Tuexenia 7: 329–346. Göttingen 1987

Alder (Alnus glutinosa) carr in Poland

– Barbara Solińska-Górnicka –

Abstract

The paper aims at the analysis of ecological and regional variation of forest communities from the class *Alnetea glutinosae* in Poland. A previous syntaxonomical position of the association *Carici elongatae-Alnetum* has been revised. Instead, two new alder-carr associations have been described. They differ in character and differential species, with dissimilar trophic requirements. The group of species with *Sphagnum squarrosum* is differential for acidophilous bog moss alder carrs (*Sphagno squarrosi-Alnetum*), while the group of species with *Ribes nigrum* differentiates mesotrophic black-currant alder carr (*Ribo nigri-Alnetum*).

Both alder-carr associations occur throughout lowland Poland. Their floristic compositions differ regionally. Suboceanic and mid-European species grow in alder carr of western Poland, while boreal and boreocontinental species enter from the northern-east.

The studies on the regional variation are based on the analysis of distribution of differential species groups. These have resulted in the delimitation of geographical races of alder carr.

Both alder-carr associations differ from one another in their internal variation. *Sphagno squarrosi-Alnetum* varies greatly from region to region. For this association four geographical races have been distinguished. In the *Ribo nigri-Alnetum* internal trophic variation plays a more important role. Therefore, it has been divided into four subassociations and two geographical races. In central Poland black-currant alder carr occurs in a form with both geographical races but with different subassociations.

Zusammenfassung

In der vorliegenden Arbeit wird die ökologische und regionale Variabilität der Waldgesellschaften aus der Klasse *Alnetea glutinosae* in Polen analysiert. Die bisherige syntaxonomische Auffassung des *Carici elongatae-Alnetum* wird überprüft. Es ergeben sich neue Erlenbruchwald-Gesellschaften mit eigenen Kenn- und Trennarten, welche verschiedene trophische Ansprüche haben. Die Artengruppe mit *Sphagnum sqarrosum* kennzeichnet die azidophytischen Torfmoos-Erlenwälder (*Sphagno squarrosi-Alnetum*), die Gruppe mit *Ribes nigrum* die mesophytischen Schwarzjohannisbeeren-Erlenwälder (*Ribo nigri-Alnetum).*

Beide Pflanzengesellschaften kommen im ganzen polnischen Tiefland vor. Die regionalen Unterschiede in ihrer Artenzusammensetzung werden betont. In den Erlenbrüchern West-Polens sind subatlantische und mitteleuropäische Arten zu finden; vom Nordosten dringen boreale und boreokontinentale Arten ein. Die Untersuchung der regionalen Variabilität beruhte auf der Analyse der Verbreitung von Differentialartengruppen. Die Ergebnisse bilden die Grundlage für die Abgrenzung regionaler Ausbildungen.

Die innere Variabilität der zwei Bruchwald-Assoziationen ist unterschiedlich. Für das *Sphagno squarrosi-Alnetum* ist eine deutliche regionale Variabilität [mit vier Regionalausbildungen] charakteristisch. Im *Ribo nigri-Alnetum* spielt die trophische Variabilität eine größere Rolle; dieser entspricht einer Gliederung in vier Subassoziationen. Jede Subassoziation kommt in zwei Regionalausbildungen vor, die im Übergangsgebiet von Zentralpolen zusammentreffen. Sie vertreten dort jedoch verschiedene Subassoziationen.

Introduction

The studies on diversity of alder carr have aimed at the description of ecological and geographical variation of forest communities from the class *Alnetea glutinosae* in the climatically transient lowland of Poland.

In Poland, natural alder carr and its regenerative forms are encountered relatively often. Only in greatly ameliorated areas are found dessicated patches with alternated structure and alien species present. Alder-carr habitats are common in the lowlands. They occur in local land depressions, along banks of water bodies, in bog fringes and in margins of river valleys. Fen peat is the substrate in alder carr. A variable water table influences the specific floristic composition and structure of alder carr, as compared to other forest communities. Alder (*Alnus glutinosa*) is a main species in the forest stand. The ground layer is structurally complex. In hummocks, near the base of tree trunks, land plants grow, which avoid flooding. Hollows are occupied by agglomerations of swamp plants adapted to periodical changes in water level.

In Europe the first syntaxonomical approach to forest communities of the class *Alnetea glutinosae* was made by BODEUX in 1955. Among comprehensive data of different forms of alder forests the author distinguished a type of mesotrophic alder carr (*Alnetum glutinosae*). Its general description is still valid. BODEUX based his classification upon 185 relevés scattered over western and central Europe, in Baltic countries and in Scandinavia. With such a small number of relevés for area studied, geographical variation appears prominently. The author contrasted the association *Cariceto lavigatae-Alnetum* (Allorge 1922) Schwickerath 1937 from Atlantic Europe with the group of regional associations common in the rest of the investigated area. These were: *Cariceto elongatae-Alnetum medioeuropaeum* (Koch 1926) Tx. et Bodeux 1955, from central Europe; *Cariceto elongatae-Alnetum boreale* Preising et Bodeux 1955, from Baltic countries and southern Scandinavia; *Dryopterideto cristatae-Alnetum* (Nowiński 1929). Tx. et Bodeux 1955, described from Poland on scarce and fragmentary data. However, the presence of *Dryopteris cristata* proved its regional individuality. All the regional associations mentioned above were differentiated into 2 or 3 subassociations. The trophically poorest subassociations were characterized by the presence of bog mosses, the richest by the presence of meadow species and those of periodically flooded alder forests.

Syntaxonomical elaboration of alder carr within Poland by MATUSZKIEWICZ, TRACZYK and TRACZYK (1958) presents geographical variation of these communities. The analysis was based on 130 relevés. The authors have criticized the results of European synthesis concerning Poland, considering the association *Dryopterideto cristatae-Alnetum* to be insufficiently documented. They have stated that marked geographical variation enables to distinguish only a regional unit at the rank of a subassociation. Therefor, two regional subassociations were distinguished within Poland, i.e. *Carici elongatae-Alnetum medioeuropaeum* Tx. et Bodeux 1955 in the western part of the country and *C.e.-A. dryopteridetosum cristatae* (Tx. et Bodeux 1955) em. Mat. 1958 in the remaining area of lowland Poland. ELLENBERG (1978) still considers the results of the above mentioned syntaxonomical analyses to be valid.

The next classification, that of MAREK (1965), was based on 674 relevés and enabled recognition of regional individuality in alder carr of: north western, central, and north eastern Poland. He suggested to distinguish within Poland 3 regional subassociations: 1) *Carici elongatae-Alnetum periclymenosum* (with *Lonicera periclymenum*) from north-western Poland; 2) *C. e.-A. saxatilosum* (with *Rubus saxatilis*), its range corresponding to that of the North Sector; and 3) *C.e.-A. typicum*, from central Poland.

As the concept of a geographical subassociation is outdated and numerous new phytosociological data have been gathered, the former approach to the *Carici elongatae-Alnetum* should be revised. Moreover, regional subassociations of alder carr, distinguished so far, form non-homogeneous units due to the lack of analysis of habitat variation. Differential species are poorly constant, as they are spatially confined only to the given trophic form of alder carr. Geographical variation considered separately from other types of variation does not fully describe the diversity of plant communities.

The paper presents the results obtained in the studies on typology of Polish forests conducted under MATUSZKIEWICZ and continues „The phytosociological survey of forest communities in Poland". Approximately 1700 relevés were analysed. They were taken from papers published up to 1979 and from the archives of the Department of Phytosociology and Plant Ecology, Warsaw University. Information on papers with phytosociological tables and relevés of alder carr were taken from the „Phytosociological Bibliography of Poland" (MATUSZKIEWICZ 1967, 1972, 1981; MATUSZKIEWICZ and FALIŃSKI 1964; TRACZYK 1960). Nearly 30% of relevés were ignored as representing man-changed patches or successive stages towards *Circaeo-Alnetum* or *Vaccinio uliginosi Pinetum*. Finally, the synthesis was based on 1146 relevés that represent natural, dynamically stable alder carr.

Floristic grounds for the division of alder carr

The floristic composition of alder carr varies highly within Poland. Mean species numbers in various phytocenoses range from 30 to 50. Common, constant species constitute only 20–30% of the floristic composition of the analysed patches. Constant species include *Alnus glutinosa* (which builds the forest stand) and 5 character species of the class, order, and alliance, i.e. *Carex elongata, Solanum dulcamara, Lycopus europaeus, Thelypteris palustris* and *Calamagrostis canescens.* Other constant species include: *Frangula alnus, Lysimachia vulgaris, Galium palustre, Peucedanum palustre* and *Dryopteris carthusiana* – all companion species.

The floristic differences between acidophilous alder carr with bog mosses and rich alder carr with numerous eutrophic plant species are marked already at the stage of local variation. Also some authors of regional monographs (JASNOWSKI 1962; OLACZEK 1972; PALCZYŃSKI 1975) have published tables of alder carr differentiated by variable trophic conditions.

In the synoptic table of alder carr, two mutually exclusive groups of species, growing in Poland have been distinguished, i.e. a *Sphagnum squarrosum* group and a *Ribes nigrum* group. Both species are character species of the association *Carici elongatae-Alnetum* previously described. It may be inferred from the analysis of many carr relevés that *Ribes nigrum* and *Sphagnum squarrosum* occur in the same patch only exceptionally. In the patches with Sphagnum squarrosum other bog mosses also occur, especially *S. palustre,* and *Pinus silvestris* is more abundant in the forest stand. On the other hand *Ribes nigrum* is accompanied by *Iris pseudoacorus, Carex acutiformis, Urtica dioica* and *Prunus padus,* and also sometimes in the richest patches, by alder-forest species never encountered in bog-moss carr.

The division of the character species group supported by differential species has enabled me to distinguish two new associations of alder carr instead of the one previously described from Poland (the association *Crici elongatae-Alnetum* Koch 1926). These are: bog-moss carr (*Sphagno squarrosi-Alnetum* Sol.-Górn. 1975 mscr.) and black-currant carr (*Ribo nigri-Alnetum* Sol.-Górn. 1975 mscr.) (Tab. 1).

From the comparison of these results (Tab. 2, 3) with those of the European synthesis of alder carr (BODEUX 1955), it may be justified to distinguish both *Sphagno squarrosi-Alnetum* and *Ribo nigri-Alnetum* from the regional association *Carici laevigatae-Alnetum.* Species growing in alder carr of Atlantic Europe and those common in central and north-eastern Europe are mutually exclusive. The ranges of both carr associations distinguished spread far beyond the Polish borders. The new carr division probably concerns both *Carici elongatae-Alnetum medioeuropaeum* and *C.e.-A. boreale.*

Within Poland, variation in the carr floristic composition runs eastwards, expressed by the participation of regional species groups. Carrs of north-western Poland are characterized by the higher participation of suboceanic and mid-European flora elements. Boreal, subboreal, and boreocontinental species enter carr from the north-east. Their distributions in alder carr vary. The data on the vascular elements of the flora were taken from: MEUSEL, JÄGER u. WEINERT (1965), MEUSEL, JÄGER, RAUSCHERT u. WEINERT (1978), WALTER u. STRAKA (1970). The general informaion on moss ranges comes from the relevant bryological literature (HERZOG 1926, BOROS 1968).

Differential species of western carrs gradually disappear eastward, while boreocontinental species are more and more rare westward. The point maps were made in order to determine the ranges of species groups. The distributions of individual regional species in both carr associations were analysed. Then the number of species with the same distribution type and constancy exceeding 20% was calculated at each point. The results obtained are shown in the synthetic maps (Fig. 1–7). The number of differential species at the analysed points is illustrated by hatching richness. As a result of the map and table analysis, six groups of species were distinguished, on which the carr division was to be based. The first 3 groups of species are differential for geographical races:

1. *Lonicera periclymenum* group (Fig. 1) occurs in bog-moss carrs of north-western Poland. It consists of: *Myrica gale, Osmunda regalis, Lonicera periclymenum, Hydrocotyle vulgaris, Deschampsia caespitosa, Holcus lanatus.* These are oceanic or suboceanic floristic elements. The

Tab. 1. Forest communities from the class Alnetea glutinosae in Poland

Successive number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of relevés	14	21	63	51	6	170	65	172	92	221	191	7	53	20
Ch. D. Ass. Sphagno squarrosi-Alnetum:														
Sphagnum palustre	IV	IV	IV	V	I				•		•			II
Ch. Sphagnum squarrosum	IV	IV	III	I					I		•		•	II
Pinus sylvestris a	III	+	II	IV		•	•	•	+	•	•			
- - b/c	I	•	+	II		•			•					•
Ch. D. Ass. Ribo nigri-Alnetum:														
Carex acutiformis		III	III	I	II	III	III	V	III	III	III	IV	III	I
Iris pseudoacorus	II	II	III	+	V	IV	IV	V	III	IV	III	IV	V	+
Urtica dioica	II	I	+	I	II	IV	V	IV	II	II	V	V	V	
Ch. Ribes nigrum b/c	I		•	•	I	III	II	IV	III	II	III	V		
Prunus padus b/c			+	•		II	II	III	II	II	II	III		
D. Ass. Carici elongatae-Quercetum:														
Quercus robur a	II		+			I	•	+	•	•	•		I	V
- - b/c	II	I	I	II		I	I	I	+	I	+		II	V
Carex canescens		I	+	•	I	•	°	•	+	•	+			V
Carex nigra		+	+		I	•	•	•		•	•			III
Carpinus betulus a/bc		+		•		•			•	°	°			IV
Populus tremula a/bc		•	•			+	•		•	•	•			III
Rubus nessensis			•						•		•			II
Calamagrostis epigejos						•	•	•						II
d. geographical races:														
Suboceanic race:														
Ch. reg. Myrica gale	I													
Ch. reg. Osmunda regalis	II					•		•						
Lonicera periclymenum	IV					•							II	
Hydrocotyle vulgaris	III				I	•	+	•					•	
Avenella flexuosa	III	•												
Holcus lanatus	III	•				•	°				•		•	
Potentilla erecta	III	+	+	+					•	•	•			•
Sphagnum fimbriatum	III	+	I	•		•				•	•			•
Molinia coerulea	III	•	•	•		•								II
Subcontinental race:														
Sphagnum nemoreum			I	II		•				•	•	I		•
Carex appropinquata			II	II	I	•		•	III	II	II	II		
Ch. reg. Dryopteris cristata		I	II	III		•	•		II	II	II	II		•
Calla palustris	+	III	III	II	I	+	+	II	III	II	III	III	•	
Picea abies a		I	II	V		•	+	•	I	II	III	III		III
- - b/c		II	III	V	I	+	I	I	I	I	III	I		IV
Vaccinium myrtillus	II	•	III	V		•	+	•	I	II	II			IV
Thuidium tamariscinum			III	III		•	+		I	II	II	II	I	II
Cicuta virosa			+	III		+	•	•	III	II	II	II		
Subboreal race:														
Bazzania trilobata				II			•				•			II
Lepidozia reptans			+	II				•	•	•	+			II
Pleurozium schreberi	II		I	V		•	•	•	+	•	I			III
Sphagnum recurvum	+	I	•	III										II
Dicranum scoparium	II	•	+	IV		•	•	•	•	+	I			II
Dicranum rugosum	II		+	III		•		•	•	•	•		•	•
Rhytidiadelphus triquetrus	I		II	V		•	•	•	+	I	II	I	•	I
Hylocomium splendens		•	+	IV				•	•	•	I			+
Vaccinium vitis-idaea			+	IV						•	•			•
Juniperus communis b/c			+	III		•	•		+	+	+	I		
Carex lasiocarpa			•	III		•			+					+
Orthilia secunda			•	IV						•	•			
Pyrola rotundifolia			•	III										
Polytrichum strictum				III		•					•			
Marchantia polymorpha				II		•			•		•			
Sphagnum cuspidatum				II					•					
Ptilium crista-castrensis				I							•			•
d. subassociations:														
R.n.-A. comaretosum:														
Potentilla palustris		II	II	IV	V	•	•		V	•	•	°		•
Menyanthes trifoliata		II	I	II					III	•	•	II		
R.n.-A. chrysosplenietosum:														
Chrysosplenium alternifolium			•	•		+	III	+		•	III		•	
Geranium robertianum	II			I		I	III	I	•	I	III	I	I	
Circaea alpina	II	I	+	+		•	III	•	•	•	III		I	•
Impatiens noli-tangere	II		•	•		I	IV	III	+	+	IV	III	II	•
R.n.-A. symphytetosum:														
Eupatorium cannabinum	I	I	•		I	II	+	II	•	+	I	III		
Symphytum officinale						•		III	+	•	•	IV	+	
Humulus lupulus	+	•				II	I	V	+	+	I	V	IV	
Stachys palustris		•	I			I	+	III	I	I	I	II	III	
Calystegia sepium	I					•		II			•	I	II	
Scrophularia nodosa						•	•	II		•	•		I	
Eurhynchium swartzii		•	•	•		+	•	II		•	+	I		
Mnium longirostre			I				•	II			+		•	
Cornus sanguinea b/c	+							II	•	•	•			

Local form with Berula erecta:														
Berula erecta								.					V	
Rumex hydrolapathum		.	I	+		I	I	II	II	II	I	II	V	
Dryopteris dilatata		II	I	I	I	I	II	+	.	+	I		V	+
Crepis paludosa		.	+	.		+	.	.	+	.	I		IV	
Glyceria maxima			.			+	.	I	+	+	+		III	
Galium uliginosum		I	.			.	.	+	.	.	+		III	
Sparganium erectum		.	.			.	.		+				II	
Glyceria plicata						.	I	.		.	.		II	
Amblystegium riparium						.	.	.					II	
Silene dioica						.	.						II	
Sparganium erectum ssp.neglectum													II	
Ch. All. O. Cl. Alnetea glutinosae:														
Carex elongata	IV	V	V	IV	III	IV	V	IV	V	V	V	V	IV	V
Calamagrostis canescens	V	III	III	IV	V	II	III	III	III	III	III	III	V	V
Thelypteris palustris	IV	IV	V	V	V	III	IV	IV	V	V	V	IV	V	
Lycopus europaeus	II	IV	V	IV	V	V	V	V	IV	V	V	V	V	
Solanum dulcamara	II	V	IV	IV	IV	V	V	V	IV	IV	V	IV	V	
Salix cinerea b/c	II	II	III	IV	III	II	I	II	V	II	II	II	.	
Salix aurita b/c	II	I	+	.	I	+	.	+	II	I	+	I		I
Salix pentandra a/bc	I	.	+	+		.		I	+	.	.		.	
reg. Salix repens ssp.rosmarinifolia				.										
Companion species:														
Lysimachia vulgaris	V	V	V	V	V	V	V	IV	V	V	V	V	V	V
Alnus glutinosa a	V	V	V	IV	V	V	V	V	V	V	V	V	V	I
- - b/c	V	V	IV	V	IV	IV	IV	II	II	II	III	I	V	
Frangula alnus b/c	V	V	V	V	V	V	IV	III	V	V	V	III	IV	III
Peucedanum palustre	III	IV	V	V	V	III	III	III	V	IV	IV	IV	V	III
Galium palustre	IV	V	V	IV	IV	IV	V	V	V	V	V	V	V	I
Dryopteris carthusiana	III	III	V	V	II	III	IV	III	IV	V	V	V	.	V
Sorbus aucuparia b/c	III	III	III	IV	I	III	III	II	IV	V	IV	V	IV	I
Betula pubescens a	V	III	III	V	II	I	I	II	IV	III	III	V	I	III
- - b/c	V	III	II	IV	II	I	I	+	II	II	V		I	IV
Acrocladium cuspidatum		IV	IV	IV	IV	III	I	III	IV	IV	IV	III	III	.
Athyrium filix-femina	III	III	III	III	I	III	IV	IV	II	III	IV		IV	
Scutellaria galericulata	II	III	III	III	IV	III	IV	II	III	III	IV	III	II	II
Rubus idaeus b/c	V	+	II	+	II	III	IV	III	III	III	IV	V	V	II
Deschampsia cespitosa	III	III	III	+	III	III	III	II	I	II	III		V	IV
Lythrum salicaria	I	II	III	II	III	III	II	III	III	III	III	IV	IV	.
Ranunculus repens	I	I	III	II	II	III	III	II	II	III	III	III	III	+
Oxalis acetosella	III	II	IV	II	II	II	III	+	I	III	III	I	V	II
Caltha palustris		I	III	III	III	II	III	III	III	III	III	V		.
Climacium dendroides	I	II	IV	IV	II	I	I	III	III	III	III	II		+
Lysimachia thyrsiflora	+	II	III	IV	II	II	II	I	III	III	III	III	II	III
Filipendula ulmaria			II	III	II	II	II	III	III	III	IV	V	.	.
Eurhynchium striatum	III	.	III	II		I	.	II	II	III	III	III	+	II
Mnium cuspidatum	II	.	I	I	I	I	+	II	II	III	III	III		I
Myosotis palustris	+	I	II	II	IV	III	III	III	II	II	III	III	+	.
Maianthemum bifolium	III	I	IV	III	I	I	II	.	+	II	II	I	.	III
Mnium hornum	V	+	II	+		II	+	III	I	II	II	II	IV	
Carex pseudocyperus		II	II	III	II	II	II	I	IV	II	II	III	II	
Carex elata		.	I	+	III	I	.	+	III	II	+	II	IV	
Juncus effusus	II	III	I	+	IV	II	I	+	I	I	I		II	IV
Carex riparia		I	I	.	II	I	I	III	I	II	I	II	IV	.
Cardamine amara	+		I	I	I	I	II	II	III	II	III	I	II	
Hottonia palustris		I	II	+	II	+	II	+	II	II	+	III	III	
Equisetum fluviatile	+	II	II	+	III	I	I	II	II	II	II	III		
Viola palustris		II	III	II	III	II	II	.	I	II	II	I		
Polytrichum attenuatum	II	II	II	I		+	+	.	I	II	II		+	III
Cirsium oleraceum	I	.	+	.	I	I	II	II	+	+	II	III		
Carex vesicaria		+	II	I		I	+	I	II	II	II	II	.	III
Brachythecium rutabulum	II	.	II	.	II	II	I	II	II	II	II		V	
Calliergon cordifolium		I	+	II	II	+	+	II	II	I	II		II	III
Mnium affine	+	II	II	III	I	+	I	+	I	II	II	II	II	+
Cirsium palustre	III	I	I	I	II	II	II	I	+	+	II		II	
Phragmites australis	II	.	II	II	II	I	I	II	II	I	I	III	I	
Trientalis europaea	III	.	I	II		.	.		.	I	I			II
Ranunculus lingua		+	+	II		+	.	+	II	II	I	III		
Hypnum cupressiforme	II		II	.		+	.	II	II	II	II	II	+	.
Mnium undulatum		.	+	II	I	I	II	II	+	II	II	II	I	
Glyceria fluitans		I	II	.	I	I	II	I	II	II	II	I	+	.
Oenanthe aquatica		I	I	.	I	I	+	II	II	I	II	I	II	
Mnium seligeri		II	I	+	II	I	I	+	I	I	II	I	.	
Polygonum hydropiper	+	.	II		I	I	I	I	I	+	II		II	.
Agrostis canina		+	+	II	II	.	.	.	+	.	+	I		II
Viburnum opulus b/c			I	+	I	I	+	II	II	I	+	II		
Mnium punctatum		.	I	II		+	+	.	I	I	II	II		
Sium latifolium		.	I	+		I	II	II	II	II	I			
Poa trivialis	I	I	I	.		I	II	II	+	I	I		II	.
Equisetum palustre		+	.	II	II	+	I	+	+	.	+	I		.
Fraxinus excelsior a				.		I	I	I	I	I	I	III		
- - b/c		.		I		II	III	III	+	+	I	I	.	.
Betula pendula a	II	.	I	+		+	+	.	I	+	+			
- - b/c	II	.	.	.		+	.	.	+	.	.			II
Lysimachia nummularia			.			II	II	II	+	+	I		.	+
Corylus avellana b/c	II		+	.			I	II			I	II		I
Rubus saxatilis			II	II		.	.		+	I	I	II		
Scirpus sylvaticus		I	II	.		I	I	I	I	I	II		I	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Epilobium palustre		I	I	II	I	+	•	•	I	+	II		I	
Plagiothecium neglectum			I	I		+	+	+	I	II	II		I	+
Lychnis flos-cuculi			I	II		I	I	+	I	+	I		•	
Phalaris arundinacea			°			I	II	I	+	+	+	II	II	
Alisma plantago-aquatica		•	I	•	I	I	II	I	I	I	I	I	+	
Lemna minor		I	+	•	I	+	I	I	I	II	+			
Plagiochila asplenioides			•	II		•	°	°	•	+	I		I	I
Rorippa amphibia			•	+		•	II	II	+	+	+	I		
Angelica sylvestris			+	I		•	+	•	+	I	I	II		
Polytrichum commune	+	I	+	II		•		•		•	+			•
Carex cespitosa	II		•	•		•		+	+		•			+
Fissidens adiantoides			•	+		•	•	•	II	I	I			
Galium aparine	II	•				I	I	I			+		•	
Plagiothecium laetum			•	I						•	•			II

1 - Sphagno squarrosi-Alnetum Sol.-Górn. 1975, suboceanic race

2 - S.s.-A., mid-European race

3 - S.s.-A., subcontinental race

4 - S.s.-A., subboreal race

5 - Ribo nigri-Alnetum Sol.-Górn. 1975, comaretosum prov., mid-European race

6 - R.n.-A., typicum, mid-Eur. r.

7 - R.n.-A., chrysosplenietosum, mid-Eur. r.

8 - R.n.-A., symphytetosum, mid-Eur. r.

9 - R.n.-A., comaretosum, subcontinental race

10 - R.n.-A., typicum, subcont. r.

11 - R.n.-A., chrysosplenietosum, subcont. r.

12 - R.n.-A., symphytetosum prov., subcont. r.

13 - Community from the alliance Alnion glutinosae, local form with Berula erecta from Uznam

14 - Carici elongatae-Quercetum Sokołowski 1972

Explanations for table 1 and 2, 3

Constancy:
"Point" /./: 0,5-5,0%, "Cross" /+/: 5,1-10,0%, I: 10,1-20,0%, II: 20,1-40,0%, III: 40,1-60,0%, IV: 60,1-80,0%, V: 80,1-100,0%.

Nomenclature of mosses follows ROTHMALER, W.: Exkursionsflora. B. 1, Niedere Pflanzen.- Volk und Wissen Volkseigener Verlag, 811 S. Berlin 1983

majority reach their eastern or south-eastern range limits in eastern Poland. *Molinia coerulea, Potentilla erecta* and *Sphagnum fimbriatum* have similar distributions in carr. However, since the number of relevés is small, their confinement to *Lonicera periclymenum* group may be accidental.

2. *Vaccinium vitis-idaea* group (Fig. 2) occurs in bog-moss carrs of north-eastern Poland. Its range is narrower than that of the North Sector. It is composed of 15, mainly boreal species. In hummocks, numerous mosses and dwarf-shrubs specific to the zone of boreal coniferous forests also grow. They include: *Dicranum scoparium, D.rugosum, Pleurozium schreberi, Rhytidiadelphus triquetrus, Vaccinium vitis-idaea, Orthilia secunda, Pyrola rotundifolia* and others. In hollows, elements of transient mires such as *Carex lasiocarpa, Potentilla palustris and Sphagnum cuspidatum,* appear. The group of pine forest species is accompanied by higher participation of *Betula pubescens, Picea abies* and *Pinus sylvestris* in the forest stand.

3. *Dryopteris cristata* group (Fig. 3 and 4) occurs in both associations in eastern Poland. It is common in the Masurian Lake district and extends to the vicinity of Warsaw and the region of the Świętokrzyskie Mountains. The group consists of boreal and boreocontinental species such as *Calla palustris, Dryopteris cristata, Vaccinium myrtillus, Carex appropinquata* and *Picea abies.* They represent a boreal-montane range type. The small differences in the composition of this group, generally common for *Sphagno squarrosi-Alnetum* and *Ribo nigri-Alnetum,* result

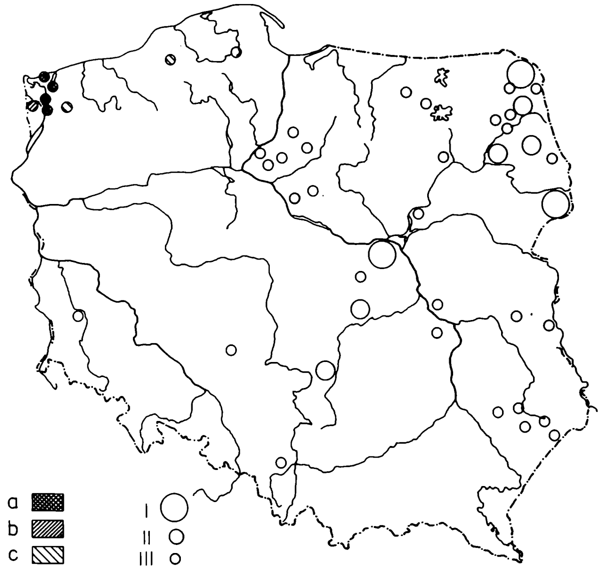

Fig. 1: Distribution of the suboceanic group of differential species with *Lonicera periclymenum* in the *Sphagno squarrosi-Alnetum*. The group includes: *Avenella flexuosa, Holcus lanatus, Hydrocotyle vulgaris, Lonicera periclymenum, Myrica gale, Osmunda regalis.* Number of species with constancy > 20%: a = 4–6, b = 3, c = 1. Number of relevés: I = 10, II = 5–10, III = 1–4.

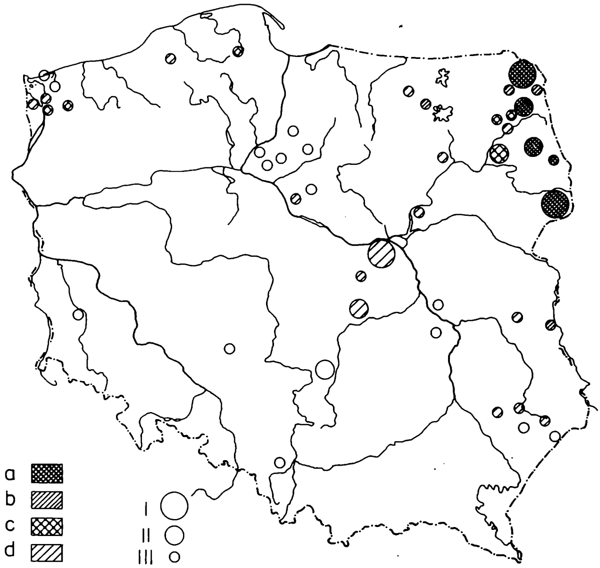

Fig. 2: Distribution of the boreal group of differential species with *Vaccinium vitis-idaea* in the *Sphagno squarrosi-Alnetum*. The group includes: *Bazzania trilobata, Carex lasiocarpa, Cicuta virosa, Dicranum rugosum, D. scoparium, Hylocomium splendens, Juniperus communis, Marchantia polymorpha, Orthilia secunda, Pleurozium schreberi, Polytrichum strictum, Pyrola rotundifolia, Rhytidiadelphus triquetrus, Sphagnum recurvum, Vaccinium vitis-idaea.* Number of species with constancy > 20%: a = 7–15, b = 5–6, c = 3–4, d = 1–2. I–III as in Fig. 1.

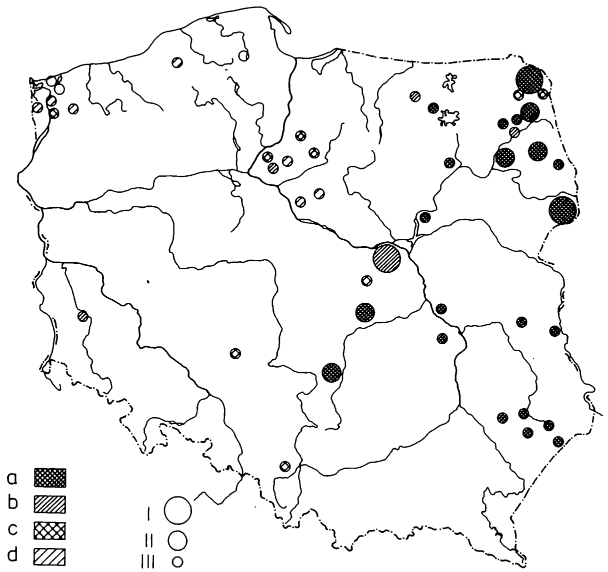

Fig. 3: Distribution of the boreocontinental group of differential species with *Dryopteris cristata* in the *Sphagno squarrosi-Alnetum.* The group includes: *Calla palustris, Carex appropinquata, Dryopteris cristata, Picea abies. Potentilla palustris, Sphagnum nemoreum, Thuidium tamariscinum, Vaccinium myrtillus.* Number of species with constancy > 20%: a = 4–8, b = 3, c = 2, d = 1. I–III as in Fig. 1.

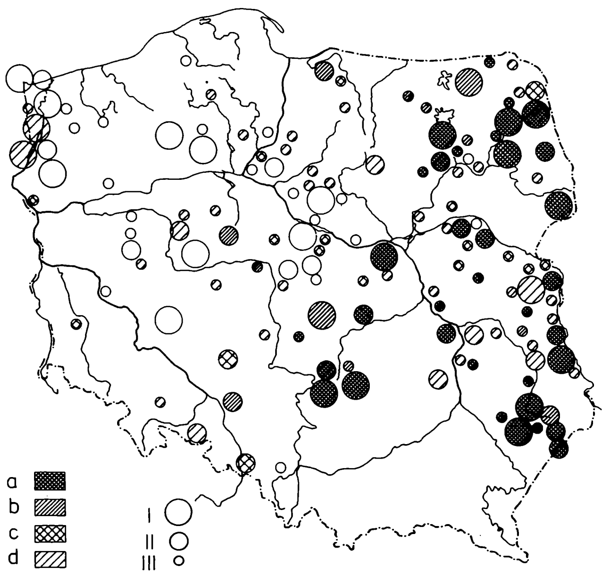

Fig. 4: Distribution of the boreocontinental group of differential species with *Dryopteris cristata* in the *Ribo nigri-Alnetum.* The group includes: *Calla palustris, Carex appropinquata, Cicuta virosa, Dryopteris cristata, Picea abies. Thuidium tamariscinum, Vaccinium myrtillus.* Number of species with constancy > 20%: a = 4–7, b = 3, c = 2, d = 1. I–III as in Fig. 1.

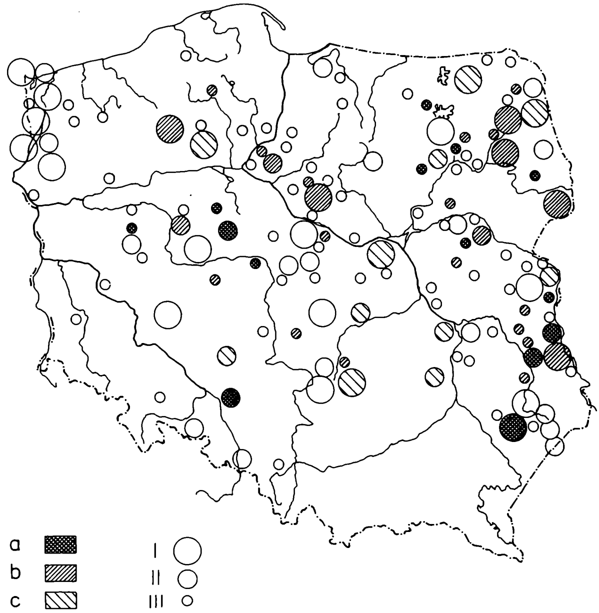

Fig. 5: Distribution of differential species for the *Ribo nigri-Alnetum comaretosum (Menyanthes trifoliata, Potentilla palustris).* Number of species with constancy > 20%: a = 2, b = 1; c = occasional occurence. I–III as in Fig. 1.

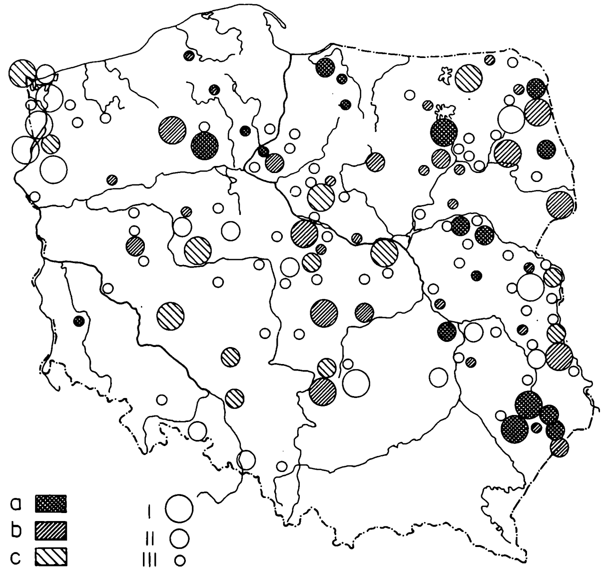

Fig. 6: Distribution of differential species for the *Ribo nigri-Alnetum chrysosplenietosum (Chrysosplenium alternifolium, Circaea alpina).* Number of species with constancy > 20%: a = 2, b = 1; c = occasional occurence. I–III as in Fig. 1.

from the differences in habitats occupied by these associations. The *Dryopteris cristata* group differentiates the subcontinental race from the mid-European race in both carr associations. Broadly, the range of this race and the composition of the differential species group correspond to the geographical subassociation *Carici elongatae-Alnetum dryopteridetosum cristatae* (Tx. et Bodeux 1955) em. Mat. 1958, described by MATUSZKIEWICZ, TRACZYK and TRACZYK (1958).

Poland lies within continuous ranges of the majority of species of the last two groups. Their absence in carrs of western Poland probably indicates narrowing of the ecological scale of their habitats or dispersion of their localities.

The other 3 groups of species differentiate subassociations of *Ribo nigri-Alnetum*. However, their occurrences in alder carr of eastern and western Poland differ. Therefore, their distribution in the *R.n.-A.* has been investigated in a similar way as for the regional species groups.

4. *Potentilla palustris – Menyanthes trifoliata* group (Fig. 5) is composed of two character species of the class *Scheuchzerio-Caricetea fuscae*. They differentiate the poorest subassociation of *R.n.-A.* Both species represent boreal elements in the Polish flora and are common mainly in alder carr of northern and eastern Poland.

5. *Chrysosplenium alternifolium – Circaea alpina* group (Fig. 6) consists of some *Circaeo-Alnetum* species. They grow, together with *Impatiens noli-tangere* and *Geranium robertianum*, in the richest patches of *Ribo nigri-Alnetum* in eastern and central Poland. Both, *Chrysosplenium alternifolium* and *Circaea alpina*, are boreal elements. Their occurence in alder carr of western Poland markedly decreases.

6. *Symphytum officinale* group (Fig. 7) comprises a number of species common in great river valleys. According to MATUSZKIEWICZ (1976) such species as *Humulus lupulus, Calystegia sepium, Symphytum officinale, Cornus sanguinea* and *Scrophularia nodosa* differentiate willow-poplar forests from the class *Salicetea purpureae* and *Ficario-Ulmetum* from *Circaeo-Alnetum.* In this group the most numerous species are mid-European elements, like *Eupatorium cannabinum, Symphytum officinale, Cornus sanguinea* etc. The *Symphytum officinale* group is

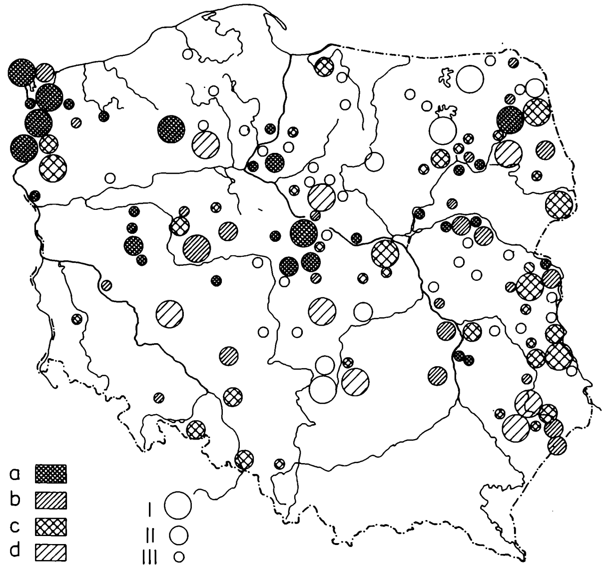

Fig. 7: Distribution of differential species for *Ribo-nigri Alnetum symphytetosum (Calystegia sepium, Cornus sanguinea, Eupatorium cannabinum, Humulus lupulus, Stachys palustris, Symphytum officinale).* Number of species with constancy > 20% : a = 3–6, b = 2, c = 1; d = occasional occurence. I–III as in Fig. 1.

common in the richest black-currant carrs of western Poland. In eastern Poland they are confined to alder carrs growing in the vicinity of great rivers. This probably indicates dynamical relationships between rich carrs and *Circaeo-Alnetum* forests.

From the map comparison it may be inferred that some groups of species exclude each other spatially, while some partly overlap and form regional species combinations. The analysis of spatial variation in species combinations enables delimitation of geographical races of both alder-carr associations within lowland Poland.

Description of the distinguished alder-carr associations

Both alder-carr associations within Poland differ in their internal variation and habitat range. The *Sphagno squarrosi-Alnetum* (Fig. 8) occurs in isolated land depressions, far away from water courses, along the fringes of bogs and transient mires. The structure of the community is characterized by slightly marked hummocks which are always beyond periodical water rise. Forest stands of bog-moss carr are composed mainly of alder (*Alnus glutinosa*) and birch (*Betula pubescens*), with admixture of pine (*Pinus sylvestris*). In hummocks unaffected by the periodic flooding, oligo- and mesotrophic elements occur, such as *Dryopteris carthusiana*, *Oxalis acetosella* and numerous mosses. In north-eastern Poland, in the hummock ground layer, pine-forest dwarf-shrubs dominate. In hollows, bog mosses are common, especially *Sphagnum squarrosum* and *S. palustre*. Meadow and swamp plants are relatively rare.

The *Sphagno squarrosi-Alnetum* varies strongly geographically. Within Poland four regional races occur:

– suboceanic race occurs in the vicinity of the Odra estuary and in western Pomerania. It is differentiated by a group of species with *Lonicera periclymenum*.

– mid-European race is common in western Poland. It has no differential species and corresponds to *Carici elongatae-Alnetum medioeuropaeum* (Koch 1926) Tx. et Bodeux 1955, subass, with *Betula pubescens* (Tab. 2).

– subcontinental race occurs in central and eastern Poland. It is differentiated by the boreocontinental species group with *Dryopteris cristata*.

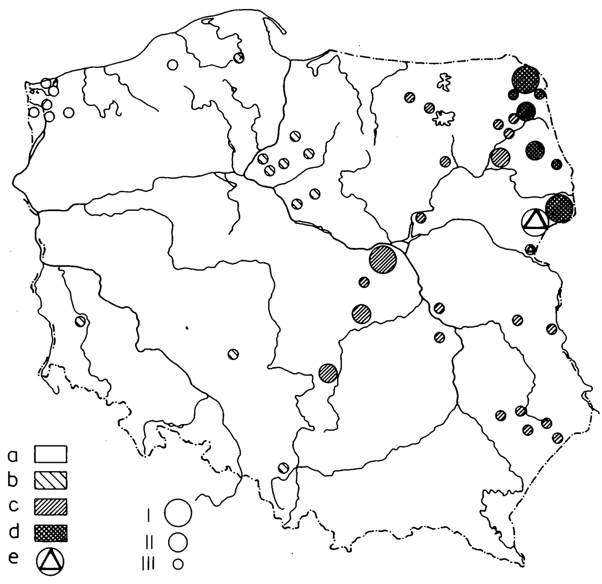

Fig. 8.: Distribution of geographical races of the *Sphagno squarrosi-Alnetum:* a = suboceanic race, b = mid-European race, c = subcontinental race, d = subboreal race, e = *Carici elongatae-Quercetum.* I–III as in Fig. 1.

Tab. 2. Differentiation of Sphagno squarrosi-Alnetum in Poland compared to that of oligotrophic European alder carrs

	Atlantic region	Middle-European	Poland NW	Poland W	Poland E	Poland NE	Boreal region
Successive number	1	2	3	4	5	6	7
Number of relevés	17	61	14	21	63	51	11
Carex laevigata	V						
Scutellaria minor	V						
Blechnum spicant	IV						
Osmunda regalis	V	I	II				
Molinia coerulea	III		III	•	•	•	
Sphagnum fimbriatum	III		III	•	•	•	
Sphagnum recurvum	IV		+	I	•	III	
Calamagrostis canescens	IV	III	V	III	III	IV	V
Salix cinerea b/c	+	I	II	II	III	IV	III
Salix aurita b/c	I	II	II	I	+	•	I
Sphagnum squarrosum	I	II	IV	IV	III	I	III
Sphagnum palustre	IV		IV	IV	IV	V	III
Alnus glutinosa a/bc	V	V	V	V	V	IV	V
Betula pubescens a/bc	IV	IV	V	III	III	V	III
Frangula alnus b/c	IV	IV	V	V	V	V	V
Galium palustre	II	III	IV	V	V	IV	III
Dryopteris carthusiana	IV	V	III	III	V	V	III
Athyrium filix-femina	IV	III	III	III	III	III	II
Deschampsia cespitosa	I	III	III	III	III	+	III
Carex elongata		III	IV	V	V	IV	II
Thelypteris palustris		I	IV	IV	V	V	III
Lycopus europaeus		II	II	IV	V	IV	II
Solanum dulcamara		II	II	V	IV	IV	I
Lysimachia vulgaris		IV	V	V	V	V	III
Sorbus aucuparia b/c		IV	III	III	III	IV	III
Oxalis acetosella		II	III	II	IV	II	II
Peucedanum palustre			III	IV	V	V	III
Lonicera periclymenum		II	IV				
Hydrocotyle vulgaris			III				
Holcus lanatus			III	•			
Avenella flexuosa			III	•			
Potentilla erecta			III	+	+	+	
Scutellaria galericulata			II	III	III	III	
Lythrum salicaria		I	I	II	III	III	
Calla palustris			+	III	III	II	
Mnium affine			+	II	II	III	
Viola palustris				II	III	II	
Lysimachia thyrsiflora			+	II	III	IV	I
Acrocladium cuspidatum	I			IV	IV	IV	II
Thuidium tamariscinum					III	III	
Carex appropinquata					II	II	
Pinus sylvestris a/bc			III	+	II	IV	III
Vaccinium myrtillus			II	I	IV	IV	III
Climacium dendroides			II	•	III	V	III
Caltha palustris		I		I	III	III	III
Picea abies a/bc				I	III	III	III
Dryopteris cristata		I		I	II	III	II
Potentilla palustris				II	II	IV	IV
Rhytidiadelphus triquetrus					II	V	IV
Filipendula ulmaria		I			II	III	IV
Pleurozium schreberi			II		I	V	IV
Hylocomium splendens				•	+	IV	IV
Vaccinium vitis-idaea					+	IV	IV
Juniperus communis b/c					+	III	III
Orthilia secunda					•	IV	III
Pyrola rotundifolia					•	III	III

Dicranum scoparium			II	•	+	IV	
Dicranum rugosum			II		+	III	
Cicuta virosa					+	III	
Lepidozia reptans					+	II	
Carex lasiocarpa					•	III	
Polytrichum strictum						III	
Marchantia polymorpha						II	
Bazzania trilobata						II	
Sphagnum nemoreum					I	II	IV
Rubus saxatilis					II	II	IV
Mnium punctatum				•	I	II	IV
Equisetum palustre				+	•	II	III
Viola epipsila							III
Sphagnum girgensohnii						•	III
Aulacomnium palustre					•	•	III
Carex vaginata							III
Carex tenella							II

1 - Cariceto laevigatae-Alnetum /Allorge 1922/ Schwickerath 1937, subass. with Sphagnum palustre

2 - Cariceto elongatae-Alnetum medioeuropaeum /Koch 1926/ Tx et Bodeux 1955, subass. with Betula pubescens

3 - Sphagno squarrosi-Alnetum Sol.-Górn. 1975, suboceanic race

4 - S.s.-A., mid-European race

5 - S.s.-A., subcontinental race

6 - S.s.-A., subboreal race

7 - Cariceto elongatae-Alnetum boreale Preising et Bodeux 1955, subass. with Sphagnum acutifolium

– subboreal race occurs in north-eastern Poland. It is differentiated by a group of numerous species with *Vaccinium vitis-idaea;* it may be identified with *Carici elongatae-Alnetum boreale* Preising et Bodeux 1955, subass. with *Sphagnum acutifolium* (Tab. 2).

The floristic individuality of the subatlantic and subboreal races is, undoubtedly, more pronounced than that of the two other races. They may form regional associations at their range margines.

The *Ribo nigri-Alnetum* is much more common than the *Sphagno squarrosi-Alnetum.* It occupies both isolated depressions and margins of river valleys unaffected by periodic flooding. Vertical water movement results in the distinct hollow- and hummock-structure. Generally, forest stands are built up by *Alnus glutinosa.* Only in eastern Poland does *Betula pubescens* admixture occur. Plants characteristic of deciduous forests enter flood-unaffected hummocks. In hollows, tall-sedge swamps prevail.

Black-currant carrs are less variable geographically than bog-moss carrs. Two regional races have been distinguished for the former: a mid-European race without differential species, common in western Poland, and a subcontinental race from eastern Poland. The latter is differentiated by the *Dryopteris cristata* group common to both alder-carr associations. However, black-currant carr shows internal variation due to the trophic conditions. Four subassociations of *Ribo nigri-Alnetum* have been described, not evenly distributed between two regional races:
– *R.n.-A. comaretosum:* the most acidophilous subassociation, with differential species *Potentilla palustris* and *Menyanthes trifoliata.* It is common in eastern Poland (Fig. 9) and occurs mainly in the subcontinental race. In the mid-European race, without the *Dryopteris cristata* group, only few poor patches have been encountered. The *R.n.-A. comaretosum* corresponds to the *Carici elongatae-Alnetum boreale* Preising et Bodeux 1955, 1955, subass. *typicum* (Tab. 3).

Tab. 3. Differentiation of Ribo nigri-Alnetum in Poland
compared to that of eutrophic European alder carrs

	Atlantic region	Middle-European		Poland western				Poland eastern				Boreal region	
Successive number	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of relevés	11	18	19	6	170	65	172	92	221	191	7	10	13
Salix atrocinerea b/c	V												
Valeriana procurrens	V												
Carex laevigata	IV												
Osmunda regalis	IV												
Carex remota	IV												
Lysimachia nemorum	III												
Mentha aquatica	III												
Mnium undulatum	III	IV	I	I	I	II	II	+	II	II	II		
Juncus effusus	IV	III	IV	IV	II	I	+	I	I	I			
Alnus glutinosa a/bc	V	V	V	V	V	V	V	V	V	V	V	V	V
Galium palustre	IV	III	V	IV	IV	V	V	V	V	V	V	III	III
Ranunculus repens	IV	IV		II	III	III	II	II	III	III	III	I	IV
Athyrium filix-femina	IV	III	I	I	III	IV	IV	II	III	IV		III	V
Caltha palustris	III	II	III	III	II	III	III	III	III	III	V	I	III
Deschampsia cespitosa	III	III	III	III	III	III	II	I	II	III		II	IV
Filipendula ulmaria	III	III	V	II	II	II	III	III	III	IV	V	IV	V
Acrocladium cuspidatum	III			IV	II	I	III	IV	IV	IV	III	III	III
Dryopteris carthusiana	III	II	II	II	III	IV	III	IV	V	V	V	III	IV
Calamagrostis canescens	III	III	II	V	II	III	III	III	III	III	III	IV	I
Lycopus europaeus	I	III	IV	V	V	V	V	IV	V	V	V	III	III
Solanum dulcamara	I	III	IV	IV	V	V	V	IV	IV	V	IV	III	III
Ribes nigrum b/c	I	II	II	I	III	II	IV	III	II	III	V		II
Salix cinerea b/c	+	I	II	III	II	I	II	V	II	II	II	I	I
Carex elongata		II	I	III	IV	V	IV	V	V	V	V	IV	IV
Thelypteris palustris		II	I	V	III	IV	IV	V	V	V	IV	III	I
Urtica dioica		IV	IV	II	IV	V	IV	II	II	V	V		IV
Rubus idaeus b/c		III	I	II	III	IV	III	III	III	IV	V	II	IV
Oxalis acetosella		III		II	II	III	+	I	III	III	I	II	IV
Cardamine amara		III		I	I	II	II	III	II	III	I		III
Lysimachia vulgaris		III	V	V	V	V	IV	V	V	V	V	IV	IV
Iris pseudoacorus		II	V	V	IV	IV	V	III	IV	III	IV		
Lythrum salicaria		II	IV	III	III	II	III	III	III	III	IV		
Salix aurita b/c		I	III	I	+	.	+	II	I	+	I		
Glechoma hederacea		I	V										
Galium aparine		I	III		I	I	I			+			
Lysimachia nummularia		I	III		II	II	II	+	+	I			
Valeriana officinalis		I	V										
Phalaris arundinacea			III		I	II	I	+	+	+	II		
Eupatorium cannabinum		I	IV	I	II	+	II	.	+	I	III		
Symphytum officinale			IV		•		III	+	.	.	IV		
Calystegia sepium		I	IV		.		II			•	I		
Humulus lupulus		III	V		II	I	V	+	+	I	V		
Stachys palustris					I	+	III	I	I	I	II		
Eurhynchium swartzii					+	.	II		.	+	I		
Scrophularia nodosa					•	.	II		.	•			
Mnium longirostre						.	II			+			
Cornus sanguinea b/c							II	.	.	.			
Scutellaria galericulata				IV	III	IV	II	III	III	IV	III		
Carex acutiformis				II	III	III	V	III	III	III	IV		
Prunus padus b/c					III	II	III	II	II	II	III	I	III
Frangula alnus b/c		I		V	V	IV	III	V	V	V	III	V	IV
Peucedanum palustre				V	III	III	III	V	IV	IV	IV	IV	II
Sorbus aucuparia b/c				I	III	III	II	IV	V	IV	V	II	II
Picea abies a/bc						+	.	I	II	III	III	IV	IV
Dryopteris cristata					.	•		II	II	II	II	I	I
Vaccinium myrtillus					.	+	.	I	II	II		I	I
Calla palustris				I	+	+	I	III	II	III	III		
Thuidium tamariscinum					.	+		I	II	II	II		
Carex appropinquata				II	.	•	.	III	II	II	II		
Cicuta virosa					+	•	.	III	II	II	II		
Eurhynchium striatum					I	.	II	II	III	III	III		
Mnium cuspidatum				I	I	+	II	II	III	III	III		
Menyanthes trifoliata						.		III	.	.	II		
Potentilla palustris				V	.	•	.	V	.	.		III	I
Rubus saxatilis					.	•		+	I	I	II	IV	I
Rhytidiadelphus triquetrus					.	-	.	+	I	II	I	III	I

	1	2	3	4	5	6	7	8	9	10	11	12	13
Circaea alpina					.	III	.	.	.	III			
Geranium robertianum					I	III	I	.	I	III	I		
Chrysosplenium alternifolium					.	III			+	III	+		III
Impatiens noli-tangere					I	IV	III	+	+	IV	III		III
Equisetum sylvaticum													IV
Stellaria nemorum					.	+	.		.	+			III
Paris quadrifolia					+	I	I	.	.	I		I	III
Gymnocarpium dryopteris												I	III

1 – Cariceto levigatae-Alnetum /Allorge 1922/ Schwickerath 1937, subass. with Valeriana procurens

2 – Cariceto elongatae-Alnetum medioeuropaeum /Koch 1926/ Tx et Bodeux 1955, subass. with Ranunculus repens

3 – C.e.-A.m., subass. with Symphytum officinale

4 – Ribo nigri-Alnetum Sol.-Górn. 1975 comaretosum prov., mid-European race

5 – R.n.-A. typicum, mid-Eur. r.

6 – R.n.-A. chrysosplenietosum, mid-Eur. r.

7 – R.n.-A. symphytetosum, mid-Eur. r.

8 – R.n.-A. comaretosum, subcontinental race

9 – R.n.-A. typicum, subcont. r.

10 – R.n.-A. chrysosplenietosum, subcont. r.

11 – R.n.-A. symphytetosum prov., subcont. r.

12 – Cariceto elongatae-Alnetum boreale Preising et Bodeux 1955, subass. typicum

13 – C.e.-A.b., subass. with Equisetum silvaticum

– *R.n.-A. typicum* with no differential species, is common in the whole of Poland (Fig. 10), in both regional races.
– *R.n.-A. chrysosplenietosum:* a rich subassociation, differentiated by a group of species with *Chrysosplenium alternifolium.* It is common mainly in eastern Poland (Fig. 11) and occurs usually in the subcontinental race, in combination with the *Dryopteris cristata* group. The *R.n.-A. chrysosplenietosum* may be identified with the *Carici elongatae-Alnetum boreale* Preising et Bodeux 1955, subass. with *Equisetum sylvaticum* (Tab. 3).
– *R.n.-A. symphytetosum:* a rich subassociation differentiated by a group of species with *Symphytum officinale.* It is common mainly in western Poland (Fig. 12), generally in the mid-European race. In eastern Poland only some patches (combinations with the *Dryopteris cristata* group) have been encountered. Its occurrence in the east is restricted to present and ancient river valleys. The *R.n.-A. symphytetosum* corresponds to the *Carici elongatae-Alnetum medioeuropaeum* (Koch 1926) Tx. et Bodeux 1955, subass. with *Symphytum officinale* (Tab. 3).

Two other critical syntaxa have not been fully described. These occur near the Polish borders and are described by local authors:
1. A community from the alliance *Alnion glutinosae* – local form from Uznam, described by PIOTROWSKA (1960). It is differentiated by a group of species confined to flowing water (Tab. 1).
2. The *Carici elongatae-Quercetum:* an alder carr with oak-forest stands, described by SOKOLOWSKI (1972) from the Bialowieza Primeval Forest. It is differentiated by a specific species combination, not confirmed over a wider range (Tab. 1).

Regional variation of alder carr is discontinuous. Alder carrs in central Poland are represented by two geographical races, each with different subassociations. Black-currant carr localities farthest west are occupied by the acidophilous subassociation (*Ribo nigri-Alnetum comaretosum*), whereas in eastern Poland the mid-European race is represented by the rich subassociation (*R.n.-A. symphytetosum*). Distribution of geographical races of carr is related to

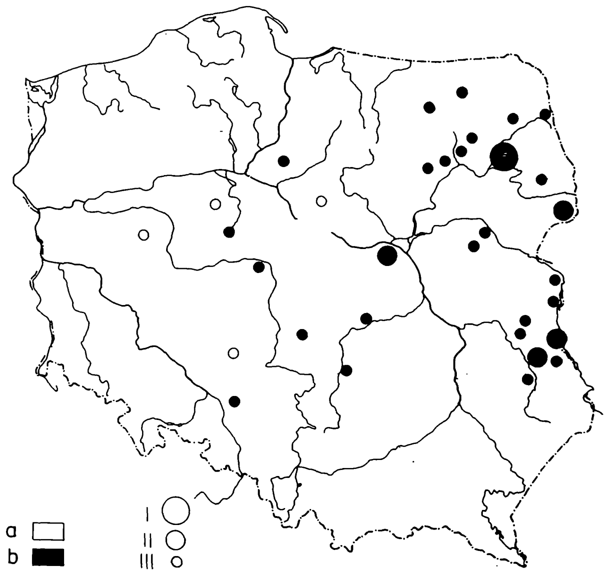

Fig. 9: Distribution of geographical races of the *Ribo nigri-Alnetum comaretosum:* a = mid-European race, b = subcontinental race. I–III as in Fig. 1.

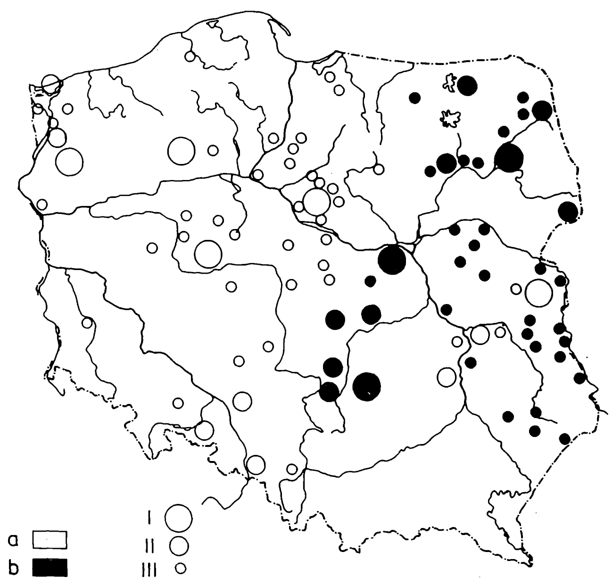

Fig. 10: Distribution of geographical races of the *Ribo nigri-Alnetum typicum:* a = mid-European race, b = subcontinental race. I–III as in Fig. 1.

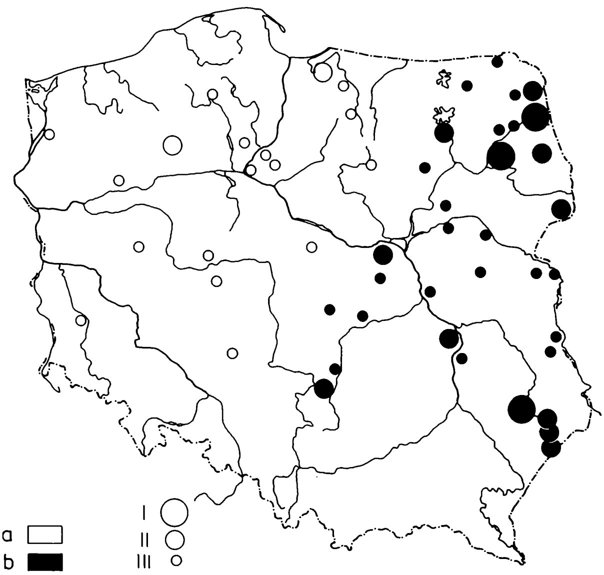

Fig. 11: Distribution of geographical races of the *Ribo nigri-Alnetum chrysosplenietosum:* a = mid-European race, b = subcontinental race.

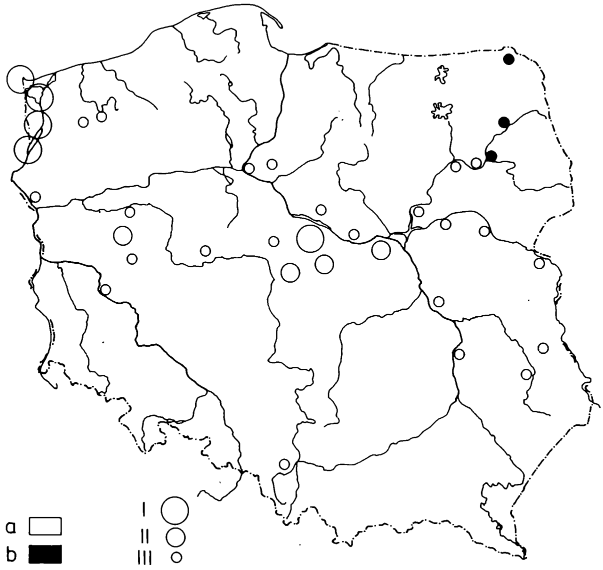

Fig. 12: Distrubition of geographical races of the *Ribo nigri-Alnetum symphytetosum:* a = mid-European race, b = subcontinental race. I–III as in Fig. 1.

geomorphology and local climate conditions. Generally, in present and ancient river valleys, carrs of the mid-European race enter from the east, while carrs of the subcontinental race prevail in uplands.

To analyse phenomena of the geographical variation of alder carrs thoroughly, a much larger area than the territory of Poland has to be taken into account. The transition between mid-European and boreal regional associations ought to be reconsidered over European scale as a transition between the pair of regional associations from the alliance *Alnion glutinosae*. Thus, variation of *Sphagno squarrosi-Alnetum* and *Ribo nigri-Alnetum* should be analysed separately. Only summing up of all current data on European alder carr will enable determintion of geographical ranks of taxa distinguished within Poland and description of their marginal local forms.

References

BODEUX, A. (1955): Alnetum glutinosae. – Mitt. Flor.-soz. Arbeitsgem. N. F. 5: 114–157. Stolzenau/ Weser.

BOROS, Á. (1968): Bryogeographie und Bryoflora Ungarns. – Akadémiai Kiadó, Budapest. 466 S.

ELLENBERG, H. (1978): Vegetation Mitteleuropas mit den Alpen in ökologischer Sicht. 2. Aufl. – E. Ulmer, Stuttgart. 982 S.

HERZOG, T. (1926): Geographie der Moose. – G. Fischer Verlag, Jena. 439 S.

JASNOWSKI, M. (1962): Budowa i roślinność torfowisk Pomorza Szczecińskiego. – Sczec. T. N. Wydz. Nauk Przyr. Roln. 10. Szczecin. 340pp.

MAREK, S. (1965): Biologia i stratygrafia torfowisk olszynowych w Polsce. – Zesz. Probl. Post. Nauk Roln. 57. Warszawa 266pp.

MATUSZKIEWICZ, A.: Bibliografia fitosocjologiczna Polski, Cz. 3 (1964–1966). – Mater. Zakł. Fitosocj. Stos. UW. 19: 1–48. Warszawa-Biołowieża (1967);

Cz. 4 (1967–1970) + Supl. Cz. 1–3.–Mater. Zakl. Fitosocj. Stos. UW. 28: 1–73. Warszawa-Bialowieza (1972);

Cz. 5 (1971–1975). – Phytocenosis, Suppl. Bibl. 1: 1–102. Warszawa-Bialowieża (1981).

MATUSZKIEWICZ, A., FALIŃSKI, J.B. (1964): Bibliografia fitosocjologiczna Polski, Cz. 2 (1959–1963). – Mater. Zakl. Fitosocj. Stos. UW. 5: 1–57. Warszawa-Białowieża.

MATZSZKIEWICZ, J. (1976): Przegląd fitosocjologiczny zbiorowisk leśnych Polski. Cz. 3 Lasy i zarośla legowe. – Phytocenosis 5 (1): 1–66. Warszawa-Bialowieza.

MATUSZKIEWICZ, W., TRACZYK, H., TRACZYK, T. (1958): Materialy do fitosocjologicznej systematyki zespołów olsowych w Polsce. – Acta Soc. Bot. Polon. 27: 21–44. Warszawa.

MEUSEL, H., JÄGER, E., WEINERT, E. (1965): Vergleichende Chorologie der zentraleuropäischen Flora. – VEB G. Fischer Verlag, Jena. Text: 583 S. Karten: 7–258 S.

MEUSEL, H., JÄGER, E., RAUSCHERT, S., WEINERT, E. (1978): Vergleichende Chorologie der zentraleuropäischen Flora. – VEB G. Fischer Verlag, Jena. Text: XI + 418 S. Karten: 259–421 S.

OLACZEK, R. (1972): Formy antropogeniczenej degeneracji leśnych zbiorowisk roślinnych w krajobrazie rolniczym Polski niżowej. – Uniwersytet łódzki, csódź. 170 pp.

PAŁCZYŃSKI, A. (1975): Bagna Jaćwieskie (Pradolina Biebrzy). Zagadnienia geobotaniczne, paleofitosocjologiczne i gospodarcze. – Wydz. Nauk Roln. PAN Roczn. Nauk Roln. Ser. D Monogr. 145: 1–232. Warszawa.

PIOTROWSKA, H. (1960): Lasy poludniowo-wschodniego Uznamu. –Bad. Fizjogr. Pol. Zach. PTPN 6: 69–158. Poznań.

SOKOŁOWSKI, A. (1972): Zespół Carici elongatae-Quercetum, dębniak turzycowy. – Acta Soc. Bot. Polon. 16 (1): 113–120. Warszawa.

TRACZYK, H. (1960): Bibliografia fitosocjologiczna Polski, Cz. 1: do 1958 r. – Mater. Zakł. Fitosocj. Stos. IB PAN 1: 1–35. Warszawa-Białowieża.

WALTER, H., STRAKA, H. (1970): Arealkunde. Floristisch-historische Geobotanik. – Einführung in die Phytologie III/2. – E. Ulmer, Stuttgart. 478 S.

Address of the author:
Barbara Solińska-Górnicka
ul. Grójecka 35 m 29
PL-02030 Warszawa