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ORIGINAL RESEARCH PAPER

A new locality of *Galeopsis angustifolia* (Ehrh.) Hoffm. in Pyrzyce Plain (West Pomerania, Poland)

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Abstract

The aim of the research was to explore a new locality of *Galeopsis angustifolia* (Lamiaceae), a rare taxa in Poland. The floristic composition of a plant community with *G. angustifolia* was determined. The species was recorded along the railway line from Pyrzyce to Stargard Szczeciński, near to the railway station in Okunica village, not used since 2004. Currently, the plant community with *G. angustifolia* occupies a transect >300 m in length. It is also sporadically found in the areas adjacent to the railway line. The species penetrates into ruderal communities from the *Artemisietea vulgaris* class and creates plant communities with *Galeopsis angustifolia*, a dominant species in the patches. Synanthropic species, e.g., *Rubus caesius*, *Convolvulus arvensis*, *Senecio viscosus*, meadow species, e.g., *Arrhenatherum elatius*, *Potentilla reptans*, *Pastinaca sativa*, and mosses of dry and rocky habitats also form plant communities with *Galeopsis angustifolia*.

Keywords

rare species; *Galeopsis angustifolia*; railway areas; plant communities

Introduction

Railway lines create specific environmental and soil conditions for plant growth. Species growing in these biotopes have distinctive ecological features; they are tolerant to excessive light, temperature fluctuations, resistant to the strong effect of precipitation, frost, erosion, wind, and air movement initiated by passing trains [1]. Despite harmful abiotic factors, railway lines create a habitat for many plant species from different ecological groups. Wildlife developed along railway lines has been the object of interest of many naturalists for many years. A lot of attention has been dedicated to flora growing in railway areas [2–21], including rare and protected plant species growing along railway embankments [22–25]. *Galeopsis angustifolia* from Lamiaceae is one of the rare species that grows in railway habitats in Poland [26,27].

Galeopsis angustifolia (Ehrh.) Hoffm. is an annual plant with a height of 10–40 cm and a grey-hairy stem, without firm bristles near the nodes. It is characterized by lance-shaped or narrow lance-shaped leaves and by entire or softly corrugated leaf margins with 4 pairs of teeth at the most. The flowers are small (15–25 mm), with a red-violet perianth, gathered in pseudo-whorls. The calyx is very hairy, usually without glands, with visible veins in the lower parts and three times shorter than the corolla. The fruit is an ovoid nutlet which contains numerous seeds. It blooms from June till October [28,29]. According to the ecological indicator values, this species prefers warm regions and microhabitats (T = 5–4), and it grows in full light (L = 5). It is adapted to dry places (W = 2), rich in calcium carbonate (R = 5), poor in nutrients (Tr = 2) and organic matter (H = 2), scree and gravel [27].

It seldom grows in natural habitats in Poland, however it is found in the rocky parts of the mountains and in the mountain parts of the river valleys, especially [30]. So far, the localities of *G. angustifolia* in Poland have been shown with the localities of *G. ladanum* on one collective map [31]. According to Rutkowski [29], the species was introduced in the north. According to Hultén and Fries [32], it is possible that a part of its distribution within Poland is its natural range. *G. angustifolia* grows commonly in the regions of Western Europe (in England, Wales, and Scotland), but the number of its localities has been decreasing for a few years [33]. In the Czech Republic, the species has been assessed in the red lists of threatened species as VU [34–36].

The aim of the research was to show a new locality of *Galeopsis angustifolia* and its participation in a plant community developed in railway areas.

Material and methods

During the growing period in 2014, a specimen-rich locality of a rare species, *Galeopsis angustifolia*, was found along railway lines. The top of the railway track, including areas next to it with a width of 1 m from the rail track, was the object of the study. Spatial identification of the locality was determined using GPS. To determine habitat preferences, 10 phytosociological relevés were made along a transect of 300 m in length using the Braun-Blanquet method with an expanded numerical scale [37]. Names of vascular plant species follow Mirek et al. [38], names of moss species are given according to Ochyra et al. [39], whereas names of phytosociological units follow Matuszkiewicz [30].

Results

Characteristics of the new locality

A new locality of *Galeopsis angustifolia* in West Pomerania (Poland) was found along an unused railway line from Pyrzyce to Stargard Szczeciński, near the old railway station in Okunica village (Fig. 1). The railway line runs across a meadow phytocoenosis and different types of agrocoenosis across the Okunica village and it also borders mid-field roadsides.

Okunica village is situated in Pyrzyce commune, in the southern part of West Pomeranian Voivodeship. According to physical and geographical regionalization, the study area is situated in the mesoregion of Pyrzyce-Stargard Plain [40], whereas according to geobotanical regionalization it is a part of the Pyrzyce Subdistrict [41]. A new locality of *Galeopsis angustifolia* is situated in AC-15 square according to the ATPOL cartographic system [31].

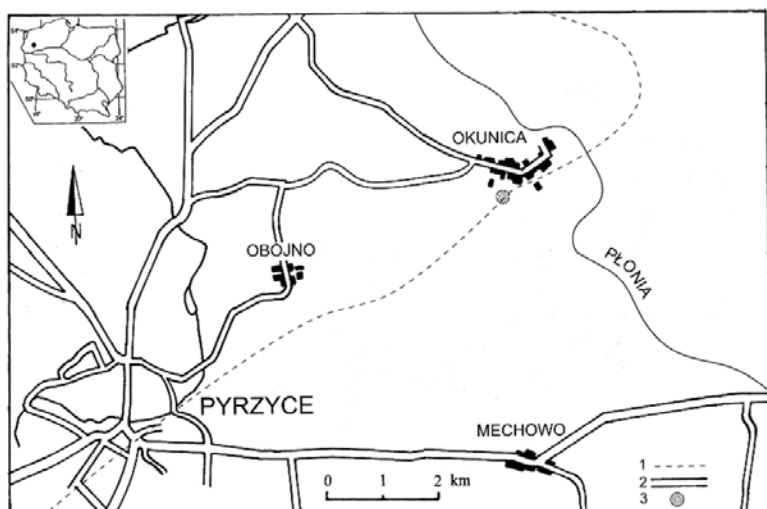


Fig. 1 Location of the new locality of *Galeopsis angustifolia* (Ehrh.) Hoffm. in Poland: 1 – railway; 2 – roads; 3 – the new locality near Okunica village.

Characteristics of the community with *Galeopsis angustifolia*

The community with *Galeopsis angustifolia* developed along the railway line was found to be at the pioneer stage. *G. angustifolia* was dominant in the patch and covered 40–80% of the patch area (Tab. 1). This species usually grows at the top of the railway track and sometimes it is found on railway embankments. The

Tab. 1 Phytosociological structure of the community with *Galeopsis angustifolia*.

Record number	1	2	3	4	5	6	7	8	9	10	S	Wp
Relevé number	10	1	5	3	4	9	2	6	8	7		
Date	July 1, 2014											
Location	Okunica											
Site	Railway line – 300 m transect											
Latitude (N)	53°11'31.0"											
Longitude (E)	14°56'42.6"											
Relevé area (m ²)	20	10	20	30	20	40	20	40	40	40		
Herbaceous layer cover (%)	50	40	60	80	80	80	80	80	80	80		
Mossy layer cover (%)	2	5	5	5	2	10	10	5	10	2		
Number of species in the relevé	5	6	6	11	10	10	6	8	9	10		
Ch.Cl. <i>Thlaspietea rotundifolii</i>												
<i>Galeopsis angustifolia</i>	2b3	2b3	3.3	3.3	3.3	3.3	4.4	4.4	4.4	4.4	V	4350
Ch.Cl. <i>Artemisietea vulgaris</i>												
<i>Rubus caesius</i>	.	2m3	1.1	2m3	2m3	2a3	2m3	1.1	2m3	1.1	V	1200
<i>Convolvulus arvensis</i>	.	2m3	2m3	2m3	+	.	+	2a1	.	+	IV	703
<i>Lactuca seriola</i>	+	.	.	+	+	1.1	.	+	1.1	+	IV	105
<i>Senecio viscosus</i>	3.3	.	.	+	+	1.1	.	.	+	.	III	428
<i>Tanacetum vulgare</i>	.	.	.	+	1.1	.	.	.	.	+	II	52
<i>Conyza canadensis</i>	.	.	.	.	.	+	.	.	+	+	II	3
<i>Picris hieracioides</i>	.	.	.	+	.	+	.	.	.	.	I	2
Ch.Cl. <i>Molinio-Arrhenatheretea</i>												
<i>Arrhenatherum elatius</i>	.	1.1	1.1	1.1	1.1	.	1.1	1.1	1.1	1.1	IV	400
<i>Potentilla reptans</i>	.	.	1.1	1.1	.	.	.	.	.	.	I	100

Tab. 1 Continued

<i>Pastinaca sativa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	51
<i>Achillea millefolium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	+	3
<i>Rumex acetosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	+	2
Others																					
<i>Sedum sexangulare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	51
<i>Medicago sativa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	1
<i>Sonchus asper</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	1
<i>Ceratodon purpureus</i> d	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	+	303
<i>Brachythecium albicans</i> d	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	275
<i>Brachythecium salebrosum</i> d	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	51

Sporadic: Ch.Cl. *Artemisietaea vulgaris*: *Melandrium album* 7 (+), *Artemisia vulgaris* 8 (+), *Artemisia absinthium* 3 (r), *Geranium robertianum* 3 (r). S – constancy class; Wp – cover ratio.

species richness in particular patches ranges from 5 to 11 and on average it is 8.1. Species typical for railway grounds were also found, such as *Senecio viscosus*, *Rubus caesius*, *Convolvulus arvensis* from the *Artemisietaea vulgaris* class, and concomitant species such as *Sedum sexangulare*. Synanthropic species from ruderal phytocoenoses were also recorded. Among them, *Tanacetum vulgare*, *Artemisia vulgaris*, *A. absinthium*, *Sonchus asper*, and other species often attain a high degree of coverage. Meadow species from the *Molinio-Arrhenatheretea* class also composed the community. *Arrhenatherum elatius* is characterized by a high degree of permanency (IV). The other taxa from that class are seldom found (Tab. 1). The patches are covered in a small percentage by mosses, e.g., *Ceratodon purpureus*, *Brachythecium albicans*, and *B. salebrosum* – species of especially dry and stony habitats.

The patches with *Galeopsis angustifolia* especially distinguished themselves the mosaic of the other communities developed in the neighborhood of the railway station due to flowering individuals. The various colors of their flowers attest the visual-aesthetic attractiveness of rural landscape areas.

Discussion

A lot of studies show that *Galeopsis angustifolia* grows well in the specific habitat of railway lines [22,42–48]. However, this species also grows well in post-exploitation areas [49], in sandy lawns [50] or at the foot of the mountains [51]. According to Jonik et al. [52] and Kleszcz et al. [53], *G. angustifolia* is mainly located in railway areas as opposed to morphologically similar *G. ladanum*, which is typical for segetal communities. Galera et al. [54] identified *G. angustifolia* among the species of railway areas, but it was recorded only in 11 localities. Sudnik-Wójcikowska et al. [55] revealed *G. angustifolia* along the railway lines in northeastern Poland only in 4 localities. *Galeopsis angustifolia* was also found rarely and in dispersion in railway areas in the middle eastern part of Poland (11–30 localities) [56].

It is difficult to determine the time of the first occurrence of *G. angustifolia* in the study area. The railway line from Pyrzyce to Stargard Szczeciński was operated until 2004 and the type of its use probably promoted seed dispersal. *Galeopsis angustifolia* was recorded for the first time in 1995 during floristic investigation of the Płonia River valley (unpublished data). Then, only a few specimens were found. After the closure of the whole railway line, the species spread along the top of the track and in the areas next to the railway line. Currently, it occupies a transect of over 300 m in length. Also Galera et al. [54] are of the opinion that *G. angustifolia* localities are more often situated along unused railway lines compared to used and active railway lines. This is in agreement with the opinion that railway lines create artificial corridors for wildlife and support the distribution of alien species diaspores [22,44,57–60].

Galeopsis angustifolia has been identified as a species of indigenous origin recently [38,56,61], it has however been included in the group of kenophytes because of its occurrence only in anthropogenic habitats [54,62–64]. According to Sudnik-Wójcikowska et al. [55], it belongs to the group of epecophytes. *Galeopsis angustifolia* was brought to Poland at the turn of the eighteenth and nineteenth century from Western Europe. *Galeopsis angustifolia* penetrates into plant communities commonly growing in anthropogenic habitats [64]. We confirmed the occurrence of *G. angustifolia* in ruderal communities. In the study region, the species from the *Artemisietea vulgaris* class show a high degree of constancy and represent a high degree of coverage in the patches where *G. angustifolia* is noted. However, the examined vegetation patches with *G. angustifolia* are floristically poorer in comparison with those observed in railway areas by Ćwikliński [42]. Therefore, we distinguished a plant community with *G. angustifolia*, whereas Ćwikliński [42] identified *Galeopsidetum angustifoliae* (Tx. 1931) Borkmann 1960 within the *Festuco-Brometea* class.

Conclusion

The present locality of *Galeopsis angustifolia* in West Pomerania is valuable and this species is expected to spread further. The survey along the railway line from Pyrzyce to Stargard Szczeciński will be continued in order to determine the syntaxonomic classification of the community with *Galeopsis angustifolia*.

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Nowe stanowisko *Galeopsis angustifolia* (Ehrh.) Hoffm. na Równinie Pyrzyckiej, wchodzącej w skład Pomorza Zachodniego

Streszczenie

Celem niniejszej pracy było przedstawienie nowego stanowiska *Galeopsis angustifolia* na nieużytkowanej od 2004 r. linii kolejowej relacji Pyrzyce–Stargard Szczeciński. Płaty z *G. angustifolia* zostały odnotowane w pobliżu stacji Okunica, wzdłuż torowiska i na przytorzach. Na podstawie przeprowadzonych badań stwierdzono, że *G. angustifolia* wnika do zbiorowisk ruderalnych z klasy *Artemisietea vulgaris* lub tworzy odrębne zbiorowisko roślinne. W płatach towarzyszą mu gatunki synantropijne m.in. *Rubus caesius*, *Convolvulus arvensis*, *Senecio viscosus*, łąkowe *Arrhenatherum elatius*, *Potentilla reptans*, *Pastinaca sativa*, a także gatunki mchów z siedlisk suchych i kamienistych.