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SEGETAL FLORA OF THE WIGRY NATIONAL PARK

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Abstract

Segetal flora of the Wigry National Park (Poland) was studied in the period 2008-2010 within an area occupied by 33 villages. The analysis was based on 195 phytosociological relevés taken in fields of cereal crops, root plants and in stubble fields. The total number of species recorded in agrocenoses was 181 and they represented 36 botanical families. The most numerous families were Asteraceae, Fabaceae and Brasicaceae. The segetal flora of the Wigry National Park included mostly native species of apophytes (53.6%) that predominated over anthropophytes. Among apophytes, meadow apophytes (35 species) and those from waterside habitats (26 species) were noted most often, archaeophytes (74 species) were predominant among anthropophytes, while epecophytes (9 species) and ergasiophytes (1 species) were much less abundant. Among the life forms analysed, therophytes (61.9%) predominated over hemicryptophytes (27.1%) and geophytes (11%). The number of short-lived species in the flora of this Park was much greater (68.5%) than that of perennial ones (31.5%). The flora of the Park included 31 rare species classified in different categories of threat. Among them, *Centaurium pulchellum* and *Centaurium erythraea* belong to fully protected species (Dz.U. (Polish Journal of Laws) 2004 No. 168, item 1764).

Key words: segetal flora, anthropophytes, apophytes, rare species, Wigry National Park.

INTRODUCTION

The process of recession of many species has been observed in Poland for many years (Zarzycki and Kaźmierczakowa, 1993). It is also known to relate to a numerous group of segetal weeds (Warcholińska, 1994a). Within the framework of a general strategy for nature conservation (Liro, 2002; Programme Document of the Environmental Protection Ministry, 2003), the most valuable components of agrocenoses are also protected. It seems that the protection of segetal weeds can be highly successful in national or landscape parks. Only a few reports have been devoted to the flora of agriculturally used fields within the areas of national parks or their protected zones (Trąba and Ziemińska, 1998; Jędruszczak and Owczarczuk, 2006; Sołtys, 2006). In legally protected areas, crop fields are generally small and cultivated using traditional methods. They usually interact with plant communities characteristic of marshy, meadow, sward, forest and shrub habitats, which significantly enriches the flora of agrocenoses and allows conservation of a large group of weeds classified as rare at the regional or national level (Korniak, 1998; Warcholińska, 1994a). Agrophytocenoses are important components of the landscape of many national parks and occupy from 5% to about 35% of their area (Bomanowska, 2006; Ratuszniak and Sobisz, 2006; Sołtys, 2006).

As yet, no detailed study on segetal flora in the area of the Wigry National Park (WNP) has been performed, although much attention has been devoted to the plants from natural habitats (Sokołowski, 1996). Segetal vegetation has been studied on a wide scale over the whole region of north-eastern Poland (Korniak, 1992, 1998).

The main aim of the study was to determine the present state of segetal vegetation in the area of the Wigry National Park and its buffer zone. In particular, the study was undertaken to identify segetal flora species segetal flora most valuable for the region and the country, to find the sites of populations of rare and threatened species and to estimate their abundance.

THE STUDY AREA

The Wigry National Park was founded in 1989 in order to protect a valuable complex of lakes and forest ecosystems in the area of the former landscape park. WPN is located in the south-eastern part of the Suwałki administrative unit. The park includes the northern part of the Augustów Primeval Forest, which is the largest compact forest complex in European Lowlands. According to the physiographic division (Kondracki, 2002), the Park's area comprises parts of three mesoregions: Western Suwałki Lake District, Eastern Suwałki Lake District and Augustów Plain. Together with the buffer zone, the Park spreads between 53°57' and 54°10' north latitude and 22°57' and 23°15' east longitude.

The area of the Park is 15,085.5 ha, of which the greatest part is covered with forests – 9,464.5 ha (65.7%), while water occupies 2,907.2 ha (19.3%) and agriculturally used land occupies 2 228 ha (14.8%). The area of the buffer zone is 11,283.8 ha (Danowski et al. 2003). As far as morphology is concerned, the Park's terrain is much diversified and it formed as a result of Vistulian glaciation. To the north of Lake Wigry, there are hills of terminal moraines and pressed moraines cut across with many river valleys and lakes, while in the southern part gently rolling sandur plains are predominant.

The Park area lies in the middle part of the Czarna Hańcza River and belongs to the catchment area of the Niemen River, in the range of continental climate. It is the coolest part of Poland; the growing period lasts 175 days and the period with no ground frost is 30 days shorter than in central Poland. Mean annual precipitation is 650 mm.

The soils in the Park area, formed from young glacier sedimentary rocks, are not very diverse. The largest area is covered with brown soils and pararendzinas characterised by a high content of calcium carbonate and skeleton particles, while podsolic soil as well as lessives and silt-peat soils are rare. A considerable part of the area covered by such soils is overgrown with natural vegetation and the soil in arable fields belongs to the poorest agricultural soil complexes. The soils ensuring higher production of the very good rye complex, good wheat complex and cereal-fodder strong complex are found mostly in the central part of the Park, for instance near the villages of Leszczewo, Leszczewek, Magdalenowo, Mikołajewo, Czerwony Folwark, Rosochaty Róg, and Maćkowa Ruda.

MATERIALS AND METHODS

The study on the segetal flora of the Wigry National Park and its agriculturally used buffer zone, whose results are presented in this paper, was conducted in the period 2008-2010. Within the area occupied by 33 villages (see Fig. 1), a series of 195 phytosociological relevés were taken in agrocenoses of cereals and root plants according to the well-known Braun-Blanquet method (Pawłowski, 1972) as well as a large number of floristic lists were made.

The taxonomic system of species followed Rutkowski (2007), while the nomenclature was adopted from Mirek et al. (2002). Using the studies of Kornaś (1968), Korniak (1992), Jackowiak (1990), Zając E.U. and Zając A. (1975, 1992), Zając A. (1979) Zając et al. (1998) and Rutkowski (2007), a detailed analysis of the specimens was made taking into account the following criteria (see Table 1):

- persistence (S – short lived, P – perennials)
- life form according to Raunkiaer (Ch – chamaephytes, H- hemicryptophytes, G – geophytes, T – therophytes)
- geographic-historical group (A – apophytes: m – meadow, w – waterside, ps – psammophilous sward, x – xerothermic sward, f – forest, s – shrub; Ar – archaeophytes, Ep – epecophytes, Er - ergasiophygophytes)
- frequency of occurrence species according to conventional frequency scale (1,2 localities – very rare; 3-7 localities – rare, 8-17 – frequent, 18-23 – common)
- category of threat (Korniak, 1998; Warcholińska, 1994; Zarzycki and Szeląg, 2006) (E – endangered with extinction, V – vulnerable, R – rare, I – indeterminate category of threat).
- conservation status according to the Decree of the Environmental Protection Minister of July 28th, 2004.

The distribution of sites the most interesting species in the investigated area is given in Fig. 5.

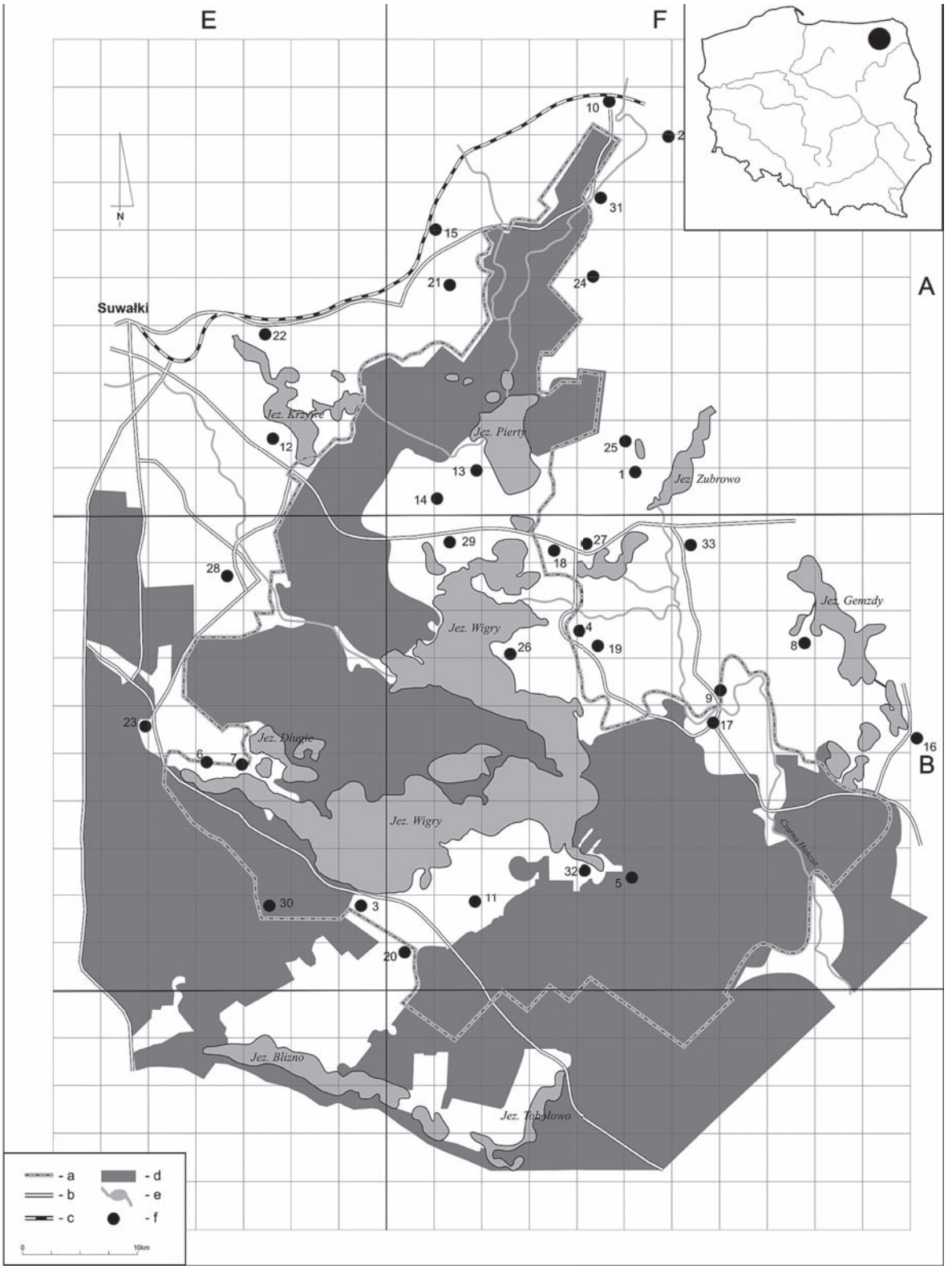

Fig. 1. The study area

a – borders of the Wigry National Park; b – road; c – railway; d – forest complexes; e – water, f – localities, study sites. 1 Aleksandrowo, 2. Bobrowisko, 3. Bryzgel, 4. Czerwony Folwark, 5. Czerwony Krzyż, 6. Gawrych Ruda, 7. Gaworzec, 8. Gremzdy Polskie, 9. Gremzdówka, 10. Kaletnik, 11. Krusznik, 12. Krzywe, 13. Leszczewo, 14. Leszczewek, 15. Lipniak, 16. Jeziorki, 17. Maćkowa Ruda, 18. Magdalenowo, 19. Mikołajewo, 20. Mońkinie, 21. Nowa Wieś, 22. Okuniowiec, 23. Płociczno, 24. Piotrowa Dąbrowa, 25. Ramienkiń26. Rosochaty Róg, 27. Ryżówka, 28. Sobolewo, 29. Stary Folwark, 30. Tartak, 31. Wiatrołuża 32. Zakąty, 33. Żubrówka Nowa

Table 1.
Systematic list of species and characteristics of segetal flora of the Wigierski National Park

Species	Geographic--historical groups	Persi-stence	Life--form	Frequency occurrence	Rare and critically endangered species in Poland		Pro-tected species	Regio-nally rare in N-E Poland
					1	2	3	4
Equisetaceae								
1. *Equisetum arvense* L.	Am	P	G	common				
2. *E. sylvaticum* L.	Am	P	G	frequent				
Urticaceae								
3. *Urtica urens* L.	Ar	S	T	very rare				
Polygonaceae								
4. *Rumex crispus* L.	Am(w)	P	G	very rare				
5. *R. acetosella* L.	Aps	P	G	frequent				
6. *R. acetosa* L.	Am	P	H	rare				
7. *Polygonum amphibium* L.	Aw	P	G	very rare				
8. *P. persicaria* L.	Aw	S	T	frequent				
9. *P. lapathifolium* L. subsp. *pallidum* / With./ Fr.	Aw	S	T	common				
10. *P. lapathifolium* L. subsp. *lapathifolium*	Aw	S	T	common				
11. *P. hydropiper* L.	Aw	S	T	rare				
12. *P. aviculare* L.	Aw	S	T	frequent				
13. *P. minus* Huds.	Aw	S	T	rare				
14. *Fallopia convolvulus* /L./A. Löve	Ar	S	T	common				
15. *Fagopyrum tataricum* L.	Er	S	T	very rare				
Chenopodiaceae		S						
16. *Chenopodium polyspermum* L.	Aw	S	T	rare	I			I
17. *Ch. album* L.	Aw	S	T	common				
18. *Atriplex patula* L.	Ar	S	T	rare				
Amaranthaceae		S						
19. *Amaranthus retroflexus* L.	Ep	S	K	rare				
20. *A. lividus* L.	Ep	S	T	very rare				
Caryophyllaceae		S						
21. *Arenaria serpyllifolia* L.	Ax	S	T	common				
22. *Stellaria media* /L./ Vill.	Am (f)	S	T	common				
23. *S. graminea* L.	Am	P	H	rare				
24. *Cerastium arvens*e L.	Aps	P	H(Ch)	rare				
25. *C. holosteoides* Fr. Em. Hyl.	Am	S	H	rare				
26. *Sagina procumbens* L.	Am(w)	P	H	rare				
27. *Scleranthus annuus* L.	Ar	S	T	frequent				
28. *Herniaria glabra* L.	Aps	S	T	rare	I			I
29. *Spergula arvensis* L.	Ar	S	T	frequent				
30. *Spergularia rubra* /L./J. Presl et C. Presl	Aw	S	T	rare				I
31. *Agrostemma githago* L.	Ar	S	T	frequent	V			V
32. *Melandrium album* /Mill./ Garcke	Am	S	T	frequent				
33. *M. noctiflorum* (L.) Fries	Ar	S	T	frequent	I			

34. *Silene vulgaris* (Moench) Garcke	Aw	S	T	rare			
35. *Gypsophila muralis* L.	Aw	S	T	rare			R
Ranunculaceae		S					
36. *Myosurus minimus* L.	Aw	S	T	rare	I	V	I
37. *Consolida regalis* Gray	Ar	S	T	frequent	I		
38. *Ranunculus repens* L.	Am (w)	P	H	frequent			
Papaveraceae							
39. *Papaver argemone* L.	Ar	S	T	rare	V		
40. *P. dubium* L.	Ar	S	T	rare	I		
41. *P. rhoeas* L.	Ar	S	T	rare	I		
Fumariaceae		S					
42. *Fumaria officinalis* L.	Ar	S	T	frequent	I		
Brassicaceae		S					
43. *Sisymbrium officinale* /L./ Scop.	Ar	S	T	rare			
44. *Descurainia sophia* /L./ Webb ex Prantl	Ar	S	T	rare			
45. *Erysimum cheiranthoides* L.	Ar	S	T	frequent			
46. *Arabidopsis thaliana* /L./ Heynh.	Aps	S	T	very rare			
47. *Sinapis arvensis* L.	Ar	S	T	frequent	I		
48. *Erophila verna* /L./ Chevall.	Aps	S	T	very rare			
49. *Camelina microcarpa* Andrz	Ax	S	T	rare	V		V
50. *Neslia paniculata* (L.) Desv.	Ar	S	T	frequent	I		
51. *Capsella bursa-pastoris* /L./ Medik.	Ar	S	T	common			
52. *Thlaspi arvense* L.	Ar	S	T	frequent			
53. *Armoracia rusticana* P.Gaertn.,B.Mey. et Scherb.	Ar	P	G	very rare			
54. *Cardaminopsis arenosa* /L./ Hayek	Aps	S	H	rare			
55. *Raphanus raphanistrum* L.	Ar	S	T(H)	frequent			
56. *Berteroa incana* (L.) DC.	Ar	S	T(H)	rare			
57. *Rorippa sylvestris* (L.) Besser	Aw	P	H	rare			
58. *R. palustris* (L.) Besser	Aw	S	G(H)	rare			
Rosaceae							
59. *Potentilla anserina* L.	Am	P	H	frequent			
60. *P. reptans* L.	Af	P	H	frequent			
61. *P. norvegica* L.	Af	P	H	rare			
62. *Geum urbanum* L.	Af	P	H	very rare			
Fabaceae							
63. *Vicia sativa* L.	Ar	S	T	rare			
64. *V. angustifolia* Scop.	Ar	S	T	frequent			
65. *V. hirsuta* /.L/ S.F. Gray	Ar	S	T	common			
66. *V. tetrasperma* L.	Ar	S	T	frequent			
67. *V. villosa* L.	Ar	S	T	frequent			
68. *V. cracca* L.	Am	P	H	rare			
69. *Lathyrus pratensis* L.	Am	P	H	rare			
70. *L. tuberosus* L.	Ar	P	G	very rare	R		R
71. *Melilotus alba* Medik.	Ar	S	H	frequent			
72. *Medicago lupulina* L.	Ax	S	T(H)	rare			

73. *Trifolium arvense* L.	Aps	S	T	rare			
74. *T. dubium* Sibth.	Am	S	T	rare			
75 *T. repens* L.	Am	P	H	frequent			
76 *T. pratense* L.	Am	S	T	rare			
77. *T. hybridum* L.	Am	P	H	rare			
78. *T. medium* L.	Az	P	H	rare			
79. *T. montanum* L.	Az	P	H	rare			
80. *Anthyllis vulneraria* L.	Ax	P	H	very rare			
81. *Lotus corniculatus* L.	Am	S	T	rare			
Oxalidaceae							
82. *Oxalis fontana* Bunge	Ep	P	G	frequent			
Geraniaceae							
83. *Geranium dissectum* L.	Ar	S	T	very rare	V		I
84. *G. pusillum* Burm. F. ex L.	Ar	S	T	common			
85. *Erodium cicutarium* /L./ L	Ar	S	T (H)	frequent			
Euphorbiaceae		S					
86. *Euphorbia peplus* L.	Ar	S	T	very rare			
87. *E. helioscopia* L.	Ax	P	G (H)	frequent			
88. *E. esula* L.	Ax	S	T	very rare			
Malvaceae		S					
89. *Malva neglecta* Wallr.	Ar	S	T	very rare			
90. *M. alcea* L.	Ar	S	H	very rare			
Clusiaceae							
91. *Hypericum perforatum* L.	Am	P	H	rare			
Violaceae							
92. *Viola arvensis* Murray	Ar	S	T	common			
93. *V. tricolor* L.	Ar	S	T	rare			R
Onagraceae							
94. *Epilobium parviflorum* Schreb.	Aw	P	H	frequent			
95. *E. roseum* Schreber	Aw	P	H	rare			
Apiaceae							
96. *Pimpinella saxifraga* L.	Am	P	H	rare			
97. *Aethusa cynapium* L.	Ar	S	T	frequent	I		I
98. *Torilis japonica* (Houtt.) DC	As	S	T (H)	very rare			
99. *Daucus carota* L.	Ar	S	T	frequent			
Primulaceae		S					
100. *Anagallis arvensis* L.	Ar	S	T	frequent			
101. *Lysimachia nummularia* L.	Am	P	G	rare			
102. *Centunculus minimus* L.	Ar	S	T	very rare	V		V
Gentianaceae		S					
103. *Centaurium erythraea* Rafn	Am	S	H	very rare		Rc	
104. *C. pulchellum* (Sw.) Druce	Aw	S	T	very rare	V	Rc	V
Rubiaceae		S					
105. *Galium aparine* L.	Af	S	T	common			
Convolvulaceae							
106. *Convolvulus arvensis* L.	Ax	P	G	common			
107. *Cuscuta europaea* L.	Ar	S	T	very rare	V		V

Boraginaceae							
108. *Lithospermum arvense* L.	Ar	S	T	rare			
109. *Echium vulgare* L.	Ar	S	H	frequent			
110. *Anchusa arvensis* (L.) M. Bieb.	Ar	S	H	frequent			
111. *Anchusa officinalis* L.	Ar	S	H	frequent			
112. *Myosotis arvensis* /L./ Hill.	Ar	S	T	frequent			
113. *M. stricta* Link ex Roem. et Schult.	Aps	S	T	very rare			
114. *Asperugo procumbens* L.	Ep	S	T	very rare	V	E	V
Solanaceae		S					
115. *Solanum nigrum* L. em. Mill.	Ar	S	T	frequent			
Scrophulariaceae							
116. *Linaria vulgaris* Mill.	Aps	P	G	rare			
117. *Chaenorhinum minus* /L./ Lange	Ax	S	T	frequent	R		R
118. *Veronica serpyllifolia* L.	Am	P	H	rare			
119. *V. arvensis* L.	Ar	S	T	common			
120. *V. opaca* Fr.	Ar	S	T	rare	V		
121. *V. persica* Poir.	Ep	S	T	frequent			
122. *V. agrestis* L.	Ar	S	T	rare	I		
123. *Rhinanthus serotinus* (Schönh.) Oborný	Ar	S	T	frequent			
Lamiaceae							
124. *Scutellaria galericulata* L.	Aw	P	H	very rare			
125. *Galeopsis pubescens* Besser.	Af	S	T	rare			
126. *G. tetrahit* L.	Af	S	T	common			
127. G. bifida Boenn.	Af	S	T	rare			
128. *Stachys annua* (L.) L.	Ar	S	T	frequent	V		V
129. *S. palustris* L.	Af	P	G	frequent			
130. *Glechoma hederacea* L.	Am	P	H	rare			
131. *Prunella vulgaris* L.	Am	P	H	rare			
132. *Lamium purpureum* L.	Ar	S	T	common			
133. *L. amplexicaule* L.	Ar	S	T	frequent			
134. *Acinos arvensis* (Lam.) Dandy	Ax	S	H	rare	I		
135. *Mentha arvensis* L.	Aw	P	H	frequent			
136. *Elsholtzia ciliata* (Thunb.) Hyl.	Ep	S	T	very rare			
Plantaginaceae							
137. *Plantago major* L.	Af	P	H	frequent			
138. *P. intermedia* Gilib.	Aw	P	H	frequent			
139. *P. lanceolata* L.	Am	P	H	frequent			
Valerianaceae							
140. *Valerianella dentata* (L.) Poll.	Ar	S	T	very rare	I		R
Dipsacaceae							
141. *Knautia arvensis* (L.)J. M. Coult.	Af	P	H	frequent			
Companulaceae							
142. *Campanula rapunculoides* L.	Ax	P	G	frequent	I		
Asteraceae							
143. *Conyza canadensis* /L./ Cronquist	Ep	S	T	common			
144. *Gnaphalium uliginosu*m L.	Aw	S	T	frequent			

145. *Bidens tripartita* L.	Aw	S	T	frequent		
146. *Galinsoga parviflora* Cav.	Ep	S	T	frequent		
147. *G. ciliata* /Raf./S.F. Blake	Ep	S	T	frequent		
148. *Anthemis tinctoria* L.	Ar	S	H	frequent	R	
149. *Anthemis arvensis* L.	Ar	S	T	common		
150. *Achillea millefolium* L.	Am	P	H	frequent		
151. *Chamomilla recutita* /L./ Rauschert	Ar	S	T	rare		
152. *Matricaria maritima* L. subsp. *inodora* /L./ Dostal	Ar	S	T	frequent		
153. *Artemisia vulgaris* L.	Am(w)	P	H	rare		
154. *Tussilago farfara* L.	Am	P	G	rare		
155. *Senecio vulgaris* L.	Ar	S	T (H)	rare		
156. *Arctium lappa* L.	Af	S	H	rare		
157. *Cirsium arvens*e /L./ Scop.	Af	P	G	common		
158. *Centaurea cyanus* L.	Ar	S	T	frequent		
159. *Cichorium intybus* L.	Ar	P	H	rare		
160. *Leontodon autumnalis* L.	Am	P	H	frequent		
161. *Sonchus oleraceus* L.	Ar	S	T (H)	frequent		
162 *S. asper* /L./ Hill	Ar	S	T	rare		
163. *S. arvensis* L.	Ar	P	H	frequent		
164. *Lactuca serriola* L.	Ar	S	H	rare		
165. *Taraxacum officinal*e F.H. Wigg.	Am	P	H	frequent		
166. *Lapsana communis* L.	Af	S	T (H)	frequent		
Juncaceae						
167. *Juncus bufonius* L.	Aw	S	T	frequent		
Cyperaceae						
168. *Carex hirta* L.	Am	P	G	rare		
Poaceae						
169. *Lolium perenne* L.	Am	P	H	frequent		
170. *Poa annua* L.	Am	S	T	common		
171. *Apera spica-venti* (L.) P. Beauv.	Ar	S	T	frequent		
172. *Bromus secalinus* L.	Ar	S	T	frequent	V	V
173. *Elymus repens* (L.) Gould.	Aw	P	G	common		
174. *Avena strigosa* Schreber	Ar	S	T	frequent	E	
175. *A. fatua* L.	Ar	S	T	frequent		
176. *Agrostis gigantea* Roth.	Am	P	H	frequent		
177. *Phragmites australis* (Cav.) Trin. ex Steud.	Aw	P	G	rare		
178. *Echinochloa crus-galli* /L./P. Beauv.	Ar	S	T	frequent		
179. *Digitaria ischaemum* /Schreb./ H.L. Muhl.	Ar	S	T	frequent		
180. *Setaria viridis* (L.)P.B.	Ar	S	T	frequent		
181. *S. pumila* /Poir./ Poem et Schult.	Ar	S	T	frequent		

Explanations: Ar – archaeophytes, Ep – epecophytes, Kn – kenophytes, A - Apophytes: m – meadow, w – waterside, ps – psammophilous sward, x – xerothermic sward, f – forest, s – shrub; S – short-lived, P – perennials, T – therophytes, H – hemicryptophytes, G – geophytes, Ch – chamaephytes,
1-Polish red list of segetal weeds, Warcholińska 1994, 2- Polish red list of vascular plants, Zarzycki and Szeląg 2006, 3 Conservation status 2004, 4- N-E Poland Korniak 1998. E – critically endangered R – rare, V – vulnerable, I – taxa of indeterminate category of threat. Rc- legal status – full protection.

RESULTS

The segetal flora of the Wigry National Park was found to comprise 181 species of vascular plants representing 125 genera and 36 botanic families. The majority (62%) of the flora represent 7 most abundant families of which the most richly represented were: Asteraceae (24 species and 20 genera), Fabaceae (19 species and 6 genera) and Brasicaceae (16 species and 15 genera). Over half of the species identified was found to be very rare or rare (102-56%). These were mostly the species coming from the neighbouring forest and meadow or ruderal communities, such as: *Pimpinella saxifraga*, *Rumex acetosa, Stellaria graminea, Lathyrus pratensis, Torilis japonica*. As far the conservation status is concerned, endangered species (Rc) such as: *Centaurium erythraea, Centaurium pulchellum* and those on the national red lists of vulnerable species: *Lathyrus tuberosus, Geranium dissectum, Centunculus minimus* and others, were also rarely found. Typical weeds accompanying field crops, which are eurytopic taxa such as: *Matricaria maritima* subsp. *inodora, Centaurea cyanus, Echinochloa crus-galli, Polygonum aviculare,* were frequently encountered. Troublesome field weeds represented by 21 species and accounting for 11.6% of the segetal flora of the Park, such as: *Chenopodium album, Polygonum lapathifolium* subsp. *lapathifolium, Fallopia convolvulus, Stellaria media, Viola arvensis, Cirsium arvense, Elymus repens* and others were also frequent.

Analysis of the proportions of geographical-historical groups in the segetal flora of the Park revealed the predominance of native species and apophytes (96 species making up 53.6% of the flora) over anthropophytes (Fig. 2). Species diversity of the apophytes reflects the habitat conditions of the area studied. The dominant species are apophytes of meadow habitats (35 species) and waterside habitats (26 species). The proportion of apophytes originating from forest and shrub habitats is also significant – 16 species. The other apophytes found were characteristic of xerothermic grassland (11 species) and psammophylous grassland (9 species) (Fig. 3). Common apophytes are, e.g., *Equisetum arvense, Polygonum lapathifolium* subsp. *lapathifolium, Arenaria serpyllifolia*, whereas *Herniaria glabra, Arabidopsis thaliana, Gypsophila muralis* and others are met much less frequently.

Among anthrophytes, the most numerous group is that of archaeophytes (74 species), including troublesome weeds such as *Viola arvensis, Anthemis arvensis, Cirsium arvense*, as well as all protected, rare and threatened species in the country, such as: *Agrostemma githago, Papaver argemone, Neslia paniculata, Centunculus minimus.* The percentage of kenophytes is low (5.5% of the flora); they are mainly represented by epecophytes (9 species) of which *Oxalis fontana, Veronica persica*, *Conyza canadensis* and *Galinsoga parviflora* are the most frequently noted and which locally can be a threat to field crops. Ergasiophygophytes are represented only by *Fagopyrum tataricum* which is very rare in the Park area.

The segetal flora of the Wigry National Park is dominated by short-lived species (124 species, 68.5% of the flora) compared to perennial ones (57 species, 31.5%). From among the life forms analysed, terophytes (112 species, 61.9%) are predominant over hemicryptophytes (49 species, 27.1%) and geophytes (20 species, 11%) (Fig. 4).

The flora of the Park's phytoagrocenoses includes 31 valuable species representing the conservation status of endangered, rare and legally protected species. On the basis of the red list of segetal species threatened in our country (Warcholińska, 1994; Zarzycki and Szeląg, 2006), 30 species representing four categories of conservation status were identified:

- E – (endangered) – *Asperugo procumbens, Avena strigosa*
- V – (vulnerable) – *Agrostemma githago, Bromus secalinus, Camelina microcarpa, Centunculus minimus, Centaurium pulchellum, Cuscuta europaea, Geranium dissectum, Papaver argemone, Stachys annua*,*Veronica opaca*.
- R – (rare) – *Anthemis tinctoria, Chaenorhinum minus, Lathyrus tuberosus.*
- I – (indeterminate category of threat) – *Aethusa cynapium ssp. agrestis, Acinos arvensis, Campanula rapunculoides, Chenopodium polyspermum, Consolida regalis, Fumaria officinalis, Herniaria glabra, Melandrium noctiflorum, Myosurus minimus, Neslia paniculata, Papaver dubium, P. rhoeas, Sinapis arvensis, Valerianella dentata, Veronica agrestis.*

Moreover, the Park's flora was found to include some species from the regional red list (Korniak, 1998), such as: *Spergularia rubra, Gypsophila muralis,* and *Viola tricolor*. *Centaurium pulchellum* and *Centaurium erythraea* are fully protected species (Dz.U. (Polish Journal of Laws) 2004 No. 168, item 1764) that are encountered very rarely in the area studied.

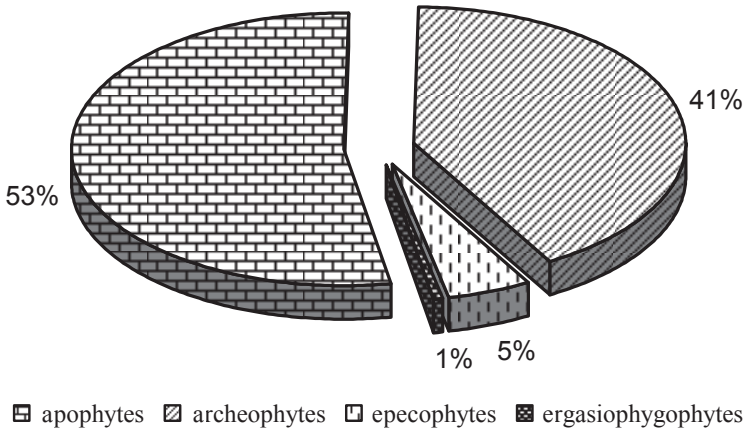

Fig. 2. Proportions of geographical-historical groups in the segetal flora in the area of the Wigry National Park.

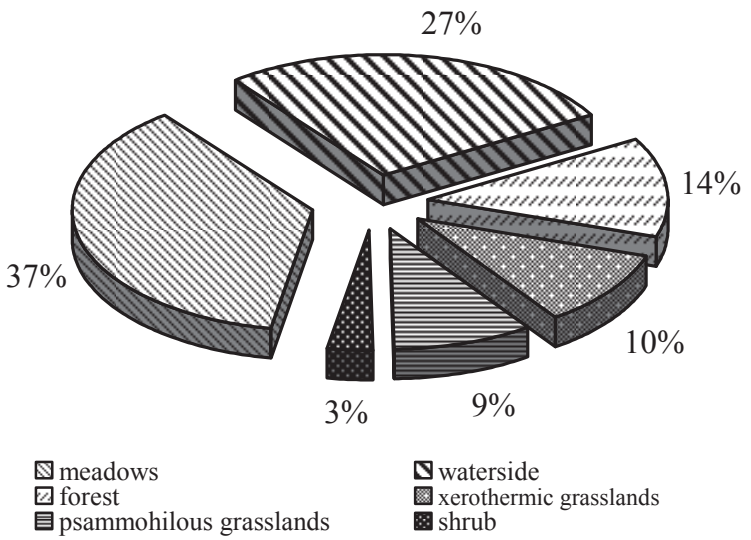

Fig. 3. Origin of apophytes in the segetal flora in the area of the Wigry National Park.

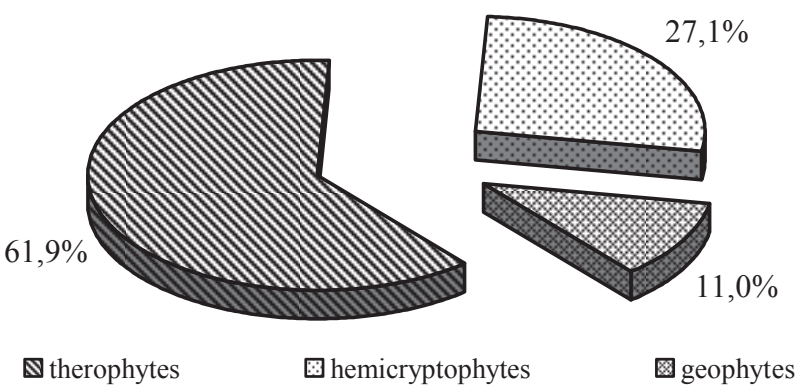

Fig. 4. Proportions of different biological forms in the segetal flora in the area of the Wigry National Park.

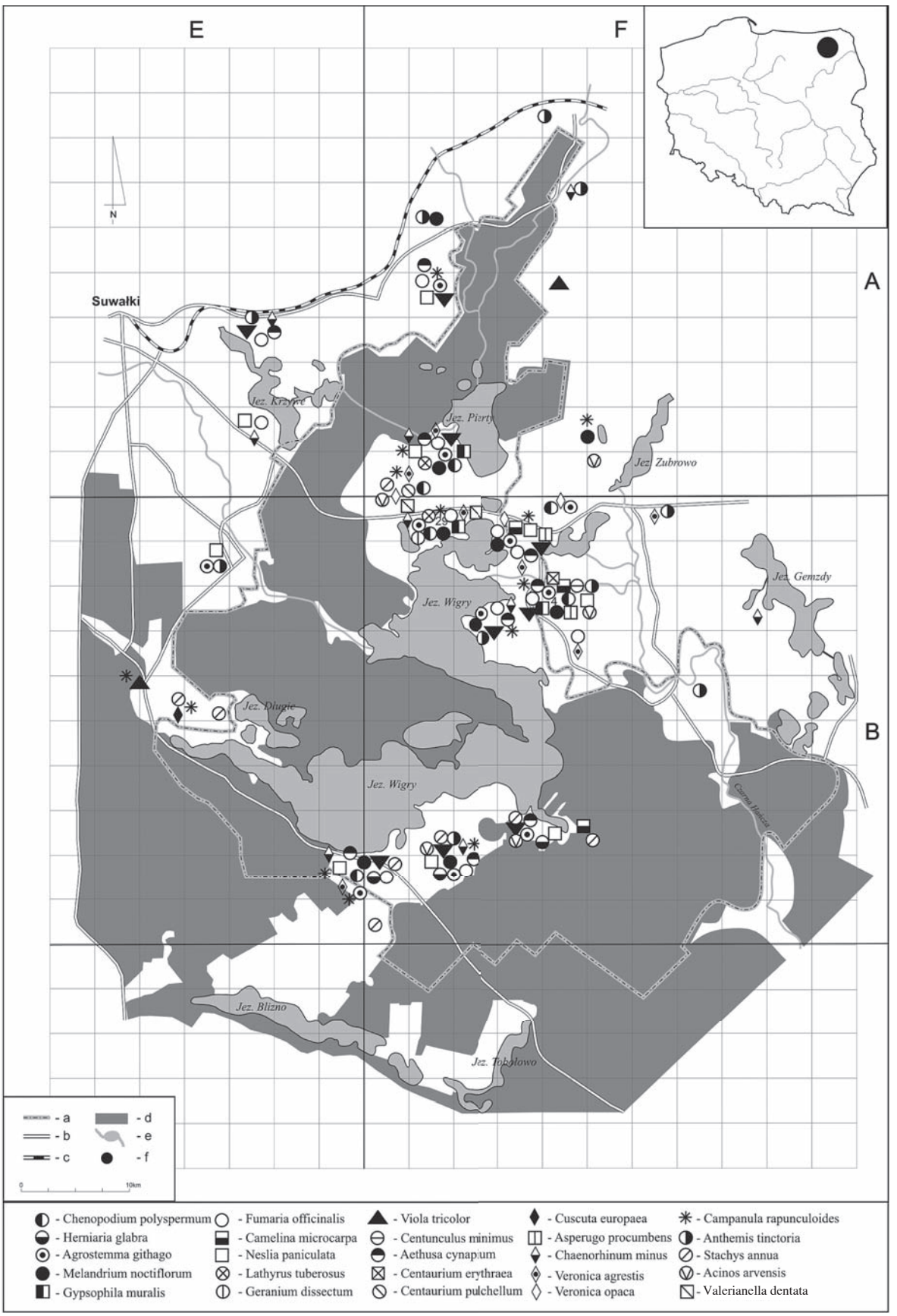

Fig. 5. Occurrence of rare species of the segetal flora within the borders of the Wigry National Park.

DISCUSSION

The segetal flora of the Wigry National Park accounts for 51% of the flora of agrocenoses of north-eastern Poland (Korniak, 1992). Taking into account the small area occupied by agrocenoses in the Park and its buffer zone, it can be considered to be rather rich. The richness is mostly a consequence of the specific character of agriculture in the area (arable fields are usually small and tilled in a traditional way) and the diverse mosaic landscape of the Park related to diverse ecological potential of the field habitats. Such a specific form of agricultural land use is assumed by the National Strategy of Protection and Moderate Use of Biological Diversity as one of the measures aimed at conservation of the diversity of agrophytocenoses.

The main threat to segetal weeds in the protected area is cessation of agricultural use of the fields in this area. Changes in land use lead to changes in the species composition of the segetal flora and to restriction or disappearance of entire communities (Bomanowska, 2006; Sołtys, 2006).

The analysis of the segetal flora of the Wigry National Park shows that the contribution of geographically-historical groups, life forms and the persistence of species are similar to those in the majority of local segetal floras of protected areas (Bomanowska, 2006; Gołdyn et al. 2002; Hołdyński and Korniak, 1994; Ratuszniak and Sobisz, 2006; Sołtys, 2006; Ziemińska-Smyk, 2006). An interesting feature is the presence of a large group of species of different conservation status. The species from this group represent 44.3% of total species with conservation status in the region (Korniak, 1998). This group of species includes those from the national red list (Warcholińska 1994a; Zarzycki and Szeląg, 2006) and fully protected species (the Decree of the Environmental Protection Minister of July 28th, 2004).

The problem of impoverishment of segetal communities has been discussed in many papers and it concerns the flora of both protected areas (Korczyński, 2006; Rzymowska and Skrajna, 2006; Sokołowski, 1989; Sołtys, 2006) and typical agriculturally used land (Fijałkowski and Nycz, 1998; Korniak, 1992; Siciński, 2003; Warcholińska, 1994b). In view of the above and given the results of our study, it seems highly recommendable to monitor the segetal flora, in particular the rare species, in the area of the Wigry National Park in order to grasp the dynamics of changes in its structure and to conserve the species diversity of agrocenoses.

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Flora segetalna Wigierskiego Parku Narodowego

Streszczenie

Badanie flory segetalnej Wigierskiego Parku Narodowego prowadzono w latach 2008-2010 na terenie 33 miejscowości. W uprawach zbóż, okopowych i na ścierniskach wykonano 195 zdjęć fitosocjologicznych. Ogółem w agrocenozach zarejestrowano 181 gatunków, które należały do 36 rodzin botanicznych. Najliczniejsze w gatunki rodziny to Asteraceae, Fabaceae i Brassicaceae. We florze segetalnej Wigierskiego Parku Narodowego przeważają gatunki rodzime – apofity (53,6%) nad antropofitami. Wśród apofitów najczęściej notowano apofity łąkowe (35 gatunków) i siedlisk nadwodnych (26 gatunków). W grupie antropofitów dominują archeofity (74 gatunki), nad epekofitami (9 gatunków) i ergazjofitami (1 gatunek). Wśród analizowanych form życiowych przeważają terofity (61,9%) nad hemikryptofitami (27,1%) i geofitami (11%). We florze segetalnej Wigierskiego Parku Narodowego odnotowano ponad dwukrotnie więcej gatunków krótkotrwałych (68,5%), niż wieloletnich (31,5%). W badanej florze wystąpiło 31 gatunków cennych przyrodniczo, o różnych kategoriach zagrożenia. Do gatunków objętych ochroną ścisłą (Dz.U. 2004 Nr 168, poz. 1764) należą *Centaurium pulchellum i Centaurium erythraea.*