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Revision of some Mazovian interglacial macrofossil floras of Poland

FELIKS Yu. VELICHKEVICH[1], KAZIMIERA MAMAKOWA[2] and LEON STUCHLIK[2]

[1]Institute of Geological Sciences, National Academy of Sciences of Belarus, Kuprevich str.7, 220141 Minsk, Belarus
[2]W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland;
e-mail: mamakowa@ib–pan.krakow.pl, stuchlik@ib–pan.krakow.pl

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ABSTRACT. Results of a revision of the macrofossil plant remains collection from six Polish localities referred to the Mazovian interglacial are presented. This work is a continuation of the revision undertaken on the Polish Quaternary and Pliocene collections housed in the Palaeobotanical Museum of the W. Szafer Institute of Botany, Polish Academy of Sciences in Krakow, that started at the beginning of the 90s of the last century.

KEY WORDS: macrofossils, revision, Mazovian interglacial floras, Poland

INTRODUCTION

This paper is a continuation of the research initiated during the beginning of the 90s of the last century, that undertook a necessary revision of the plant macrofossil collections of Pleistocene and some Pliocene localities from Poland. These collections are housed in the Palaeobotanical Museum of the W. Szafer Institute of Botany, Polish Academy of Sciences in Kraków (KRAM-P). The revision was necessary in order to correct determinations of numerous specimens that had been previously made, to provide additional detailed determinations of some remains identified by earlier authors, and to identify specimens considered by earlier authors to be indeterminate. The methods used are described by Velichkevich and Mamakowa (1999). Some results of the revision have already been published (Mamakowa & Velichkevich 1993a,b, Velichkevich & Lesiak 1996, 1999, Velichkevich & Granoszewski 1996, Velichkevich & Mamakowa 1999, 2003). From the floristic point of view the Mazovian interglacial floras belong to the most interesting and important group of the whole Pleistocene, and these are often cited by many palaeobotanists working with European interglacial floras, especially eastern European Pleistocene floras. As a consequence it has been important to undertake a revision of some classical Polish profiles containing Mazovian interglacial floras (Fig. 1). It is worthy to note, that the age determination of the investigated floras, in spite of considerable changes

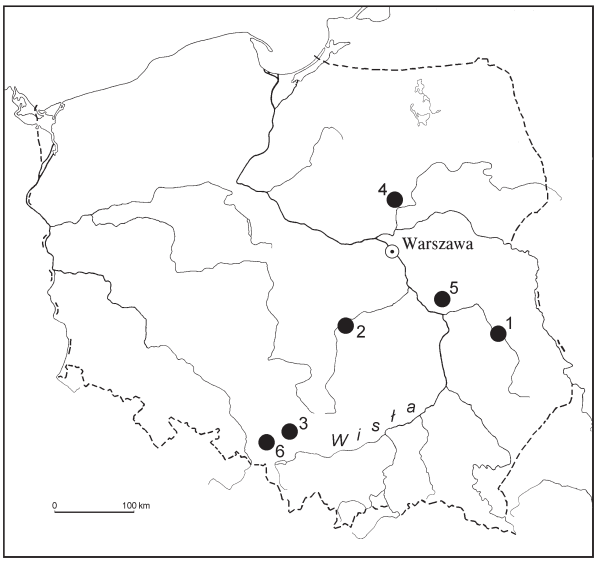

Fig. 1. Location of the revised floras: **1** – Ciechanki Krzesimowskie, **2** – Olszewice, **3** – Stanowice, **4** – Maków Mazowiecki, **5** – Wylezin, **6** – Gościęcin

in the flora composition, has not been changed. Results have confirmed the age suggested by previous authors although this investigation has allowed more precise determinations to be made in certain cases. In addition to this revision it has become apparent that the floras are now more accurately known and constitute a more valuable tool for palaeophytogeographic reconstructions.

RESULTS OF THE REVISION

CIECHANKI KRZESIMOWSKIE
(Tab. 1)

The investigated by Brem (1953) fossil flora from the locality Ciechanki Krzesimowskie contained 43 taxa of trees, shrubs and herbaceous plants (Tab. 1). Apart from a few species (*Ajuga reptans* L., *Ceratophyllum demersum* L.,

Table 1. List of macroscopic plant remains from Ciechanki Krzesimowskie (KRAM-P-Q-62)

Abbreviations: e – endocarp, f – fruit, fr – fragment, n – needle, s – seed, sc – scale, sp – spine; [(a)] only in collection

After revision	Type of remains	Number of specimens	After Brem (1953)
Abies sp.	n	2 fr	*Abies* sp.
Ajuga reptans L.	f	2	*Ajuga reptans* L.
Aldrovanda cf. *dokturovskyi* Dorof.	s	1	*Aldrovanda vesiculosa* L.
Alisma plantago-aquatica L.	s	1	[(a)]indet.
Alnus sp.	f	3	[(a)]indet.
Arctostaphylos uva-ursi (L.) Spreng.	s	1	[(a)]indet.
Batrachium sp.	f	6	*Batrachium* sp.
Betula sect. *Albae* Rgl.	f/sc	40/1	*Betula "alba"*
Betula sect. *Albae* Rgl	f	2	[(a)]indet.
B. cf. *humilis* Schrank	f	1	[(a)]indet.
Brasenia borysthenica Wieliczk. s.l.	s	2	*Brasenia purpurea* Mich.
Carex paucifloroides Wieliczk.	f	7	*Carex* sp. div.
C. pseudocyperus L.	f	12	*Carex* sp. div.
Carex sp. div. (2-sided)	f	130	*Carex* sp. div.
Carex sp. div. (3-sided)	f	386	*Carex* sp. div.
Carduus sp.	s	3	[(a)]indet.
Carpinus betulus L.	f	10	*Carpinus betulus* L.
Caulinia goretskyi Dorof.	s	1010	*Najas flexilis* (Willd.)Rostk. & Schmidt
C. minor (All.) Coss. & Germ.	s	50	*N. minor* All.
C. ex gr. *tenuissima* (A. Br.) Tzvel.	s	1fr	*N. tenuissima* A. Br.
Ceratophyllum demersum L.	f	263	*Ceratophyllum demersum* L.
C. submersum L.	f	122	*C. submersum* L.
Cladium mariscus (L.) Pohl	f	1	[(a)]indet.
Cyperaceae gen.	f	2	*Carex* sp. div.
Hippuris vulgaris L.	f	1	[(a)]indet.
Larix sp.	s	56	*Larix* sp.
Lycopus europaeus L.	f	7	*Lycopus europaeus* L.
Menyanthes trifoliata L.	s	66	*Menyanthes trifoliata* L.
Myriophyllum spicatum L.	f	48	*Myriophyllum alternifolium* DC.
M. spicatum L.	f	21	*M. spicatum* L.
Najas marina L.	s	13	*Najas marina* L.
Nuphar lutea (L.) Sibth. & Sm.	s	71	*Nuphar luteum* (L.) Sm.
N. pumila (Timm) DC.	s	17	*N. pumilum* (Timm) DC.
Nymphaea cf. *alba* L.	s	12	*Nymphaea candida* Presl.
N. candida C. Presl.	s	2	*N. candida* Presl.
N. cf. *cinerea* Wieliczk.	s	128	*N. candida* Presl.
Oenanthe aquatica (L.) Poir.	f	1	[(a)]indet.
Picea sect. *Omorica* Willk.	n	1fr	*Picea omoricoides* Web.
Picea sp.	s/n	14/10	*Picea* sp.

Table 1. Continued

After revision	Type of remains	Number of specimens	After Brem (1953)
Pinus sp.	s	17	[a]indet.
Polygonum lapathifolium L.	f	6	[a]indet.
Potamogeton acutifolius Link.	e	27	*Potamogeton* sp. div.
P. cf. *acutifolius* Link.	e	2	*Potamogeton* sp. div.
P. alpinus Balb.	e	7	*Potamogeton* sp. div.
P. compressus L.	e	52	*Potamogeton* sp. div.
P. crispus L.	e	3	*Potamogeton* sp.div.
P. friesii Rupr.	e	8	*Potamogeton* sp. div.
P. cf. *friesii* Rupr.	e	5	*Potamogeton* sp. div.
P. cf. *goretskyi* Dorof.	e	20	*Potamogeton* sp. div.
P. gramineus L.	e	15	*Potamogeton* sp. div.
P. lucens L.	e	65	*Potamogeton* sp. div.
P. natans L.	e	699	*Potamogeton* sp. div.
P. obtusifolius Mert. & Koch	e	35	Potamogeton sp. div.
P. cf. *obtusifolius* Mert. & Koch	e	5	*Potamogeton* sp. div.
P. panormitanoides Dorof.	e	2	*Potamogeton* sp. div.
P. perfoliatus L.	e	1	*Potamogeton* sp.
P. perforatus Wieliczk.	e	18	*Potamogeton* sp. div.
P. praelongus Wulf.	e	39	*Potamogeton* sp. div.
P. rutilus Wolfg.	e	5	*Potamogeton* sp. div.
P. trichoides Cham. & Schlecht.	e	4	*Potamogeton* sp. div.
P. vaginatus Turcz.	e	1	*Potamogeton* sp.
Potamogeton sp.	e	28	*Potamogeton* sp. div.
Potentilla sp.	f	3	*Potentilla* sp.
Prunus spinosa L.	f	1	*Prunus padus* L.
Ranunculus sceleratus L.	f	6	[a]indet.
Rubus idaeus L.	f	14	*Rubus idaeus* L.
Rumex maritimus L.	f	82	*Rumex maritimus* L.
Sagittaria sagittifolia L.	s	4	*Sagittaria sagittifolia* L.
Sambucus. ebulus L.	s	1	*Sambucus ebulus* L.
S. racemosa L.	s	1	*S. racemosa* L
Schoenoplectus lacustris (L.) Palla	f	57	*Scirpus lacustris* L.
Sch. tabernaemontani (C.C. Gmel.) Palla	f	1	[a]indet.
Sparganium emersum Rehm.	e	29	*Sparganium* cf. *simplex* Huds.
S. minimum Wallr.	e	12	*S.* cf. *minimum* Fries.
Stachys palustris L.	f	1	[a]indet.
Stratiotes aloides L.	s	31	*Stratiotes aloides* L.
Taxus baccata L.	s	1	*Taxus baccata* L.
Trapa capitulata Szafer	f	1	[a]*Trapa capitulata* Szafer
T. natans L.	f/sp	7+fr/2	*T. natans* L.
Urtica dioica L.	f	4	[a]indet.
Viola sp. div.	s	3	*Viola* sp.
Vitis sylvestris C.C. Gmel.	s	1	*Vitis sylvestris* Gmel.

Hippuris vulgaris L., *Menyanthes trifoliata* L., and others) that are common for interglacial floras of various ages, a group of taxa characteristic mostly of the Mazovian interglacial has been recorded. These are *Abies* sp., *Picea* sect. *Omorica* Willk., *Taxus baccata* L., *Vitis sylvestris* C.C.Gmel., and others. Most of the taxa determined by Brem (1953) have been confirmed by the revision, in spite of the revision formally changing some names (*Sparganium simplex* Huds. = *S. emersum* Rehm., *Scirpus lacustris* L. = *Schoenoplectus lacustris* (L.) Palla, and others), following the rules of the International Code of Botanical Nomencla-

ture (Greuter et al. 2000). However, some taxa determined by Brem (1953) to recent species, as it was used at that time, became evident extinct Pleistocene species. This concerns species of the following genera: *Aldrovanda*, *Brasenia*, *Caulinia* (*Najas*), and *Nymphaea*, all described in the 60s and 70s but not known by palaeobotanists at the mid of last century. After the revision the flora from Ciechanki Krzesimowskie is nearly twice as rich as it was described by Brem (1953). This is mainly due to the revision distinguishing several species of *Potamogeton* and providing specific identifications for taxa that were previously considered to be indeterminate. Many endocarps of *Potamogeton* from this flora have also been determined by Aalto in 1974 during her visit in the Institute of Botany Polish Academy of Sciences in Kraków. Most of these species remain valid today for which the revision has only added species not known in the 70s. These are *Potamogeton goretskyi* Dorof. recognized as a recent far eastern species, *P. oxyphyllus* Miq., or *P. panormitanoides* Dorof. endocarps of which have been compared by Aalto with the recent European species *P. panormitanus* Biv. Finely, some endocarps from the collection distinguished by Aalto only to the genus, have been after revision determined as *P. perforatus* Wieliczk.

Thanks to the revision the flora from Ciechanki Krzesimowskie has been considerably enriched especially in extinct species, and can be now recognized as one of the richest and best-defined interglacial flora of the Mazovian age in Poland and neighbouring countries.

OLSZEWICE
(Tab. 2)

The flora from Olszewice locality is one of the earliest recognized interglacial floras of the Mazovian age in Poland. It was collected in 1925 and later elaborated by Lilpop (1929, 1932). This is an immensely expressive interglacial flora bearing many indicator taxa for the Mazovian interglacial including *Abies alba* Mill., *Aldrovanda dokturovskyi* Dorof., *Aracites interglacialis* Wieliczk., *Brasenia borysthenica* Wieliczk., *B. borysthenica* var. *heterosperma* Wieliczk., and *Scirpus torreyi* Olney. Some of these (*Abies*, *Aracites*, *Brasenia*) are abundantly represented in the macrofossil collection, what makes the Olszewice interglacial flora one of the richest Mazovian flora in Poland. It is understandable that at the beginning of the last century fossil macro-remains were mainly comparable with recent taxa, and our knowledge about extinct taxa began to establish in the 1960s–70s. The majority of plant remains from Olszewice have been correctly determinate to the genus range, and this was unquestionable achievement for that time.

It should be emphasized that the flora from Olszewice having in common most of its taxa with other Mazovian floras, differs from them by having two atypical species of that age: *Pinus montana* Mill. and *Nuphar* cf. *ovata* Dorof. Lilpop (1929) classified the abundantly preserved macroscopic remains of *Pinus* (needles, seeds, cones, twigs) to *Pinus montana*, but in closer comparison with this recent taxon many features are similar also with *P. sylvestris* L., particularly with its forma *palustris* Staszk., and cone morphology is very similar, too. With our actual knowledge we can neither confirm nor negate the Lilpop's opinion, but taking into consideration that *Pinus montana* has never been found in Mazovian floras in east European lowlands, we assign the macrofossils from Olszewice to *Pinus sylvestris* L. f. *palustris* Staszk. It is worth-while remembering that *Pinus montana* is a sub-mountain species and the Olszewice locality is situated in a typical lowland setting.

The second mentioned species *Nuphar* cf. *ovata* Dorof. belongs to a group of extinct Pleistocene species incorporated early in the European flora, and disappeared from the flora composition during the last million years. Dorofeev (1992) described *N. ovata* from the middle Pleistocene interglacial flora Nikol'skoe near the town Demshinsk in central Russia. He recognized that in the morphology of this species features of the European species *N. lutea* (L.) Sibth. & Sm. are mixed with features of some American species of the genus. In Olszewice occasional seeds of *Nuphar* cf. *ovata* occur together with numerous seeds of *N. lutea* without any intermediate forms. Olszewice represents the first report of *N. ovata* in the Polish Quaternary floras and is the second in the East-European Lowlands.

One of the most important result of the revision was the statement, that the only seed with a wing distinguished by Lilpop (1929) as *Tsuga* aff. *canadensis* Murr. is an immature seed of *Abies alba* Mill.

Table 2. List of macroscopic plant remains from Olszewice (KRAM-P-Q-116)

Abbreviations: co – cone, cp – cupula, e – endocarp, f – fruit, l – leaf, n – needle, s – seed, sc – scale, w – wing; [(a)] only in collection, [(b)] determined by M. Łańcucka-Środoniowa, [(c)] determined by M. Aalto

After revision	Type of remains	Number of specimens	After Lilpop (1929, 1932)
Abies alba Mill.	s/n/sc	163/263/15	*Abies alba* Mill.
Abies alba Mill.	w	1	*Tsuga* aff. *canadensis* Murr.
Aldrovanda dokturovskyi Dorof.	s	2	*Aldrovanda vesiculosa* L.
Andromeda polifolia L.	s/l	16/3	*Andromeda polifolia* L.
Aracites interglacialis Wieliczk.	s	680	[(a)] indet. [[(b)]*Aracispermum johnstrupii* (Harz) Nikit.]
Betula sect. *Albae* Rgl.	f/sc	15/17	*Betula alba* L.
B. humilis Schrank	sc	1	[(a)]indet.
Brasenia borysthenica Wieliczk. s.l.	s	4	[(a)]*Brasenia nehringii* Szafer
B. borysthenica var. *heterosperma* Wieliczk.	s	88	*B. purpurea* Mich.
Carex sp. div. (2-sided)	f	223	*Carex* sp. div.
Carex sp. div. (3-sided)	f	12	*Carex* sp. div.
Carex sp. (3-sided)	f	1	*Rhynchospora alba* Vahl.
Carpinus betulus L.	f	16	*Carpinus betulus* L.
C. betulus L.	l	2	*C. betulus* L.
C. betulus L.	f	1	*Scheuchzeria palustris* L.
Carpinus sp.	f	1	[(a)]indet.
Comarum palustre L.	f	11	[(a)]indet.
Cyperaceae gen.	f	10	[(a)]indet.
Ericaceae gen.	cp	1	[(a)]Coniferae
Fallopia convolvulus (L.) Á. Löve	f	1	*Polygonum dumetorum* L.
Larix sp.	n	29	*Larix* sp.
Ledum palustre L.	l	24	*Ledum palustre* L.
Menyanthes trifoliata L.	s	16	*Menyanthes trifoliata* L.
Nuphar lutea (L.) Sibth. & Sm.	s	79	*Nuphar luteum* (L.) Sm.
N. cf. *ovata* Dorof.	s	7	*N. luteum* (L.) Sm.
Nymphaea alba L.	s	9	*Nymphaea alba* L.
N. cf. *candida* C. Presl.	s	1	*N. alba* L.
[(b)]*Ornithopus* sp.	f	5	[(a)]indet.
Oxycoccus palustris Pers.	l	7	*Oxycoccus quadripetala* Gilib.
Picea sect. *Eupicea* Willk.	s	9	[(a)]Coniferae
Picea sp. div.	s/n/w	10/112/71	*Picea* sp. div.
Pinus sylvestris L. f. *palustris* Staszk.	s/n/co	∞/∞/ 9	*Pinus montana* Mill.
Poaceae gen.	f	1	[(a)]indet.
Polygonum aviculare L.	f	5	[(a)]indet
P. lapathifolium L.	f	2	*Polygonum lapathifolium* L.
P. lapathifolium L	f	1	*Ranunculus* cf. *bulbosus* L.
Potamogeton natans L.	e	1039	*Potamogeton* sp. div. ([(c)]*P. natans* L.)
P. obtusifolius Mert. & Koch	e	5	[(a)] *P. obtusifolius* Mert. & Koch
P. cf. *perfoliatus* L.	e	9	*Potamogeton* sp. div. ([(c)]*P. natans* L.)
P. praelongus Wulf.	e	1	[(a)]*P. praelongus* Wulf.
Potamogeton sp.	e	1	*Potamogeton* sp. ([(c)]*P. natans* L.)
Potentilla sp.	f	1	[(a)]indet.
Quercus robur L.	l	1	*Quercus robur* L.
Rubus idaeus L.	f	1	[(a)]indet.
Rumex acetosella L.	f	1	[(a)]indet.
R. crispus L.	f	3	*Rumex crispus* L.
Sambucus racemosa L.	s	1	[(a)]indet.
Scirpus torreyi Olney	f	14	*Scirpus* sp. div.
Scleranthus annuus L.	f	5	[(a)]*Scleranthus*
Scrophulariaceae gen.	f	1	[(a)]indet.
Sparganium sp.	e	2	[(a)]indet.
Tilia cf. *cordata* Mill.	f	10	[(a)]indet.
Viola sp. div.	s	16	[(a)]indet.

It is worthy of note that until 1966 in the collection were housed a lot of indeterminate seeds of *Aracites interglacialis* Wieliczk., later revised and all determined by Łańcucka-Środoniowa (1966) as *Aracispermum johnstrupii* (Hartz) Nikit. At the beginning of the 90s the correct taxonomic position of all specimens has been established (Mamakowa & Wielichkevich 1993b). This species is characteristic only of the Mazovian interglacial and is abundant in the fossil floras in Poland (e.g. Olszewice, Stanowice, Nowiny Żukowskie), Belarus (e.g. Minichi, Ruba, Gralevo, Verkhov'e-1) and Russia (e.g. Alkhimkovo, Yakovlevskoe). This species is as abundant, as it is in Olszewice only in Krukenichi in the Ukraine (Velichkevich 1982) and Stonava in Czech Republic determined by Vodičková-Kneblová (1961) as *Scheuchzeria palustris* L.

STANOWICE
(Tab. 3)

The interglacial flora from Stanowice after revision comprises over 100 taxa, and is actually the richest and the best-known of all hitherto elaborated Mazovian macroscopic floras in Poland. Most of the taxa were correctly determined by Sobolewska (1977) for which revision has not been necessary. The taxonom-

Table 3. List of macroscopic plant remains from Stanowice (KRAM-P-Q-12)

Abbreviations: a – axis of cone, e – endocarp, f – fruit, m – macrospore, mi – microspore, msp –microsporangium, n – needle, s – seed, sc –scale, sp – spine, w – wing; [(a)] only in collection

After revision	Type of remains	Number of specimens	After Sobolewska (1977)
Abies alba Mill.	s/n/w	3/17/4	*Abies alba* Mill. (s/w [(a)])
Abies sp.	s	1	[(a)]indet.
Alchemilla sp.	f	1	[(a)]indet.
Aldrovanda dokturovskyi Dorof.	s	12	*Aldrovanda vesiculosa* L.
A. vesiculosa L.	s	10	*A. vesiculosa* L.
Alisma plantago-aquatica L.	s	1	*Alisma plantago-aquatica* L.
A. plantago-aquatica L.	s	1	*Sagittaria sagittifolia* L.
Alnus glutinosa (L.) Gaertn.	f	39	*Alnus glutinosa* (L.) Gaertn.
A. incana (L.) Moench	f	10	*A. glutinosa* (L.) Geartn.
Alnus sp.	a	10	[(a)]*A. glutinosa* (L.) Geartn.
Alnus sp.	f	5	*Carex* sp.
Alnus sp.	f	1	[(a)]indet.
Andromeda polifolia L.	s	5	*Andromeda polifolia* L.
A. polifolia L.	s	15	*Menyanthes trifoliata* L.
A. polifolia L.	s	26	[(a)]indet.
Aracites interglacialis Wieliczk.	s	117	*Aracispermum johnstrupii* (Hartz) Nikit.
Azolla filiculoides Lam.	m	120	*Azolla filiculoides* Lam.
Batrachium sp.	f	42	*Ranunculus (Batrachium)*
Betula sect. *Albae* Rgl.	f/sc	130/6	*Betula alba* L. (sc [(a)])
B. sect. *Albae* Rgl.	f/sc	73/13	[(a)]*Betula* sp.
B. humilis Schrank	f/sc	10/1	*B. alba* L. (sc [(a)])
B. humilis Schrank	f/sc	1/1	[(a)]*Betula* sp.
Betula sp.	sc	1	[(a)]*Betula* sp.
Brasenia sp. (exotic)	s	1	*Brasenia schreberi* J.F.Gmel. (*B. purpurea*)
Brassicaceae gen.	s	1	[(a)] indet.
Caldesia parnassifolia (L.) Parl.	f/e	25/2	*Caldesia parnassifolia*(L.) Parl.
C. parnassifolia (L.) Parl.	e	1	*Potamogeton* sp.
Calla palustris L.	s	2	*Calla palustris* L.
Callitriche sp.	f	25	*Callitriche* sp.
Carex cf. *chordorrhiza* Ehrh.	f	6	*Carex* cf. *chordorrhiza* Ehrh.
C. pseudocyperus L.	f	2	[(a)]indet.
C. cf. *pseudocyperus* L.	f	14	*C. pseudocyperus* L.
C. cf. *pseudocyperus* L.	f	40	*Carex* sp.
C. rostrata Stokes	f	1	*C. rostrata* Stokes

Table 3. Continued

After revision	Type of remains	Number of specimens	After Sobolewska (1977)
Carex sp. div. (2-sided)	f	922	*Carex* sp.
Carex sp. div. (2-sided)	f	691	*Acorellus pannonicus* (Jacq.) Pall.
Carex sp. div. (3-sided)	f	165	*Carex* sp.
Caulinia cf. *goretskyi* Dorof.	s	5	*Najas flexilis* (Willd.) Rostk. & Schmidt
C. minor (All.) Coss. & Germ.	s	1077	*N. minor* All.
Ceratophyllum demersum L.	f	71	*Ceratophyllum demersum* L.
C. cf. *demersum* L.	f	1	[(a)]indet.
Ceratophyllum sp.	f	1	[(a)]indet.
Chenopodium rubrum L.	s	1	*Chenopodium rubrum* L.
Cicuta virosa L.	f	1	*Cicuta virosa* L.
C. virosa L.	f	1	[(a)]indet.
Comarum palustre L.	f	3	*Comarum palustre* L.
C. palustre L.	f	2	[(a)]indet.
Cyperus fuscus L.	f	8	*Cyperus flavescens* L.
C. fuscus L.	f	4	*C. fuscus L.*
Dulichium arundinaceum (L.) Britt.	f	95	*Dulichium spathaceum* Pers.
Eleocharis ovata (Roth) Roem. & Schult.	f	1	*Carex* sp.
E. palustris (L.) Roem. & Schult.	f	1	*Carex* sp.
E. praemaximowiczi Dorof.	f	95	*Cyperus flavescens* L.
E. praemaximowiczi Dorof.	f	10	*Scirpus* sp.
E. praemaximowiczi Dorof.	f	62	[(a)]indet.
Eurylae ferox Salisb.	s/sp	49/∞	*Eurylae ferox* Salisb.
Euryale sp.	s	2	[(a)]indet.
Frangula alnus Mill.	f	15	*Frangula alnus* Mill.
Hippuris vulgaris L.	f	1	[(a)]indet.
Hydrocharis morsus-ranae L.	s	4	*Hydrocharis morsus-ranae* L.
Hydrocotyle ranunculoides L.	f	208	*Hydrocotyle ranunculoides* L.
Larix sp.	s	1	[(a)]indet.
Lemna minor L.	s	23	*Lemna* sp.
L. trisulca L.	s	2	*Lemna* sp.
Lychnis flos-cuculi L.	s	1	*Cerastium arvense* L.
Lycopus europaeus L.	f	182	*Lycopus europaeus* L.
Lysimachia vulgaris L.	s	1	*Lysimachia* sp.
Mentha arvensis L.	f	2	*Mentha aquatica* L.
M. arvensis L.	f	2	*M. arvensis* L.
M. arvensis L.	f	1	[(a)]indet.
Menyanthes trifoliata L.	s	475	*Menyanthes trifoliata* L.
M. trifoliata L.	s	1	*Lathyrus palustris* L.
Myriophyllum spicatum L.	f	10	*Myriophyllum verticillatum* L.
M. spicatum L.	f	8	*Myriophyllum* sp.
M. spicatum L.	f	1	[(a)]indet.
Najas marina L.	s	6	*Najas marina* L.
Nymphaea cf. *cinerea* Wieliczk.	s	5	*Nymphaea alba* L.
Picea sect. *Eupicea* Willk.	n	1	*Picea abies* (L.) Karst.
Picea sect. *Eupicea* Willk.	n/w	2/1	*Abies alba* Mill.(w [(a)])
Picea sect. *Omorica* Willk.	n	3	*A. alba* Mill.
Picea sp.	s	1	[(a)]indet.
Picea sp.	s	1	*Najas marina* L.
Pinus cf. *sylvestris* L.	n	3	*Picea abies* (L.) Karst.
P. sylvestris L.	sc	3	[(a)]indet.
P. cf. *sylvestris* L.	n	15	[(a)]*Picea* sp.
Pinus sp.	s	1	[(a)]indet.
Polygonum lapathifolium L.	f	7	*Polygonum lapathifolium* L.
Polypodiaceae gen.	mi	49	[(a)]Polypodiaceae
Potamogeton alpinus Balb.	e	2	*Potamogeton alpinus* Balb.

Table 3. Continued

After revision	Type of remains	Number of specimens	After Sobolewska (1977)
Potamogeton crispus L.	e	444	*P. crispus* L.
P. crispus L.	e	4	*Potamogeton* sp.
P. dorofeevii Wieliczk.	e	4	*Potamogeton* sp.
P. gramineus L.	e	1	*P. lucens* L.
P. gramineus L.	e	1	*Lycopus europaeus* L.
P. natans L.	e	117	*Potamogeton natans* L.
P. cf. *natans* L.	e	1	*P. gramineus* L.
P. cf. *natans* L.	e	1	*Potamogeton* sp.
P. nodosus Poir.	e	1	[(a)]*P. franchetii* Arth. Benn.
P. obtusifolius Mert. & Koch	e	1	*P. obtusifolius* Mert. & Koch
P. obtusifolius Mert. & Koch	e	2	*P. perfoliatus* L.
P. obtusifolius Mert. & Koch	e	4	*Potamogeton* sp.
P. pectinatus L.	e	1	*P. pectinatus* L.
P. pusillus L.	e	1	*P.* cf. *berchtoldii* Fieb.
P. rutilus Wolfg.	e	6	*P. rutilus* Wolfg.
Potamogeton sp.	e	2	*Potamogeton* sp.
Potentilla cf. *recta* L.	f	1	*Potentilla* sp.
Primula sp.	s	1	*Primula* sp.
Ranunculus cf. *acris* L.	f	1	*Ranunculus flammula* L.
R. cf. *acris* L.	f	1	*Scirpus lacustris* L.
R. gmelini DC.	f	1	[(a)]indet.
R. gmelini DC.	f	1	*Menyanthes trifoliata* L.
R. sceleratus L.	f	32	*Ranunculus sceleratus* L.
Rorippa palustris (L.) Bess.	s	3	[(a)]indet.
Rubus idaeus L.	f	12	*Rubus idaeus* L.
Sagittaria sagittifolia L.	s	5	*Sagittaria sagittifolia* L.
Salvinia natans (L.) All.	m/msp	654/51	*Salvinia natans* (L.) All.
Sambucus nigra L.	s	4	*Sambucus nigra* L.
Saxifraga granulata L.	s	2	[(a)]*Saxifraga granulata* L.
Schoenoplectus lacustris (L.) Palla	f	25	*Scirpus lacustris* L.
Sch. lacustris (L.) Palla	f	2	*S. maritimus* L.
Sch. lacustris (L.) Palla	f	26	*S. tabernaemontani* C.C. Gmel.
Sch. lacustris (L.) Palla	f	2	*Scirpus* sp.
Sch. mucronatus (L.) Palla	f	4	*Carex* sp.
Sch. tabernaemontani (C.C. Gmel.) Palla	f	2	*Scirpus tabernaemontani* C. C. Gmel.
Schoenoplectus sp.	f	1	[(a)]indet.
Selaginella helvetica (L.) Spring.	m	1	*Salvinia natans* (L.) All.
S. selaginoides (L.) Link	m	8	*Selaginella selaginoides* (L.) Link
S. selaginoides (L.) Link	m	1	*Salvinia natans* (L.) All.
Sisyrinchium sp.	f	3	*Sisyrinchium* sp.
Sorbus sp.	s	1	*Sorbus* sp.
Sparganium emersum Rehm.	e	51	*Sparganium* sp.
S. hyperboreum Laest.	e	1	*Sparganium* sp.
S. minimum Wallr.	e	29	*Sparganium* sp.
S. neglectum Beeby	e	33	*Sparganium* sp.
Sparganium sp.	e	1	*Sparganium* sp.
Stellaria nemorum L.	s	3	*Stelleria nemorum* L.
Stratiotes aloides L.	s	1	*Stratiotes aloides* L.
Subularia aquatica L.	s	1	[(a)]*Subularia aquatica* L.
Sweertia sp.	s	1	*Sweertia* sp.
Trapa natans L.	f	∞	*Trapa natans* L.
Trapa sp.	sp	46	*T. natans* L.
Typha sp.	s	184	*Typha* sp.
Urtica dioica L.	f	1	[(a)]indet.
Vitis sylvestris C.C. Gmel.	f	5	*Vitis sylvestris*

ical enlargement of the flora was only possible thanks to more detailed determination of species from the genera *Sparganium*, *Potamogeton*, *Schoenoplectus*, *Eleocharis*, and *Ranunculus*. Among the specimens left by Sobolewska (1977) as indeterminate some new, hitherto unknown species *Ranunculus gmelini* DC., *Sparganium hyperboreum* Laest., *Roripa palustris* (L.) Bess., *Schoenoplectus mucronatus* (L.) Palla, and one extinct Plio-Pleistocene species *Eleocharis praemaximoviczi* Dorof., have been recognized. The last one with several other extinct species (*Aldrovanda dokturovskyi* Dorof., *Aracites interglacialis* Wieliczk., *Caulinia* cf. *goretskyi* Dorof., *Nymphaea* cf. *cinerea* Wieliczk., *Brasenia* sp. (exotic), and *Potamogeton dorofeevii* Wieliczk.) represents a considerable group of exotic species, testifying to the Mazovian interglacial macrofossil flora from Stanowice. Additional confirmation of that age are other taxa characteristic for the Mazovian interglacial including *Abies alba* Mill., *Picea* sect. *Omorica* Willk., *Vitis sylvestris* C.C. Gmel., and *Euryale ferox* Salisb. as a very rare species in interglacial floras. The aquatic plant community which was formed in Stanowice seems to have been a refuge of this eastern Asiatic species. The abundance of remains of this species, in comparison with the rare occurrence of other aquatic plant remains, taxa of similar ecology (*Brasenia*, *Nymphaea*) and absence of *Nuphar*, indicate, that the aquatic plant community in Stanowice was abundantly overgrown by *Euryale*. This phenomenon is hitherto unknown from any Pleistocene floras in Europe. In this flora it is worthy of note that the occurrence of two species of *Aldrovanda*: the extinct *A. dokturovskyi* Dorof. and the recent *A. vesiculosa* L., evidently shows distinct features of these two taxa. Hitherto a similar situation has been noticed in the flora from Krukenichi (Ukraine) which is very rich and comprises about 130 taxa, although it lacks *Euryale* and even *Brasenia* (Velichkevich 1982). It is worthy to emphasize that hundreds of fruits determined by Sobolewska (1977) as *Acorellus pannonicus* (Jacq.) Pall. became evident as two-sided fruits of *Carex*. The interglacial flora from Stanowice comprises common features with all other Mazovian floras from Poland and can be treated as a standard of the Mazovian interglacial.

MAKÓW MAZOWIECKI
(Tab. 4)

Despite the interglacial flora from Maków Mazowiecki (Gołąbowa 1957) being fragmentary, it contains two extinct species typical for

Table 4. List of macroscopic plant remains from Maków Mazowiecki (KRAM-P-Q-114)

Abbreviations: a – axis of cone, f – fruit, s – seed; [(a)]only in collection

After revision	Type of remains	Number of specimens	After Gołąbowa (1957)
Alnus glutinosa (L.) Gaertn.	f	2	*Alnus glutinosa* Gaertn.
Alnus sp.	a	3	*Alnus* sp.
Aracites interglacialis Wieliczk.	s	1	[(a)]indet.
Carex paucifloroides Wieliczk.	f	10	*Carex* sp.
C. pseudocyperus L.	f	10	*Carex* sp.
C. cf. *sylvatica* Huds.	f	1	*Carex* sp.
Carex sp. (3-sided)	f	1	*Carex* sp.
Hippuris vulgaris L.	f	29	*Hippuris vulgaris* L.
Iris cf. *pseudacorus* L.	s	3	*Iris* sp.
Lycopus europaeus L.	f	2	*Lycopus europaeus* L.
Oenanthe aquatica (L.) Poir.	f	2	[(a)]indet.
Polygonum cf. *lapathifolium* L.	f	1	*Polygonum* cf. *lapathifolium* L.
Ranunculus lingua L.	f	2	[(a)]indet.
Rubus idaeus L.	f	1	*Rubus* sp.
Rumex cf. *aquaticus* L.	f	1	*Rumex* cf. *obovatus* Dans.
Sagittaria sagittifolia L.	s	2	*Sagittaria sagittifolia* L.
Schoenoplectus lacustris (L.) Palla	f	6	*Scirpus lacustris* L.

the Mazovian interglacial floras: *Aracites interglacialis* Wieliczk. and *Carex paucifloroides* Wieliczk. Although the first one is represented by only a single seed, it testifies indisputable evidence that the flora is of Mazovian age. A real surprise was the recognition many fruits of *Carex paucifloroides* Wieliczk., a Plio-Pleistocene species, hitherto not known from the Polish Quaternary floras. Mamakowa and Velichkevich (1993a) found it for the first time in Ciechanki Krzesimowskie (see Tab. 1). However, it was common in Alexandrian interglacial floras of the same age from Belarus (Velichkevich 1982).

WYLEZIN
(Tab. 5)

The flora from Wylezin is one of the most fragmentary Mazovian interglacial floras. In the collection elaborated by Dyakowska (1956) none of the taxa identified were characteristic of the Mazovian age. In general, only taxa such as *Brasenia*, *Trapa*, *Najas*, and *Ceratophyllum* indicate the interglacial character of the flora. During the revision it has been ascertained that only one seed determined by Dyakowska (1956) as *Najas flexilis* (Willd.) Rostk. & W.L.E. Schmidt belongs to the extinct species *Caulinia goretskyi* Dorof., characteristic for the Mazovian interglacial in Poland and Alexandrian interglacial in Belarus (Mamakowa & Velichkevich 1993a). In its morphological features the seed of *Brasenia* is most similar with the Eemian species *B. holsatica* (Web.) Weberb., while among the polymorphous variety *B. borystenica* var. *heterosperma* Wieliczk. present in Olszewice and some Alexandrian interglacial from Belarus (Velichkevich 1982), similar seeds are to be found. *Picea* and *Larix* represent the forest element in the flora from Wylezin, and this is not in contradiction with the Mazovian type of the flora. The Mazovian age of this flora is confirmed by the results of pollen analysis.

GOŚCIĘCIN
(Tab. 6)

The macrofossil interglacial flora from Gościęcin locality was elaborated by Środoń, and was only partly presented in his paper (Środoń 1957). The flora differs from other revised Mazovian floras by absence of any indicator taxa for the Mazovian interglacal. However, its Mazovian age is explicitly confirmed by the re-

Table 5. List of macroscopic plant remains from Wylezin (KRAM-P-Q-118)

Abbreviations: e – endocarp, f – fruit, fr – fragment, n – needle, s – seed, w – wing; [(a)] only in collection

After revision	Type of remains	Number of specimens	After Dyakowska (1956)
Brasenia cf. *holsatica* (Web.) Weberb.	s	1	*Brasenia purpurea* Mich.
Caulinia goretskyi Dorof.	s	1	*Najas flexilis* (Willd.) Rostk. & Schmidt
C. minor (All.) Coss. & Germ.	s	1	*N. minor* All.
Ceratophyllum demersum L.	f	15	*Ceratophyllum demersum* L.
Ceratophyllum sp.	f	1(fr)	[(a)]indet.
Larix sp.	s	1	[(a)]*Ranunculus* sp.
Najas marina L.	s	4	*Najas major* All. f. *typica*
N. marina L.	s	1	*N. major* All. f. *ovata*
Picea sect. *Eupicea* Willk.	n	1	[(a)]*Coniferae*
P. sect. *Eupicea* Willk.	n	1	[(a)]indet.
Picea sp.	w	2	[(a)]*Picea* sp.
Pinaceae gen.	w	1	[(a)]indet.
Potamogeton crispus L.	e	2	*Potamogeton* sp. div.
P. perfoliatus L.	e	1	*Potamogeton* sp.
Potamogeton sp.	e	2	*Potamogeton* sp. div.
Rumex sp.	f	1	*Carex* sp.
Schoenoplectus lacustris (L.) Palla	f	1	*Polygonum dumetorum* L.
Sch. lacustris (L.) Palla	f	1	[(a)]indet.
Sparganium minimum Wallr.	e	1	*Sparganium minimum* Fr.
Trapa sp.	f	9(fr)	*Trapa natans* L.
Trapa sp.	f	2(fr)	[(a)]indet.

Table 6. List of macroscopic plant remains from Gościęcin (KRAM-P-Q-117)

Abbreviations: cfr – cone fragments, cp – cupula, cut – cuticula, e – endocarp, f – fruit, l – leaf, n – needle, s – seed, sc – scale, w-fr – wing of seed, fragments, [a] only in collection, [b] det. by J. Mądalski

After revision	Type of remains	Number of specimens	After Środoń (1957)
Alnus glutinosa (L.) Gaertn.	f	2	*Alnus glutinosa*
Alnus sp.	f	2	*A. glutinosa*
Alnus sp.	cfr	1	*Betula "alba"*
Andromeda polifolia L.	s	1	[a] indet.
Asteraceae (Senecio ?)	s	1	[a] indet.
Betula sect. *Albae* Rgl.	f	163	*Betula "alba"*
Betula sect. *Albae* Rgl.	f	1	*Alnus glutinosa*
Betula sect. *Albae* Rgl.	sc	40	*Betula "alba"*
Betula humilis Schrank	f	6	*B. "alba"*
Carex sp. (2-sided)	*f*	*2*	*Betula "alba"*
Carex sp. (2-sided)	f	2	*Larix* sp. + varia – slide
Carex sp. (2-sided)	f	1	*Picea* sp. – slide
Carex sp. (2-sided)	f	1	*Carex* sp.– slide
C. cf. pseudocyperus	f	1	*Carex* sp.– slide
Chenopodium cf. *album* L.	s	1	[a]indet.
Larix sp.	s	1	[a]indet.
Najas marina L.	s	4	*Najas marina* f. *ovata*
Nuphar cf. *lutea* (L.) Sibth. & Sm.	s	3	*Nuphar luteum*
Picea sp.	n	2	*Larix* sp.
Picea sp.	n	1	*Larix* sp. + *Picea* sp. – slide
Picea sp.	n	1	*Larix* sp. + varia – slide
Picea sp.	n	2	[a]*Picea* sp.
Picea sp.	n	1	[a]*P. excelsa*
Picea sp.	cut	1	[a]*P. excelsa*
Picea sp.	w-fr	29	*Picea* sp. – slide
Pinaceae gen.	w-fr	1	*Larix* sp. + *Picea* sp. – slide
Pinus sp.	w-fr	1	*Pinus* sp.
Pinus sp.	s	1	*Nuphar luteum*
Potamogeton alpinus Balb.	e	1	[b]*Potamogeton alpinus*
P. alpinus Balb.	e	2	[b]*P. rutilus*
P. natans L.	e	6	[b]*P. fluitans*
P. natans L.	e	2	[b]*P. natans*
Ranunculus sceleratus L.	f	1	*Ranunculus sceleratus* – slide
Salix sp.	cp	2	[a]indet.
Schoenoplectus lacustris (L.) Palla	f	3	[a]indet.
Schoenoplectus sp.	f	1	[a]indet.
Solanum dulcamara L.	s	1	[a]indet.

sults of pollen analysis. Pollen succession in the profile is typical for the Mazovian interglacial. Over the bottom part of the profile with pine-birch vegetation well developed are alder-spruce, with yew horizon, and hornbeam-fir periods.

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