

VEGETATION ON THE RAILWAY-LINE EMBANKMENT AT TARNÓW

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Abstract

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Vegetation grows on many types of habitats, with some preferring rich, wet soil, while others occur on poor and dry sites. Mostly vegetation diversity depends on environmental elements and human activities. Syn-anthropical vegetation is common on transformed or artificial areas such as embankments along railway lines. The main aim of the article is to characterize the vegetation on the embankment beside the Tarnów railway-line.

Key words: vegetation, embankment railway line, Tarnów, Poland

Introduction

Diversity of vegetation depends on the plant's ecological amplitude, propagation, environmental condition and human activity. Moreover, plant species migrate from surrounding ecosystems. Syn-anthropical plants mainly occur on areas with anthropic influences, such as on the artificial embankments created along railway lines by humans (Kryszak et al., 2006). Plants, which prefer light and a dry-site most commonly grow beside railway lines (Święś, Majkut, 2006). The main aim of the article is to characterize the plant species on embankments beside the Tarnów railway-line.

Material and methods

This research was carried out in 2008 and 2010. In both years, 100 phyto-sociological records were instituted on the embankment along the railway line for a distance of 5 km distance from Tarnów. Each was 25 m² and Braun-Blanquet's 1951 methodology was utilized in this study. Tarnów forms part of the Sandomierska basin, according to the 1993 geobotanical division of Matuszkiewicz. The railway line here is located in the southern part of Tarnów (in the Kraków-Rzeszów direction) (Fig. 1) The last train to Reszow or Cracow ran in 2000. Plant species



Fig. 1. Localization of Tarnów town (Poland).

were grouped within the phyto-sociological system of Matuszkiewicz (2001). The life-form division of plants was recorded according to Raunkiaer (1934)¹, and the classification of species from the viewpoint of environmental condition (in %) was as in Ellenberg et al. (1992). Herein, L = light index, F = moisture index, R = acidity index, and N = the nitrogen index.

Results

In this study area, there were plants from all 8 syn-taxonomic classes with companion species in the herb layer. The following plants from syn-anthropical, semi-natural and natural communities were identified; *Stellarietea mediae*, *Epilobietea angustifolii*, *Agropyretea in-*

¹ Phanerophytes, phanerogamous plants with renewable buds located on the shoots more than 25 cm above the ground level; hemi-cryptophytes, hemi-cryptogamous plants with buds and shoots located directly above the ground, geophytes (buds within the soil, often with storage organs; chamaephytes, herbs with buds above the ground and therophytes, annual plants that survive hostile times – drought or low temperatures, in the form of seeds

Table 1. Plant species which occurring on embankment along railway lines.

Plant species	Syntaxonomic class	Phytosociological constancy
<i>Melilotus alba</i>	<i>Artemisietea vulgaris</i>	V
<i>Melilotus officinalis</i>	<i>Artemisietea vulgaris</i>	IV
<i>Tanacetum vulgare</i>	<i>Artemisietea vulgaris</i>	III
<i>Rubus caesius</i>	<i>Artemisietea vulgaris</i>	II
<i>Artemisia vulgaris</i>	<i>Artemisietea vulgaris</i>	I
<i>Ballota nigra</i>	<i>Artemisietea vulgaris</i>	I
<i>Cichorium intybus</i>	<i>Artemisietea vulgaris</i>	I
<i>Cirsium arvense</i>	<i>Artemisietea vulgaris</i>	I
<i>Echium vulgare</i>	<i>Artemisietea vulgaris</i>	I
<i>Geranium robertianum</i>	<i>Artemisietea vulgaris</i>	I
<i>Linaria vulgaris</i>	<i>Artemisietea vulgaris</i>	I
<i>Oenothera biennis</i>	<i>Artemisietea vulgaris</i>	II
<i>Arctium lappa</i>	<i>Artemisietea vulgaris</i>	+
<i>Artemisia absinthium</i>	<i>Artemisietea vulgaris</i>	+
<i>Melandrium album</i>	<i>Artemisietea vulgaris</i>	+
<i>Achillea millefolium</i>	<i>Molinio-Arrhenatheretea</i>	III
<i>Dactylis glomerata</i>	<i>Molinio-Arrhenatheretea</i>	II
<i>Taraxacum officinale</i>	<i>Molinio-Arrhenatheretea</i>	II
<i>Trifolium repens</i>	<i>Molinio-Arrhenatheretea</i>	II
<i>Daucus carota</i>	<i>Molinio-Arrhenatheretea</i>	I
<i>Trifolium pratense</i>	<i>Molinio-Arrhenatheretea</i>	I
<i>Geranium pratense</i>	<i>Molinio-Arrhenatheretea</i>	+
<i>Calamagrostis epigejos</i>	<i>Epilobietea angustifolii</i>	II
<i>Verbascum nigrum</i>	<i>Epilobietea angustifolii</i>	II
<i>Convolvulus arvensis</i>	<i>Agropyretea intermedio-repentis</i>	II
<i>Equisetum arvense</i>	<i>Agropyretea intermedio-repentis</i>	I
<i>Pinus sylvestris</i>	<i>Vaccinio-Piceetea</i>	I
<i>Vicia tetrasperma</i>	<i>Stellarietea mediae</i>	I
<i>Silene vulgaris</i>	<i>Stellarietea mediae</i>	+
<i>Rumex acetosella</i>	<i>Koelerio glaucae-Corynepherea canescentis</i>	III
<i>Populus alba</i>	<i>Salicetea purpureae</i>	I
<i>Rosa canina</i>	<i>Rhamno-Prunetea</i>	+
<i>Plantago major</i>	companion species	II
<i>Hypericum perforatum</i>	companion species	I
<i>Thymus pulegioides</i>	companion species	I

termedio-repentis, *Molinio-Arrhenatheretea*, *Koelerio glaucae-Corynepherea canescentis*, *Rhamno-Prunetea*, *Vaccinio-Piceetea* and *Salicetea purpureae*. This syn-anthropic community consisted mostly of 14 *Artemisietea vulgari* plant species, including *Melilotus alba*, *M. of-*

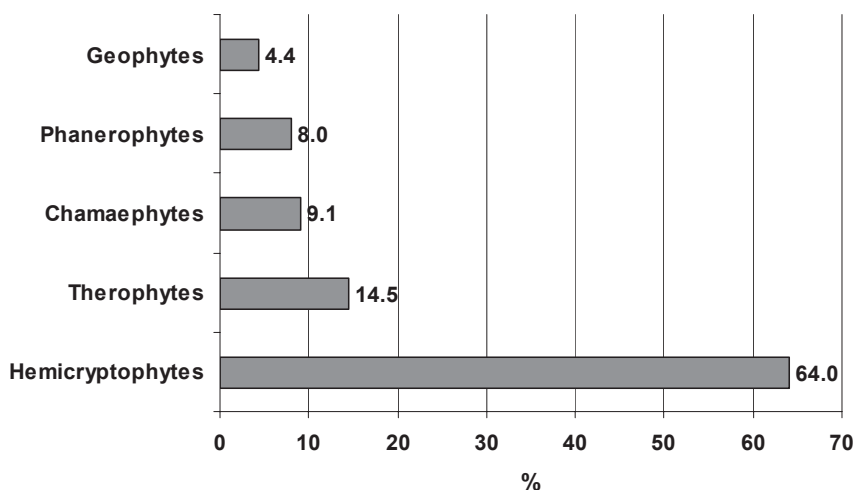


Fig. 2. Percentage cover of plants according to life-forms.

ficinalis, *Tanacetum vulgare* and *Artemisia vulgaris* (Table 1). However, of these, *Melilotus alba* and *M. officinalis* provided the highest frequency in the entire vegetation.

The five living plant-forms identified were hemi-cryptophytes, therophytes, phanerophytes, chamaephytes and geophytes. It was further noted that the *Melilotus officinalis*, *Echium vulgare*, *Oenothera biennis*, *Calamagrostis epigejos* and *Plantago major* species of hemi-cryptophytes dominated the embankment along the railway line. The 64% hemi-cryptophytes cover was the highest in this study area. The therophytes present were mostly common plant species in the *Artemisietea vulgaris* class, and these included *Geranium robertianum*. Chamaephytes (9.1), phanerophytes (8%) and geophytes (4.4%) registered the lowest cover of the five living plant forms identified along the railway line. The Phanerophytes were represented by *Pinus sylvestris*, *Populus alba* and *Rosa canina* (Fig. 2).

Most plants found on these examined embankments exhibited considerable requirements regarding lighting factors, and they preferred fresh sites with soils characterized by a neutral reaction (X-index value) and neutral nitrogen availability (X-index value).

Full and moderate light-requiring plants dominated along the railway line, with a 7, 8 or 9 index value. These included *Melilotus officinalis*, *Daucus carota*, *Trifolium repens*, *Oenothera biennis*, and *Achillea millefolium* (Fig. 3).

Plants which preferred shady sites had the lowest cover in the herb layer, with a 1, 2 or 3 index value. The identified vegetation on the embankments consisted mainly of plant species which prefer a fresh site (23.5%), where *Achillea millefolium*, *Ballota nigra*, *Dactylis glomerata* and *Vicia tetrasperma* were noted (Fig. 4).

Plants neutral in acidity and nitrogen index dominated this study area (Figs 5, 6). The percentage coverage of the neutral plant species, including *Artemisia vulgaris*, *Ballota nigra*, *Calamagrostis epigejo* and *Echium vulgare*, had the highest acidity index along the railway-line

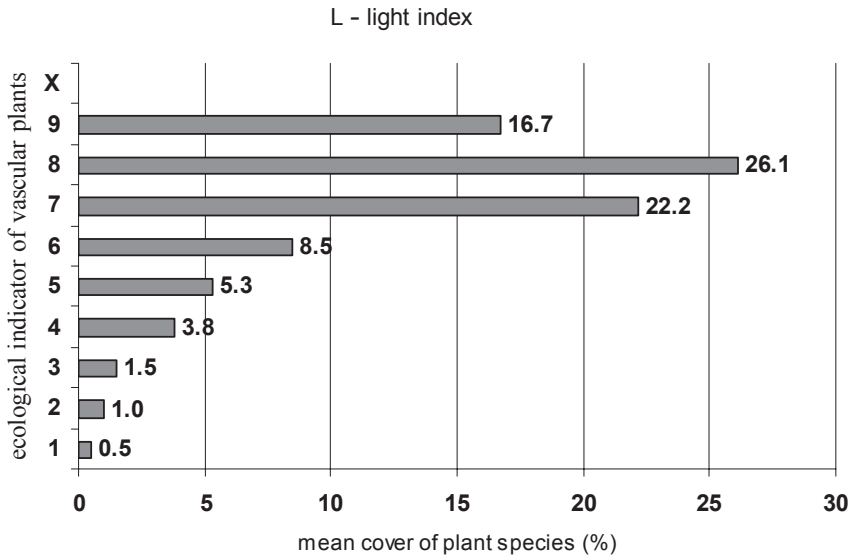


Fig. 3. Mean cover of plant species depend of light condition.

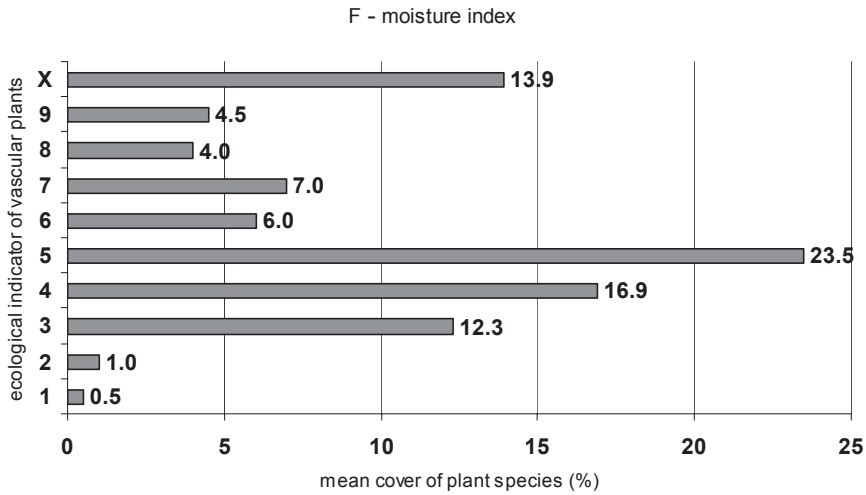


Fig. 4. Mean cover of plant species depend of moisture condition.

embankment with 51% (Fig. 5). Meanwhile, *Melilotus officinalis*, *Pinus sylvestis*, *Trifolium pretense* and *Rosa canina* preferred neutral nitrogen availability (Fig. 6).

Natural habitats are strongly influenced by human activities, and most railway areas remain continuously modified in this way. These types of habitats are very common for syn-anthropical plants.

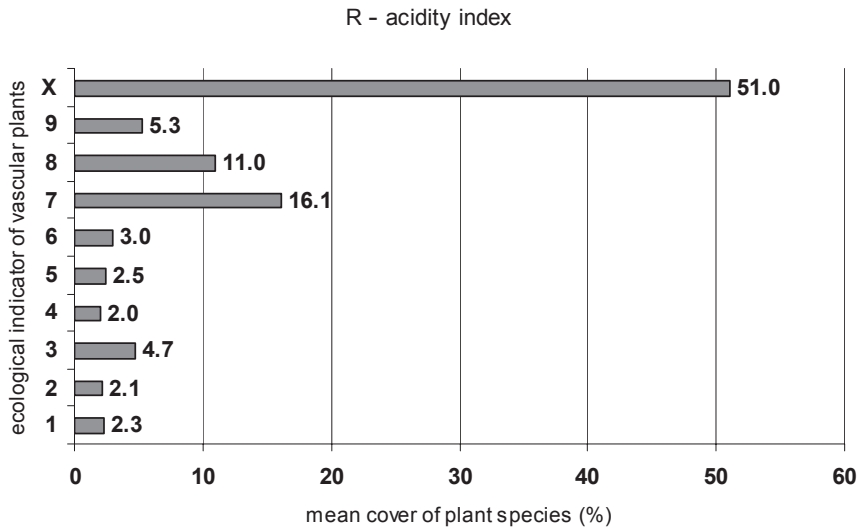


Fig. 5. Mean cover of plant species depend of acidity condition.

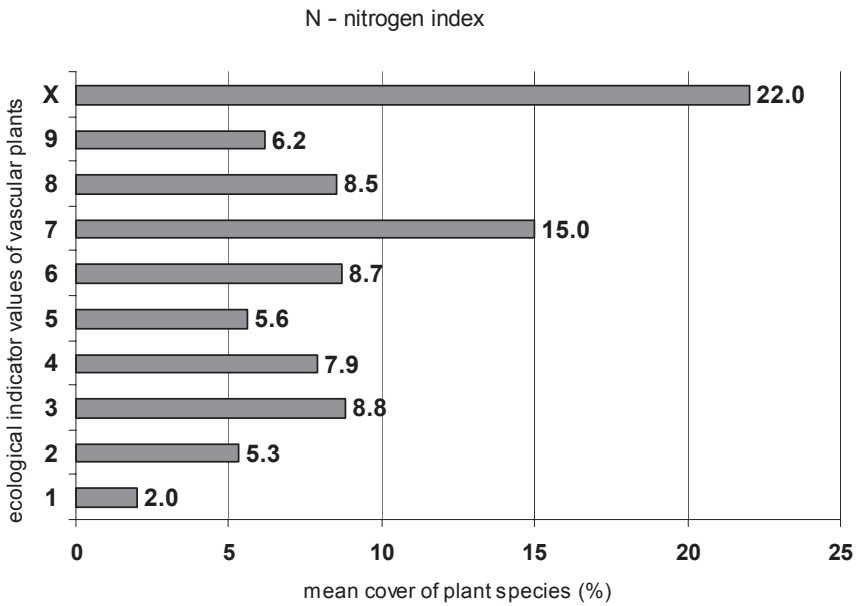


Fig. 6. Mean cover of plant species depend of nitrogen condition.

This railway terrain's habitat-specificity favours the appearance and spread of many interesting species. Destruction of vegetation in the vicinity of railway-lines and their sidings creates open localities lacking competition for newcomers from native flora. Despite the

favourable habitat conditions, few introduced species flourish successfully and the majority appear ephemerically and later disappear (Piskorz, Czarna, 2006). Many authors, including Kryszak et al. (2006), have observed syn-anthropical plant domination up to 93.1% along railway-line embankments. These plants prefer full, moderate light and soil with neutral acidity. These same results were observed on the railway-line near Sokołów-Podlaski in 2010, and again in this study area. Grasses and forest plants also occur along railway-line embankments. From the floral and phyto-sociological aspects, plant species' diversity on railway-line embankments depends on succession processes and on the surrounding areas (Brandes, 2001; Kryszak et al., 2006; Święs, Majkut, 2006; Fornal-Pieniak, Wysocki, 2010). In all, 181 species were observed growing spontaneously on Lüchow railway-station sidings (Brandes, 2001), which was more than the 35 identified in Tarnów. This was due to succession process time, since Lüchow station was closed in 1976. The spectrum of living forms indicates the greater participation of hemi-cryptophytes and therophytes. Hemi-cryptophytes have dominated many railway lines in the Lüchow area (Brandes, 2001), Sokołów Podlaski (Fornal-Pieniak, Wysocki, 2010), and also in Tarnów, with participation ranging from 41.5 to 65.7%.

Conclusion

1. Plants from the *Artemisietea vulgaris* class, which are characteristic in areas of human activity, dominated this study area.
2. Hemi-cryptophytes and therophytes had the highest percentage cover along the railway-line embankment.
3. The percentage cover of the plant species occurring here depended on the environmental conditions, including the moisture, acidity and nitrogen content which were available in this study area.

*Translated by the authors
English corrected by R. Marshall*

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