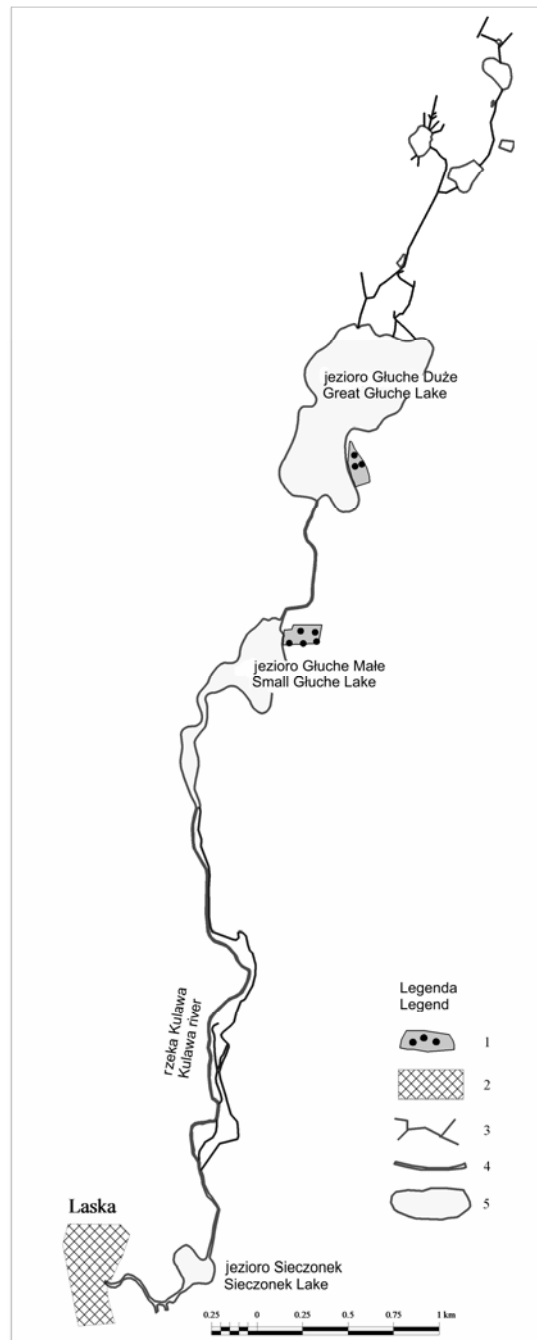


Fig. 1. Map of the investigated area: 1 – localization of phytocenoses *Sileno inflatae-Linarietum minoris* in the Kulawa river valley, 2 – Laska country, 3 – ditches, 4 – Kulawa river, 5 – lakes
 Ryc. 1. Mapa terenu badań: 1 – położenie fitocenoz *Sileno inflatae-Linarietum minoris* w dolinie rzeki Kulawy, 2 – wieś Laska, 3 – kanały, 4 – rzeka Kulawa, 5 – jeziora

Results

With respect to soil and farming value, the soil of the examined area is included into a defective wheat soil complex 3. It is deprived almost completely of humus layer; pH value is 8 and it contains 37% calcium carbonate. The moistening within the fields is irregular. Wet depressions are characterized by a considerable cereal cover, from 50% to 60%, and the occurrence of weeds with prevalence of *Potentilla anserina* or *Tussilago farfara*.

Higher situated and overdried for a better part of vegetation period places characterized by low cereal cover, from 25% to 30%, within which patches of association *Sileno inflatae-Linarietum minoris* developed with numerous contribution of segetal calciphorous species (Table 1). Important part in its structure is taken by characteristic species: *Chaenorhinum minus*, *Silene vulgaris*, *Anagalis arvensis* and *Medicago lupulina* with their quantity increasing visibly in most dried places. Within the examined patches, worth paying attention are weeds of root plants of *Polygono-Chenopodietalia* order, in particular species that are characteristic for *Veronico-Fumarietum officinalis* – *Fumaria officinalis* and *Lamium amplexicaule*. The specific character of habitat thermal conditions is emphasised by the presence of thermophilous sward and forest edge species, e.g. *Arenaria serpyllifolia* and *Hypericum perforatum*.

The incomplete form of the community under discussion was also found on an undeveloped hunting plot situated on uncovered chalk deposit to the north-west of the Great Głuche Lake. The quantity of *Chaenorhinum minus* is 4.4 there and confirms the connection of this species with warm habitat, where most probably it reaches its optimum.

Discussion and recapitulation

In the Zaborski Landscape Park, poor and sandy habitats prevail, where cereals are mostly grown, thus weed communities connected to them predominate. On sandy soils, *Teesdaleo-Arnoseridum minima* is encountered most frequently, while *Papaveretum argemones* on loamy soils (Szmeja 1994). The occurrence of phytocenoses *Sileno inflatae-Linarietum minoris* has not been stated in this area yet. It is the first record of this association outside the central part of the Kashubian Lakeland.

In relation to other Pomeranian segetal cereal crop association that develop on calcium carbonate abundant soils, i.e. *Lathyro-Melandrietum noctiflori* and *Vicetum tetraspermae*, phytocenoses *Sileno inflatae-Linarietum minoris* are characterised by the lack of or occasional contribution of cereal weeds of *Centauretalia cyani* order and a considerably larger role of species of *Polygono-Chenopodietalia* order (Table 1).

This specific floristic structure, which among others became the basis for distinguishing the association within the area of the Ostrzyckie Troughs, is also characteristic for the Kulawa river valley.

Herbich (1993), while describing the singled out association, included it into substitute communities of lime orchidaceous beech forest *Carici-Fagetum* that developed on fresh lithogenic soils on the Ostrzyckie Lake.

In the Kulawa river valley, mostly strongly anthropogenically transformed pine coniferous forests (*Leucobryo-Pinetum*) and alluvial forest (*Fraxino-Alnetum*) are located.

On the eastern bank of the river, xerothermic species occur mainly in the undergrowth of some parts of pine coniferous forests, which was the basis for **Boński** (1988) to distinguish a steppic woods *Potentillo-Quercetum*. In the western part of the valley, sites of *Cypripedium calceolus* and *Listera ovata* orchids are found, and in its southern part grow solitary old European beeches, which could suggest the occurrence of lime beech forests in the past. At present, however, there are no beech forests within the examined area; it seems also that there are sufficient grounds to distinguish there a community of steppic woods. In connection with the above, the inclusion of community *Sileno inflatae-Linarietum minoris* from the Kulawa river valley into substitute communities of Pomeranian orchidaceous beech forest would be burdened with undue subjectivism.

The area of the Kulawa river valley is very interesting and valuable in respect of its nature, which has been intended for a long time for inclusion under protection in the form of a reserve. Under conditions of agriculture intensification and segetal vegetation impoverishment, the occurrence of a rare weed community in this area not only raises natural amenities of the planned reserve, but also contributes to a better examination of *Sileno inflatae-Linarietum minoris* distribution in Poland.

Summary

There are some interesting habitats developed on lacustrine chalk deposits in the valley of the Kulawa river (Zaborski Landscape Park). Characteristic soil known as rendzina (which originate from carbonate rocks, e.g. chalk) is identified there. The soil, rich in calcium carbonate, is covered by patches of *Sileno inflatae-Linarietum minoris* community. This community, described for the first time by **Herbich** (1993) from the Kashuby Lakeland, is characterized by: 1) a great share of characteristic calciphilous and termophilous species e.g. *Chaenorhinum minus*, *Silene vulgaris*, *Medicago lupulina*, *Arenaria serpyllifolia* and *Anagalis arvensis*, 2) low participation of species from *Centaurealia cyani* order, 3) a great number of root plants agriculture's weedy species, e.g. *Fumaria officinalis*, *Euphorbia helioscopia* and *Lamium amplexicaule*.

A patchy distribution, local environmental conditions and the specific composition of identified community in the valley of Kulawa river, are very similar to characteristic traits of this community given by **Herbich** (2003) from Ostrzycko-Raduński Region (central Kashuby Lakeland).

This research helps to recognize the range of this rare community occurring on soil under cultivation by using traditional methods, in Poland.

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KALCYFILNY ZESPÓŁ SEGETALNY *SILENO INFLATAE-LINARIETUM MINORIS*
HERBICH 1993 W DOLINIE RZEKI KULAWY
(ZABORSKI PARK KRAJOBRAZOWY)

S t r e s z c z e n i e

W dolinie rzeki Kulawy (Zaborski Park Krajobrazowy) znajdują się interesujące siedliska wykształcone na kredzie jeziornej. Gleby typu rędzin pojeziornych, bardzo zasobne w węglan wapnia, porastają tam m.in. płaty *Sileno inflatae-Linarietum minoris*, zbiorowiska kalcyfilnych chwastów występujące w uprawach zbóż. Zespół ten został po raz pierwszy opisany przez **Herbicha** (1993) z terenu Pojezierza Kaszubskiego (rejon rynien Ostrzycko-Raduńskich). Charakteryzuje się on swoistym składem florystycznym, z dominacją gatunków kalcyfilnych i termofilnych: charakterystycznych – *Chaenorhinum minus* i *Silene vulgaris* oraz m.in. *Medicago lupulina*, *Arenaria serpyllifolia* i *Anagalis arvensis*. W stosunku do innych zbiorowisk chwastów zbożowych, wykształcających się na siedliskach zasobnych w węglan wapnia, fitocenozy *Sileno inflatae-Linarietum minoris* cechuje mały udział gatunków z rzędu *Centauretalia cyani* oraz dość liczna obecność chwastów upraw okopowych – *Fumaria officinalis*, *Euphorbia helioscopia* i *Lamium amplexicaule*. Wyspowe rozmieszczenie, warunki siedliskowe oraz skład gatunkowy *Sileno inflatae-Linarietum minoris* z doliny rzeki Kulawy są bardzo podobne do cech zbiorowiska zlokalizowanego w rejonie rynien Ostrzycko-Raduńskich (**Herbich** 2003). Niniejsza praca przyczynia się do lepszego rozpoznania zasięgu w Polsce tego rzadkiego zespołu chwastów występujących w uprawach prowadzonych tradycyjnymi metodami.

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