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Dynamics and systematic position of *Thelypteridi-Phragmitetum* Kuiper 1957

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Abstract

The author discusses the arising of *Thelypteridi-Phragmitetum* phytocenoses, their place in the zonal vegetation pattern and in plant succession. The diagnostic value of *Dryopteris thelypteris* and the syntaxonomic position of *Thelypteridi-Phragmitetum* are explained. This association is classified to the alliance *Phragmition*. A synthetic table is given with 480 phytosociological records representing the association studied, and a map of distribution of its sites or groups of sites reported to date in Poland.

So far but few phytosociologists considered the phytocenosis consisting of *Dryopteris thelypteris* and rush species as patches of a different syntaxon. Dąmbska (1961) described a community of *D. thelypteris* (without any precise syntaxonomic rank) with a table of 17 phytosociological records as supplement. Fabiszewski and Faliński (1967) treat *Dryopteris thelypteris* agglomerations as a transitional stage to *Alnetum* communities. Markiewicz (1972), Kępczyński and Zielski (1974) classify phytocenoses with profuse *Dryopteris thelypteris* to the association *Scirpo-Phragmitetum* W. Koch 1926 which has ceased to be accepted by a number of authors (Hilbig, 1971; Hilbig and Reichhoff, 1971; Donselaar, 1972, 1973; Lang, 1973; Tomaszewicz, 1973; Krzywański, 1974 and others). For the first time in Poland the *D. thelypteris* phytocenoses have been classified to a separate syntaxonomic unit, *Thelypteridi-Phragmitetum*, by Podbielkowski (1968), Gołdyn (1975) and Tomaszewicz (1977). The occurrence of *Thelypteridi-Phragimitetum* phytocenoses has also been confirmed by material contained in as yet unpublished master's and doctor's theses: Betlewicz (1974) — 9 records, Bogdanowicz (1976) — 17 records, Borowa (1975) — 11 records, Gromadzińska (1973) — 11 records, Jankowska (1975) — 7 records, Jaworowska (1974) — 9 records, Kłosowski (1976) — 7 records, Kowal (1973) — 21 records, Kowalczyk (1974) — 12 records, Kryszewska-Czyżewska (1974) — 6 records, Makarska

(1975) — 4 records, Michalak (1975) — 21 records, Ochyra (1976) — 11 records, Popławska (1975) — 12 records, Pospychała (1975) — 29 records, Przybysławska (1972) — 26 records, Romanowska (1973) — 13 records, Rudnik (1975) — 25 records, Sieminiak (1972) — 25 records, Szczepańska (1975) — 46 records, Wierzbicka (1973) — 6 records and the present author's own 65 phytosociological records (1973—1976) — Suwałki Lakeland, environs of Elbląg and Morąg, Lubusz Lakeland. Unpublished records (2) of dr Z. Głowacki (1972—1973); environs of Brzeg Dolny, Wrocław District were also utilized. All the record material published and unpublished comprising 480 phytosociological records is listed in a synthetic table (Table 1). The figures in the compartments of this table denote the number of occurrences of the particular species. In the group of accompanying species comprising 169 taxons only 21 with stability higher than 5 per cent have been taken into account in the table.

There are wide discrepancies as to the systematic position of *Thelypteridi-Phragmitetum* phytocenoses. An additional difficulty in consideration of the problem of existence of this association is the fact that its title species — *Dryopteris thelypteris* and *Phragmites communis* — are species characteristic for other syntaxons and as such cannot in this case be adopted as characteristic species. Therefore as regards *Thelypteridi-Phragmitetum,* one can only speak of a characteristic combination of species, formed by *Dryopteris thelypteris* and species of the class *Phragmitetea,* most frequently *Phragmites communis, Typha latifolia, Galium palustre, Lycopus europaeus, Typha angustifolia, Cicuta virosa, Lysimachia thyrsiflora, Carex acutiformis* and *Rumex hydrolapathum.* It seems that in this case *Dryopteris thelypteris* could be considered as the species defining the community (association).

Every syntaxonomic unit ranking as association should be characterized by: 1) a characteristic species composition, 2) definite habitat conditions associated with this phytocenosis, 3) a definite position in plant succession, 4) in the case of aquatic and rush communities a definite position in the zonal pattern of the vegetation. These requirements are fulfilled in all cases by *Thelypteridi-Phragmitetum* as will be proved below by describing the development of the littoral vegetation of a lake in which at present phytocenoses of this association occur.

In the initial period of development of a lake autochtonous and allochthonous organic and mineral sediments deposited in the littoral zone are washed down to deeper places where they accumulate. This prevents the shallowing of the water body in the littoral zone and further expansion of rush and aquatic communities towards the centre of the lake. The aquatic and rush communities occurring in this period on the poor mineral substrate do not occupy large areas. Frequently they are open

Thelypteridi-Phragmitetum Kuiper 1957

Table 1

Number of records = 480

Species	Abundance						Constancy	Coefficient of cover
	5	4	3	2	1	+		
Dryopteris thelypteris	263	135	57	23	2	-	V 100	7083
Ch. Phragmition								
Phragmites communis	6	21	67	83	89	81	IV 72	1303
Typha latifolia	-	-	11	31	86	162	IV 61	292
Typha angustifolia	-	-	7	21	40	33	II 21	174
Equisetum limosum	-	-	-	-	4	54	I 12	5
Sparganium ramosum	-	-	-	1	4	38	I 9	9
Acorus calamus	-	-	-	-	3	33	I 8	4
Schoenoplectus tabernaemontani	-	-	6	3	8	12	I 6	66
Rorippa amphibia	-	-	-	-	-	19	I 4	1
Schoenoplectus lacustris	-	-	2	1	2	10	I 3	22
Glyceria aquatica	-	-	1	-	1	12	I 3	9
Cladium mariscus	-	-	-	1	1	3	I 1	5
Oenanthe aquatica	-	-	-	-	1	2	I 1	1
Ch. Magnocaricion								
Galium palustre	-	-	-	1	17	189	III 43	25
Cicuta virosa	-	-	1	-	5	154	II 33	16
Carex acutiformis	-	-	6	15	46	88	II 32	151
Carex pseudocyperus	-	-	-	2	13	133	II 31	24
Lysimachia thyrsiflora	-	-	-	-	5	95	II 21	7
Scutellaria galericulata	-	-	-	-	4	96	II 21	6
Carex rostrata	-	-	1	1	9	75	I 18	22
Peucedanum palustre	-	-	-	-	3	83	I 18	5
Carex paniculata	-	-	1	5	11	53	I 15	37
Carex riparia	-	-	2	3	10	13	I 6	37
Iris pseudoacorus	-	-	1	-	2	17	I 4	10
Carex hudsonii	-	-	-	-	3	6	I 2	3
Poa palustris	-	-	-	-	-	8	I 2	1
Carex paradoxa	-	-	-	-	2	5	I 1	2
Phalaris arundinacea	-	-	-	-	-	1	I 1	1
Carex gracilis	-	-	-	-	-	2	I 1	1
Carex vesicaria	-	-	-	-	-	1	I 1	1
Ch. Phragmitetea								
Lycopus europaeus	-	-	-	2	9	200	III 44	21
Rumex hydrolapathum	-	-	-	-	4	101	II 22	6
Mentha aquatica	-	-	-	-	4	48	I 11	5
Ranunculus lingua	-	-	-	-	2	52	I 11	3
Epilobium hirsutum	-	-	-	-	1	17	I 4	1
Alisma plantago-aquatica	-	-	-	-	-	8	I 2	1
Sium latifolium	-	-	-	-	-	9	I 2	1
Berula erecta	-	-	-	-	1	6	I 1	1
Glyceria plicata	-	-	-	-	-	1	I 1	1
Scrophularia alata	-	-	-	-	-	3	I 1	1
Heleocharis palustris	-	-	-	-	-	3	I 1	1
Veronica beccabunga	-	-	-	-	-	1	I 1	1
Scolochloa festucacea	-	-	-	-	-	1	I 1	1
Accompanying species								
Lysimachia vulgaris	-	-	-	1	14	191	III 43	22
Alnus glutinosa	3	2	8	10	28	132	II 38	212
Solanum dulcamara	-	-	-	4	36	139	II 37	55
Comarum palustre	-	-	-	7	18	154	II 37	47
Salix cinerea	-	-	-	4	23	101	II 27	41
Lythrum salicaria	-	-	-	1	3	109	II 24	9
Menyanthes trifoliata	-	1	1	18	24	67	II 23	113
Lemna minor	-	1	-	3	7	81	I 19	33
Epilobium palustre	-	-	-	1	5	78	I 18	10
Hydrocharis morsus-ranae	-	1	1	4	4	57	I 14	52
Cardamine amara	-	-	-	-	2	63	I 14	3
Calliergon cuspidatum	2	2	4	5	7	28	I 10	120
Acrocladium cuspidatum	-	-	3	9	15	11	I 8	72
Carex lasiocarpa	-	-	-	1	4	35	I 8	9
Calla palustris	-	-	-	1	3	36	I 8	8
Marchantia polymorpha	-	-	-	-	3	35	I 8	4
Galium uliginosum	-	-	-	-	1	33	I 7	1
Cirsium palustre	-	-	-	-	1	29	I 6	2
Sphagnum teres	7	2	1	2	2	11	I 5	171
Mnium seligeri	-	-	1	5	3	16	I 5	30
Carex diandra	-	-	1	1	8	16	I 5	20

communities with low density of the plants and they produce small amounts of phytomass per surface unit. A turning point in the "life of the lake" is such a state of shallowness that plant communities can occupy the whole or almost whole surface of the bottom. Then the water depth in most parts of the water body does not exceed several metres and the organic and mineral sediments are deposited almost uniformly in the whole lake basin. From this moment the problem of overgrowing with vegetation and plant succession begins to run rapidly as compared with the preceding period. Well rooted compact *Phragmites communis* tracts which until now developed on a mineral or slightly silty substrate, begin to penetrate gradually the substrate with their roots and corms forming and increasingly thick organic layer. The roots and corms penetrate at first without effort the not very thick water imbibed organic layer. In time, however, with further settlement of plants, rooting and anchorage of reed individuals in the rapidly thickening organic layer becomes more and more difficult and finally the process of further spread of the phytocenosis *Phragmitetum* is almost completely arrested. The vigorously developing phytocenoses of aquatic plants continue to produce enormous amounts of phytomass and together with the rush vegetation they rapidly cause further shallowing of the water body. When the water depth around the *Phragmitetum* phytocenoses and in them is low, and in the aquatic vegetation the first outposts of *Hydrocharitetum morsus-ranae* phytocenoses penetrate, individuals of *Dryopteris thelypteris* begin to appear in the shallowed *Phragmitetum* patches. Spreading ferns overrun the fragments of *Phragmitetum* phytocenoses where the organic layer is thick and the reeds less compact, thus parts most advanced into the lake. On these sites compact phytocenoses form consisting mainly of *Dryopteris thelypteris* and *Phragmites communis* and other usually rarely occurring rush species. In further development the phytocenoses formed are unable to take root in the thick water-imbibed organic substrate. Further development occurs as follows: reeds and other rush species penetrate among the compact *Dryopteris thelypteris* tufts which form the border of the patches on the water side, finding here a sufficiently hard substrate and the possibility of taking root. At a later stage mosses appear. In this way, owing to changes in the habitat *Thelypteridi-Phragmitetum* phytocenoses develop as one of the definite stages of lake vegetation.

Frequently the following pattern of vegetation zones is seen in lakes: from the dry land side *Phragmitetum* phytocenoses, then *Thelypteridi--Phragmitetum* and further in the water phytocenoses of the class *Potametea* and *Charetea*. *Phragmitetum* phytocenoses develop here on mineral or weakly peaty substrate, whereas *Thelypteridi-Phragmitetum* forms floating tufts on the watery organic substrate or on the water surface. The position of this phytocenosis in the zonal pattern of vegetation is a good example of how the order of spatial arrangement of the zones in

the water body does not always correspond to the order of successive stages. Zones A — B — C — E — D, whereas succesive stages A — B — C — D — E (Fig. 1).

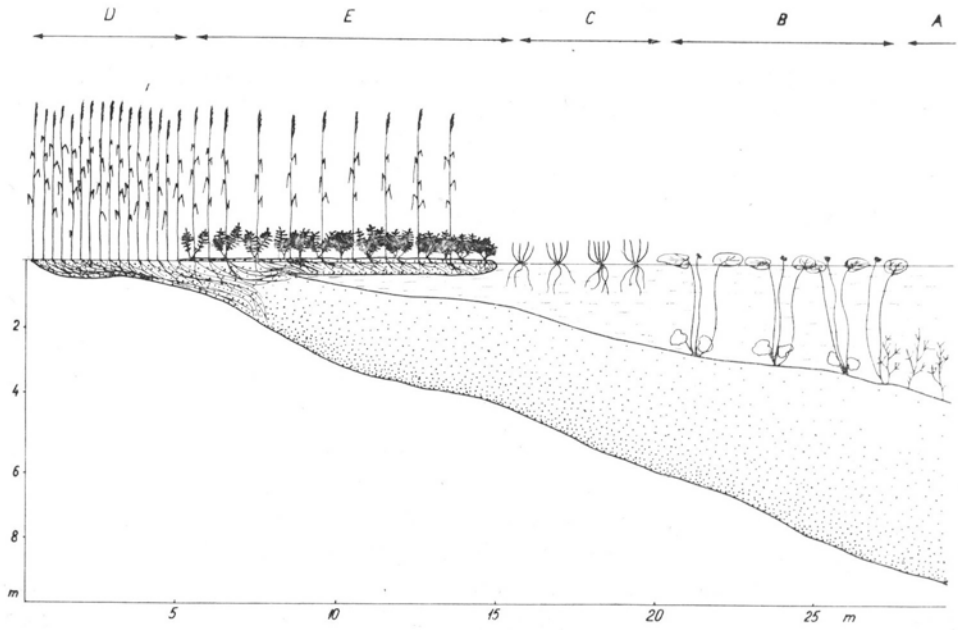

Fig. 1. Diagram of zonal littoral vegetation distribution in the lake: A — *Nitellopsidetum obtusae*, B — *Nuphareto-Nymphaeetum albae*, C — *Hydrocharitetum morsus-ranae*, D — *Phragmitetum*, E — *Thelypteridi-Phragmitetum*

To sum up, the *Thelypteridi-Phragmitetum* phytocenoses develop on water imbibedt hick organic substrate or on the water surface, forming a dense mass overruning the surface. Their place in the zonal pattern of the vegetation in the last stages of natural overgrowing of inland stagnant waters is strictly determined, they form the first zone of rush vegetation entering directly among aquatic communities. These phytocenoses constitute the last stage of rush vegetation of the alliance *Phragmition* in the natural process of transformation of stagnant water bodies into land.

It remains to be elucidated how the further development of these phytocenoses proceeds. According to literature data, they are considered as a developmental stage of communities of the class *Alnetea glutinosae*. In dependence on the trophic conditions, namely, the further development of *Thelypteridi-Phragmitetum* phytocenoses may have a different course. It results from observations in eutrophic water bodies transected by a water course that this phytocenosis is substituted by communities of the class *Alnetea glutinosae* or sometimes by sedge or moss-sedge communities, whereas, in water bodies without outflow, communities of the class *Oxy-*

cocco-Sphagnetea arise. The *Thelypteridi-Phragmitetum* phytocenoses are, therefore, not solely developmental stages of communities of the class *Alnetea glutinosae*. This is one more argument favouring the establishment of *Thelypteridi-Phragmitetum* as a separate syntaxonomic unit ranking as association.

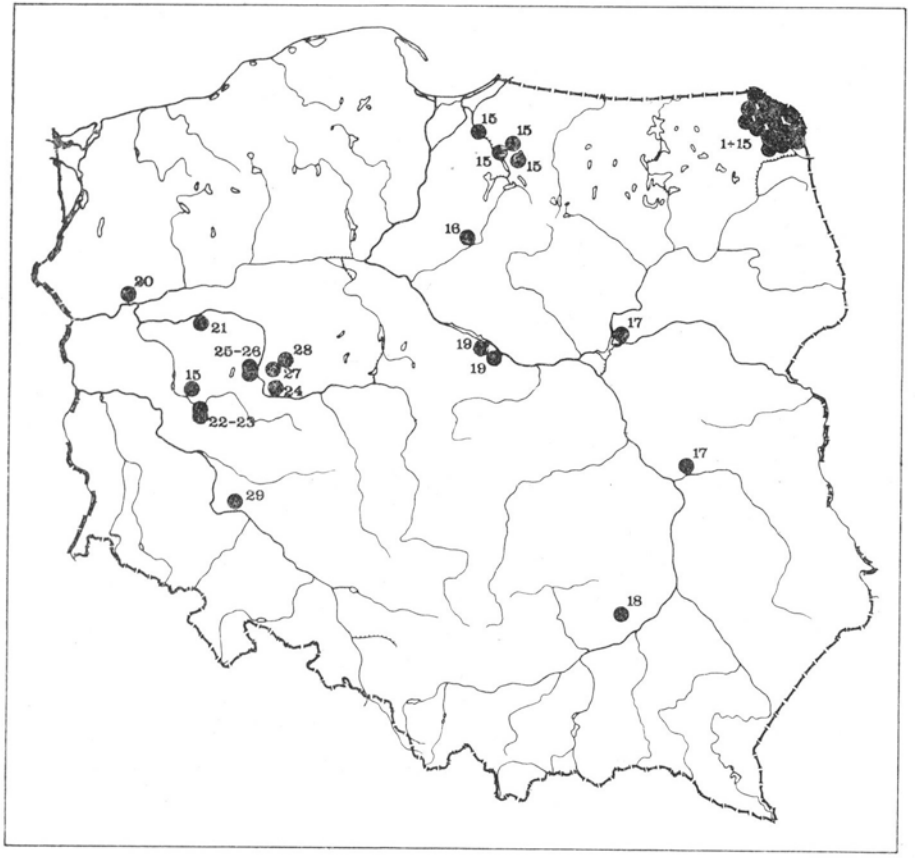

Fig. 2. Sites and groups of sites of *Thelypteridi-Phragmitetum* in Poland reported by: 1. Betlewicz (1974), 2. Bogdanowicz (1976), 3. Borowa (1975), 4. Gromadzińska (1973), 5. Jaworowska (1974), 6. Kłosowski (1976), 7. Kowal (1973), 8. Kowalczyk (1974), 9. Kryszewska-Czyżewska (1974), 10. Popławska (1975), 11. Pospychała (1975), 12. Rudnik (1975), 13. Romanowska (1973), 14. Wierzbicka (1973), 15. Tomaszewicz (1973—76 unpubl. records), 16. Kępczyński, Zielski (1974), 17. Podbielkowski (1968), 18. Ochyra (1976), 19. Tomaszewicz (1977), 20. Makarska (1975), 21. Dąmbska (1961), 22. Michalak (1975), 23. Jankowska (1975), 24. Gołdyn (1975), 25. Sieminiak (1972), 26. Przybysławska (1972), 27. Szczepańska (1975), 28. Markiewicz (1972), 29. Głowacki (1972—73) unpubl. records)

The systematic position of *Thelyperidi-Phragmitetum* within the class *Phragmitetea* should be precisely defined since here opinions are also

divergent. For instance Donselaar (1961), Podbielkowski (1968) and Gołdyn (1975) tend to classify this association to the alliance *Magnocaricion;* Markiewicz (1972), Kępczyński and Zielski (1974) include phytocenoses with abundant *Dryopteris thelypteris* into *Scripo-Phragmitetum* Koch 1926, thus to the alliance *Phragmition;* Tomaszewicz 1977) considering *Thelypteridi-Phragmitetum* as an association also classifies it to the alliance *Phragmition.* If we consider the position of *Thelypteridi-Phragmitetum* phytocenoses in the zonal pattern of communities, its role in plant succession and the floristic structure of the association, in the present authors opinion it should be classified to the alliance *Phragmition.*

The foregoing argumentation is mainly based on the author's own observations carried on for a dozen of years or so in the Gostynin Lakeland (lakes: Łąckie Małe, Drześno, Zdworskie, Lubaty I, Lubaty II, Łąckie Wielkie, Jeziorko) and in the Suwałki Lakeland (lakes: Dowcień, Królówek, Żubrowo, Klonówek, Wiązowne, Wielkie, Czarne, Jałówek, Jegleniszki, Okliny, Dziadówek, Bolcickie, Grałżyny, Sudawskie, Ślepak, Okrągłe, Gulbin, Błędne, Krajwelek, Przechodnie, Pobłędzie, Rakówek, Badugnel, Konopień, Podsumówek, Postawelek, Pogorzełek, Boczniel, Kluczysko, Jegłóweczek, Perty, Kamenduł, Jaczno, Hołny, Rygnis, Zelwa, Wiłkokuk, Gieret, Kaczan, Buchta). In observations concerning community succession the commonly used floristic-comparative method was applied which, in view of the large number of lakes studied in various stages of overgrowth with vegetation, is sufficient to allow the most probable hypothesis of plant development with one link consisting of *Thelypteridi-Phragmitetum* phytocenoses. The macroresidue of the bottom sediments was not examined.

The attached map (Fig. 2) presents the distribution of the sites or groups of sites of the association discussed recorded in Poland.

REFERENCES

Betlewicz E., 1974. Roślinność Pojezierza Suwalskiego. Zbiorowiska roślinne i flora Jeziora Przechodniego, Warszawa, (M. S.).

Bogdanowicz L., 1976. Roślinność i flora jezior: Białego, Czarnego, Płaskiego i Malona na Pojezierzu Sejneńskim, Warszawa, (M. S.).

Borowa I., 1975. Roślinność Pojezierza Sejneńskiego. Zbiorowiska roślinne i flora jeziora Gieret, Warszawa, (M. S.).

Dąmbska I., 1961. Roślinne zbiorowiska jeziorne okolic Sierakowa i Międzychodu, Pozn. Tow. Przyj. Nauk, Wydz. Mat.-Przyr., 23 (4): 1 - 120.

Donselaar J., 1961. On the vegetation of former river beds in the Netherlands, Wentia 5: 1 - 85.

Donselaar J., 1972, *Phragmitetalia*-gemeenschappen in de uiterwaarden, 1. Inleiding en *Scirpetum lacustris,* Gorteria 6 (4): 61 - 67.

Donselaar J., 1973. *Phragmitetalia*-gemeenschappen in de uiterwaarden, 2. *Typhetum angustifoliae, Typhetum latifoliae, Rorippo-Oenanthetum* en *Sparganio--Sagittarietum*, Gorteria 6 (7): 109 - 117.

Fabiszewski J., Faliński J. B., 1967. O roślinności okolic Przemętu, Przyroda Polski Zachodniej, 8, (1 - 4): 23 - 46.

Gołdyn R., 1975. Zbiorowiska roślinne Jeziora Raczyńskiego pod Zaniemyślem, Bad. Fizjogr. nad Polską Zach., B, 28: 49 - 87.

Gromadzińska K., 1973. Roślinność jeziora Kojle, Warszawa, (M. S.).

Hilbig W., 1971. Übersicht über die Pflanzengesellschaften das südlichen Teiles der DDR. II. Röhrichtgesellschaften, Hercynia N. F., 8, (4): 256 - 285.

Hilbig W., Reichhoff L., 1971. Die Wasser- und Verlandungsvegetation im Naturschutzgebiet Sarenbruch bei Klieken, Krs. Rosslau, Anleitungsmaterial für die Naturschutzmitarbeiter, Naturschutz, 1/2: 33 - 54.

Jankowska J., 1975. Roślinność Jeziora Wieleńskiego na Pojezierzu Leszczyńskim, Poznań, (M. S.).

Jaworowska W., 1974. Zbiorowiska roślinne i flora Jeziora Okrągłego, Warszawa, (M. S.).

Kępczyński K., Zielski A., 1974. Zespoły roślinne jeziora Mieliwo i torfowiska do niego przyległego w powiecie brodnickim, Acta Univ. Nicolai Copernici, Biol. 16: 125 - 167.

Kłosowski St., 1967. Roślinność jeziora Pomorze i Buchta na Pojezierzu Sejneńskim, Warszawa, (M. S.).

Kowal A., 1973. Roślinność jeziora Jaczno, Warszawa, (M. S.).

Kowalczyk J., Roślinność Pojezierza Północnosuwalskiego. Zbiorowiska roślinne i flora jeziora Krajwelek, Warszawa, (M. S.).

Kryszewska-Czyżewska J., 1974. Roślinność Pojezierza Północnosuwalskiego. Zbiorowiska roślinne i flora jeziora Gulbin, Warszawa, (M. S.).

Krzewański D., 1974. Zbiorowiska roślinne starorzeczy w dolinie środkowej Warty, Monogr. Bot., 43: 1 - 80.

Lang G., 1973. Pflanzensoziologie, Eine Reihe vegetationskundlicher Gebietsmonographien, Die Vegetation des westlichen Bodenseegebietes, 17: 1 - 451, Jena.

Makarska M., 1975. Roślinność naczyniowa zarastających zbiorników wodnych okolic Zdroiska na północny wschód od Gorzowa Wlkp., Poznań, (M. S.).

Markiewicz H., 1972. Roślinność stawów Kuracz i Zielony Dworek w Promnie pod Poznaniem, Bad. Fizjogr. nad Polską Zach. 25, B. 83 - 114.

Michalak D., 1975. Roślinność Jeziora Osłonińskiego na Pojezierzu Leszczyńskim, Poznań, (M. S.).

Ochyra R., 1976. Zarastanie lejków krasowych w okolicach Staszowa, Kraków, (M. S.).

Podbielkowski Z., 1968. Roślinność stawów rybnych woj. warszawskiego, Monogr. Bot. 27: 1 - 123.

Popławska J., 1975. Zbiorowiska roślinne i flora jeziora Wiłkokuk, Warszawa, (M. S.).

Pospychała J., 1975. Roślinność i flora jeziora Kaczan, Warszawa, (M. S.).

Przybysławska H., 1972. Zbiorowiska roślinne Jeziora Rosnowskiego w Wielkopolskim Parku Narodowym, Poznań (M. S.).

Romanowska L., 1973. Roślinność jeziora Perty, Warszawa, (M. S.).

Rudnik H., 1975. Roślinność i flora jeziora Dowcień, Warszawa, (M. S.).

Sieminiak D., 1972. Zbiorowiska roślinne Jeziora Góreckiego i jeziora Skrzynka w Wielkopolskim Parku Narodowym, Poznań, (M. S.).

Szczepańska M., 1975. Roślinność wodna okolic Nekli, Poznań, (M. S.).

Tomaszewicz H., 1973. The position of *Scirpo-Phragmitetum* W. Koch 1926 in systematics, Acta Soc. Bot. Pol., 42 (3): 379 - 390.
Tomaszewicz H., 1977. Roślinność wodno-bagienna w akwenach zlewni Skrwy i ciechomickiej na Pojezierzu Gostynińskim, Monogr. Bot. (in press).
Wierzbicka B., 1973. Roślinność jeziora Kamenduł, Warszawa, (M. S.).

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Dynamika i stanowisko systematyczne Thelypteridi-Phragmitetum Kuiper 1957

Streszczenie

W niewielu tylko pracach dotyczących roślinności wodnej i szuwarowej spotykamy opisy fitocenoz z *Dryopteris thelypteris*. Nie znaczy to wcale, że są one u nas rzadkie; wręcz przeciwnie — występują często. Jeszcze rzadziej identyfikowany jest zespół, który one tworzą, a mianowicie *Thelypteridi-Phragmitetum*. Przyczyną jest trudność w zaklasyfikowaniu fitocenoz, które zbudowane są głównie z *Dryopteris thelypteris* i gatunków szuwarowych, przeważnie ze związku *Phragmition*. Otóż, ta specyficzna jednostka nie ma gatunków charakterystycznych, a jedynie charakterystyczną kombinację gatunków, a *Dryopteris thelypteris* można jedynie wydzielić jako gatunek określający zbiorowisko. Określone miejsce fitocenoz *Thelypteridi-Phragmitetum* w układzie strefowym i w sukcesji roślinności oraz ich struktura florystyczna świadczy o ich odrębności. W zależności od warunków troficznych, ich dalszy rozwój przebiega w kierunku zbiorowisk olsowych i turzycowych, lub w kierunku zbiorowisk z klasy *Oxycocco-Sphagnetea*. W systemie zbiorowisk roślinnych zespół *Thelypteridi-Phragmitetum* powinien znaleźć się w obrębie związku *Phragmition*, na co między innymi wskazuje załączona tabela syntetyczna o rozszerzonym zasobie informacji, obejmująca 480 zdjęć fitosocjologicznych.