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Revised data on the occurrence of myxomycetes in Central Poland

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A checklist of 81 taxa has been prepared on the basis of 750 exsiccates of slime moulds collected in the years 1958-2009 in the area of Central Poland and preserved in the Herbarium LOD F. All these materials were reexamined according to contemporary literature. The paper summarizes the existing data concerning the occurrence of slime moulds in this area. Among the identified taxa there are four species indicated in the red list in Poland: *Badhamia affinis, Physarum robustum, Didymium leptotrichum*, and *Clastoderma debaryanum*.

Key words: slime moulds, checklist, biodiversity, distribution

INTRODUCTION

Slime moulds (Myxomycetes, Mycetozoa) are the group of organisms of increasing importance in biological and phylogenetical respects. Their morphological, ecological and genetic diversity is the matter of interest for specialists worldwide (e.g., Ing 1994; Heilmann-Clausen 2001; Krieglsteiner 2004). In Poland, a vast programme of biodiversity studies has been recently undertaken (Mirek ed. 2002-2009) resulting, among other works, in a checklist of 222 myxomycetes, that includes all hitherto published taxa (Drozdowicz, Ronikier, Stojanowska and Panek 2003). Recently, a field study in NE Poland has brought an interesting and rich collection of slime moulds (Panek, Romański 2010). The above publications stimulated the authors of the present paper to examine and revise slime moulds collections from the area of Central Poland, preserved in the Herbarium Universitatis Lodziensis (LOD F). Until now, some data concerning slime moulds in Central Poland were published by Orzechowski (1966) – from the Łódź city and adjacent areas, Kalinowska-Kucharska (1975) – from several localities in the area including all the myxomycetes collected in the nature reserves in course of mycocoenological studies by Ławrynowicz (1973). At present, a detailed study of slime moulds has

started in the area of Las Łagiewnicki Forest in Łódź by Salamaga (2011). The present report is a starting point for further studies of myxomycetes in this area. It could be also used for monitoring studies on slime moulds diversity changes in time.

STUDY AREA

The area of investigations is situated within the administrative borders of Łódź Province (Fig. 1). From the geographical point of view it is an area of transitional character between uplands in south and lowlands in the northern part. Its significant feature is

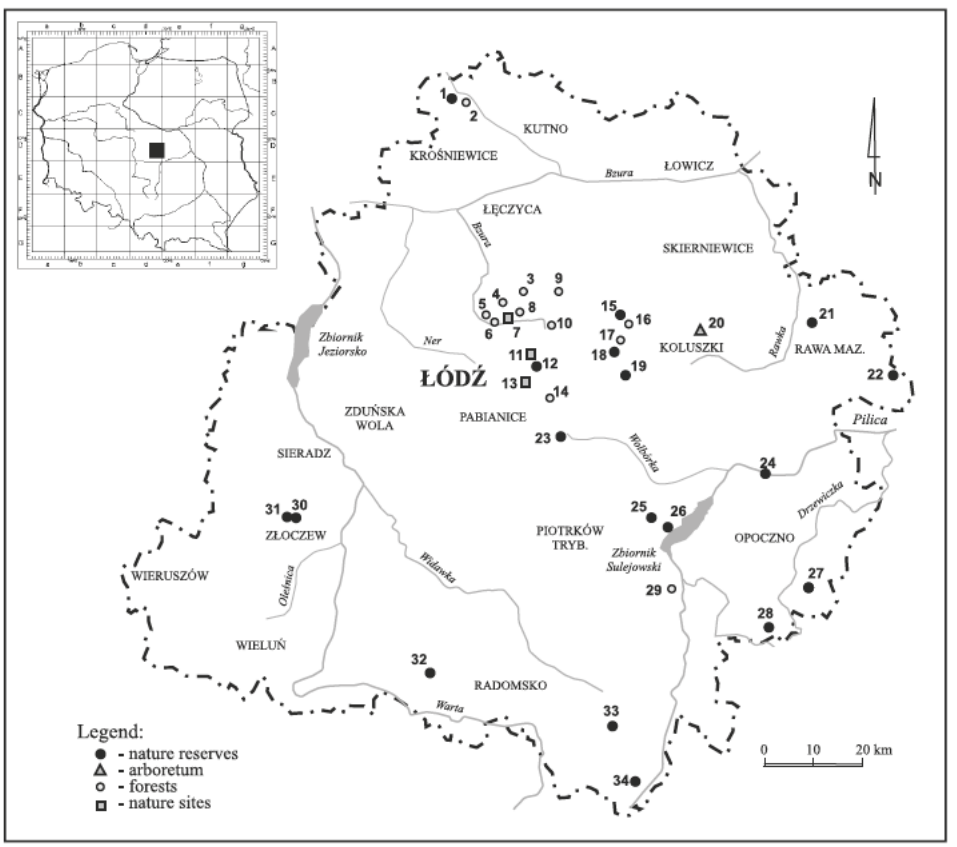

Fig. 1. Localities of the myxomycete records concerned in the paper: **1.** O – Ostrowy; **2.** P – Perna; **3.** Luć – Lućmierz; **4.** Gr – Grotniki; **5.** Jas – Jastrzębiec ; **6.** Bruż – Brużyca; **7.** Nak – Las Nakielnicki; **8.** Kr – Krogulec; **9.** Sz – Szczawin; **10.** LŁ – Las Łagiewnicki; **11.** PLZ – Park Ludowy na Zdrowiu; **12.** PK – Polesie Konstantynowskie; **13.** Lubl – Lublinek; **14.** Rd – Las Rudzki; **15.** PJ – Parowy Janinowskie; **16.** J – Janinów; **17.** Pap – Paprotnia; **18.** W – Wiączyń; **19.** G – Gałków; **20.** ArR – the Rogów Arboretum; **21.** Ba – Babsk; **22.** T – Trębaczew; **23.** M – Molenda; **24.** S – Spała; **25.** Msz – Meszcze; **26.** L – Lubiaszów; **27.** B – Białaczów; **28.** JS – Jodły Sieleckie; **29.** Ka – Kaleń; **30.** NW – Nowa Wieś; **31.** K – Komasówka; **32.** Mur – Murowaniec; **33.** KW – Kobiele Wielkie; **34.** D – Dębowiec.

a watershed between the catchment areas of Warta and Vistula rivers, running from the south to the north and dividing the area into two parts. As a consequence of geological, climatic and hydrological characters, the northern occurrence limits of three important forest trees: *Fagus sylvatica*, *Picea abies* and *Abies alba* run through this area. The most valuable stands of these tree species are protected in nature reserves.

Transitional character of Central Poland creates specific conditions for vegetation cover and communities of different organisms, including slime moulds.

The materials studied come from 34 localities indicated on the map (Fig. 1).

MATERIAL AND METHODS

In total 750 records of slime mould collected in the period 1958-2009 are the subject of interpretation. The specimens were analyzed using routine microscopic and laboratory techniques. The identification of species was carried out according to specialistic literature, e.g.: Krzemieniewska (1960), Neubert, Nowotny and Baumann (1993, 1995), Neubert et al. (2000), Martin & Alexopoulus (1969), Ing (1999) and Nannenga-Bremekamp (1991). The nomenclature follows Drozdowicz et al. (2003), updated according to Lado (2005-2011).

Table 1
Correspondence between sources of information (Tab.2) and study areas

	1	2	3	4	
I	PK	D K KW L M NW O PK S T	 G PJ W	Ba D JS KW M Mur O PK T	B G K L Msz NW PJ S W
II	—	—	—	ArR	
III	Bruż Jas Kr Luć Rd Sz	 Gr J Ka P	 Pap	Bruż J Ka LŁ P Rd	Gr Jas Kr Luć Pap Sz
IV	Lubl Nak PLZ	—	—	Lubl Nak PLZ	

The columns 1-4 correspond to the sources of information 1-4 included in Table 2. Each of them is divided into four parts corresponding to the four types of study areas: I – nature reserve, II – the arboretum, III – forests, IV – nature sites.

The detailed register prepared in course of analyzes of all exsiccates (Ławrynowicz, Ślusarczyk and Salamaga 2010) was a basis of synthesis presented in Table 2. The arrangement of taxa is adopted according to Śliwa (2010) and modified for slime moulds. The sources of data (Tab. 2, column 3) are two types: published data (1, 2, 3) and unpublished data 4 – (numbers of Herbarium exsiccates).

The specimens considered were collected with different intensity and different methods; great part of them were recorded during thorough mycocoenological or other investigations focused on fungi, but some were just single, accidental findings.

The data represent four types of study areas: nature reserves, arboretum, forests, and nature sites (Tab. 1).

All herbarium vouchers are preserved in Herbarium Universitatis Lodziensis (LOD F).

RESULTS AND DISCUSSION

Macro- and micromorphological analysis of exsiccates of slime moulds preserved in the Herbarium of the Łódź University (LOD F) resulted in the identification of 81 taxa (78 species and 3 varieties). The collection examined contains the records gathered in Central Poland before 2010. The data are summarized in a checklist (Tab. 2). Although the list covers only a number of collecting places and does not provide full information on the occurrence and distribution of slime moulds in the area concerned, it gives several interesting data. Among the slime moulds collected there is a group of widely distributed and frequently noted species: *Lycogala epidendrum*, *Fuligo septica*, *Ceratiomyxa fruticulosa*. There is also a group of rare slime moulds, among them of redlisted species: *Badhamia affinis*, *Physarum robustum*, *Didymium leptotrichum*, and *Clastoderma debaryanum* (Drozdowicz, Ronikier and Stojanowska 2006). The material examined is not a sufficient basis to describe any species as rare in a broader sense, especially in the case of the taxa observed accidentally at a single locality, but known to be common in other regions. This preliminary checklist indicates that slime moulds can colonize a variety of sites from nature reserves to anthropogenic places.

The first collections of slime moulds in the area of Łódź city and its surroundings (1958-1963) were made by Orzechowski (1966) and reveal the presence of rare species in city parks and small forests. The paper by Kalinowska-Kucharska (1975) indicates that nature reserves are the places hosting the greatest variety of slime moulds. The materials presented in this work were collected during mycocoenological studies in permanent plots in the *Tilio-Carpinetum* and *Potentillo albae-Quercetum* associations, in the area of 7 nature reserves: Ostrowy, Molenda, Nowa Wieś, Komasówka, Dębowiec, and Trębaczew.

Other mycocoenological investigations including myxomycetes were conducted in permanent plots in beech forests, mostly in *Luzulo pilosae-Fagetum*, in the nature reserves Wiączyń, Gałków, and Parowy Janinowskie, as well as in the Paprotnia forest. The reports on slime moulds from that area indicate a great role of dead wood, especially of beech trees, for slime moulds occurrence (Seta, Drozdowicz 2004; Ślusarczyk

Table 2
Myxomycetes recorded in Central Poland

Name of species	Substrate	Source of information
Amaurochaete atra (Alb. & Schwein.) Rostaf.	*Ps*	1; 2
A. tubulina (Alb. & Schwein.) T. Macbr.	fallen leaves of *Bp*; stump of *Ps*	1; 2
Arcyria affinis Rostaf.	decayed trunk of *Fs*	2
A. cinerea (Bull.) Pers.	wood of deciduous trees	1; 2; 3; 4: B (30005, 30000, 30008); JS (30004)
A. denudata (L.) Wettst.	wood of deciduous trees	1; 2; 3; 4: B (300130); Lubl (30028); LŁ (30014, 30016); Msz (30022)
A. ferruginea Saut.	wood of deciduous trees	1; 2; 4: LŁ (30032); S (30033)
A. incarnata (Pers. ex J.F. Gmel.) Pers.	*Pa*, *Ps*	1; 2; 4: B (30038); Lubl (30041)
A. obvelata (Oeder) Onsberg	wood of coniferous and deciduous trees	1; 2; 3; 4: ArR (30048); B (30044, 30055, 30056); JS (30062); LŁ (30050, 30052, 30053); Sz (30054)
A. pomiformis (Leers) Rostaf.	*Pa*, *Ps*	1
Badhamia affinis Rostaf.	bark of *Qu*	2
B. capsulifera (Bull.) Berk.	stump of *Ab*	2
B. utricularis (Bull.) Berk.	wood of deciduous trees; bark of *Ps*; twigs of *Lar*	2; 3
Ceratiomyxa fruticulosa (O. F. Müll.) T. Macbr.	wood of deciduous and coniferous trees	1; 2; 3; 4: B (30078, 30089); Lubl (30073, 30076); LŁ (30072, 30074, 30077, 30092); S (30071)
C. fruticulosa var. *porioides* (Alb. & Schwein.) G. Lister	*Pa*, *Ps*	1; 2
Clastoderma debaryanum A. Blytt	*Ps*	1
Collaria arcyrionema (Rostaf.) Nann.-Bremek. ex Lado	wood of deciduous trees	3; 4: LŁ (30302)
Comatricha nigra (Pers. ex J. F. Gmel.) J. Schröt.	fallen branches of deciduous trees; *Fs*	2; 3
C. pulchella (C. Bab.) Rostaf.	*Pa*	1
Craterium leucocephalum (Pers. ex J. F. Gmel) Ditmar	fallen leaves of *Qu*	2
Craterium minutum (Leers) Fr.	fallen leaves of *Qu*	4: LŁ (30748)
Cribraria argillacea (Pers. ex J. F. Gmel.) Pers.	wood of deciduous trees; *Cb, Pa*, *Ps*	1; 2; 3
C. aurantiaca Schrad.	*Ps*	4: Gr (30126)
C. cancellata (Batsch) Nann.-Bremek.	wood of coniferous and deciduous trees	1; 4: B (30128, 3013, 30135, 30138); JS (30127); Lubl (30129)
C. macrocarpa Schrad.	wood of coniferous trees	4: B (30749)
C. rufa (Roth) Rostaf.	*Ps*	2; 4: LŁ (30143)
C. tenella Schrad.	stump of *Ps*	2
C. vulgaris Schrad.	*Pa*	1; 2
Diachea leucopodia (Bull.) Rostaf.	herbaceous plants; fallen leaves of *Fs*	2; 3; 4: JS (30156, 30165, 30168)
Diderma radiatum (L.) Morgan	mosses	4: B (30169)
D. spumarioides (Fr.) Fr.	*Oa*	4: S (30170)
D. umbilicatum Pers.	mosses and fallen leaves	2
Didymium iridis (Ditmar) Fr.	bark of *Fs*	1
D. leptotrichum (Racib.) Massee	wood of deciduous trees	4: B (30171)
D. melanospermum (Pers.) T. Macbr.	mosses; needles of *Ps*; wood of deciduous trees; *Pa*	1; 2; 3; 4: Lubl (30172) 4: LŁ (30174); Sz (30175)

Table 2 – cont.

D. minus (Lister) Morgan	stems of herbaceous plants	2
D. squamulosum (Alb. & Schwein.) Fr.	fallen leaves	2
Enerthenema papillatum (Pers.) Rostaf.	wood of deciduous trees	2
Fuligo leviderma H.Neubert, Nowotny & K. Baumann	*Bp*, *Fs*	3
F. septica (L.) F.H. Wigg.	wood of deciduous and coniferous trees; *Qu*, *Ps*	2; 3; 4: ArR (30200, 30212); Ba (30210) B (30208, 30209, 30238); LŁ (30232 30232, 30235, 30236); Msz (30196); Mur (30222); S (30225); Sz (30233)
F. septica var. *candida* (Pers.) R.E. Fr.	wood of deciduous and coniferous trees; *Ps*	2; 4: ArR (30259); B (30258, 30253); Lubl (30254); LŁ (30256, 30257, 30260,); Pap (30250); W (30252)
Hemitrichia clavata (Pers.) Rostaf.	*Bp*, *Fs*	3; 4: Lubl (30270, 30271); LŁ (30268)
H. serpula (Scop.) Rostaf. ex Lister	*Ab*	4: S (30710)
Lamproderma columbinum (Pers.) Rostaf.	*Fs*	1; 3
Leocarpus fragilis (Dicks.) Rostaf.	leaves of *Qu*; stems of *Vm*; fern leaves; bark of *Fs*; *Bp* fallen branches of *Qu*, *Ps*	1; 2; 3; 4: ArR (30275); B (30274, 30277, 30285, 30295); Lubl (30281); LŁ (30282, 30288, 30298)
Lindbladia tubulina Fr.	wood of deciduous trees	2
Lycogala conicum Pers.	wood of coniferous trees; *Qu*	1; 4: B (30306)
L. epidendrum (L.) Fr.	wood of deciduous and coniferous trees; *Fs*, *Bp*, *Ps*	1; 2; 3; 4: Ba (30376); B (30359, 30395); J (30371); JS (30396); L (30386); Lubl (30341); LŁ (30352, 30353, 30354, 30382, 30387, 30388, 30397); Msz (30356); Mur (30343); S (30364, 30379, 30399); Sz (30366)
L. exiguum Morgan	*Ps*	1
L. flavofuscum (Ehrenb.) Rostaf.	wood of deciduous and coniferous trees	4: LŁ (30430)
Metarichia floriformis (Schwein.) Nann.-Bremek.	*Lar*	4: LŁ (30435)
M. vesparia (Batsch) Nann.-Bremek. ex G.W. Martin & Alexop.	*Bp*, *Ps*; wood of deciduous trees	1; 2; 3; 4: B (30686, 30692); Lubl (30691); LŁ (30690)
Mucilago crustacea F.H. Wigg.	grasses; fallen leaves of *Qu*	1; 2
Perichaena corticalis (Batsch) Rostaf.	*Al*	2
Physarum album (Bull.) Chevall.	fallen leaves of *Cb*; *Qu*; wood of deciduous and coniferous trees	1; 2; 3; 4: B (30470); LŁ (30455, 30469)
Ph. bivalve Pers.	fern leaves and *Fs*	2; 4: JS (30476); W (30475)
Ph. cinereum (Batsch) Pers.	*Fs*, *Ps*	2; 3
Ph. citrinum Schumach.	wood of deciduous and coniferous trees	4: B (30481, 30482, 30483)
Ph. compressum Alb. & Schwein.	*Pt*	1
Ph. globuliferum (Bull.) Pers.	*Lar*, *Pa*	1; 2
Ph. gyrosum Rostaf.	*Pa*, *Ps*	1
Ph. leucophaeum Fr.	wood of deciduous trees; *Fs*	3; 4: B (30487)
Ph. notabile T. Macbr.	*Fs*	3
Ph. psittacinum Ditmar	stump of *Qu*	2

Table 2 – cont.

Ph. robustum (Lister) Nann.-Bremek.	twigs of *Ca*	2
Ph. virescens Ditmar	*Qu*, fallen leaves of *Fs*; needles of *Ps*	2; 3; 4: B (30496, 30503); JS (30501)
Ph. viride (Bull.) Pers.	wood of deciduous trees	2
Ph. viride var. *aurantium* (Bull.) Lister	wood of deciduous trees; stump of *Qu*	2; 4: B (30509); JS (30511)
Reticularia lycoperdon Bull.	wood of deciduous and coniferous trees; trunk of *Fs*; *Qu*, *Ps*	1; 2; 3; 4: LŁ (30515)
Stemonitis axifera (Bull.) T. Macbr.	wood of deciduous and coniferous trees; *Fs*, *Bp*, *Qu*, *Ps*	1; 2; 3; 4: B (30544); LŁ (30531, 30534, 30536, 30542); Sz (30535)
S. flavogenita E. Jahn	*Qu*	2
S. fusca Roth	wood of coniferous trees; litter; *Al*	1; 2; 3; 4: Ba (30575); B (30561); Lubl (30571)
S. pallida Wingate	*Fs*	3
Stemonitopsis typhina (F.H. Wigg.) Nann.-Bremek.	wood of deciduous and coniferous trees; bark of *Qu*; *Bp*, *Ps*	1; 2; 3; 4: B (30592); JS (30712)
Trichia affinis De Bary	*Ps*	1
T. contorta (Ditmar) Rostaf.	wood of deciduous trees; litter	1; 4: Msz (30597)
T. decipiens (Pers.) T. Macbr.	wood of deciduous trees; *Fs*, *Bp*	2; 3
T. favoginea (Batsch) Pers.	wood of deciduous trees; *Fs*	1; 3; 4: B (30608)
T. persimilis P. Karst.	wood of deciduous trees; *Fs*	2; 4: Lubl (30272)
T. scabra Rostaf.	*Bp*, *Fs*	2; 3; 4: B (30614)
T. varia (Pers. ex J.F. Gmel.) Pers.	wood of deciduous trees; *Fs*	1; 2; 3; 4: Msz (30626)
Tubifera ferruginosa (Batsch) J.F. Gmel.	wood of deciduous and coniferous trees; *Fs*; litter; mosses	1; 2; 3; 4: B (30636, 30643); LŁ (30640, 30642, 30654); S (30646, 30649)

Explanations. Source of information: 1 – Orzechowski (1966); 2 – Kalinowska-Kucharska (1975); 3 – Ślusarczyk (2010); 4 – Herbarium material. Wood of trees: *Ab – Abies alba*, *Al –Alnus glutinosa*, *Bp – Betula pendula*, *Ca – Corylus avellana*, *Cb – Carpinus betulus*, *Fs – Fagus sylvatica*, *Lar – Larix decidua*, *Oa – Oxalis acetosella*, *Qu – Quercus* sp., *Ps – Pinus sylvestris, Pt – Populus tremula*, *Tc – Tilia cordata*, *Vm – Vaccinium myrtillus*.

2010). Several authors find beech wood as an excellent substrate for slime moulds (e.g., Miśkiewicz 2001; Stojanowska, Panek 2004). The abundance of wood in different stages of decay supports effectively development of a variety of slime moulds species (Stojanowska 1979; Drozdowicz 1992).

The results presented in the above mentioned papers as well as the studies of numerous collections from other areas of Central Poland confirm that dead wood is the most common substrate colonized by slime moulds. Even in the area of Łódź city and its surroundings decaying wood of different trees and shrubs was the basic substrate for them.

In the *Tilio-Carpinetum* and *Potentillo albae-Quercetum*, the main substrate for slime moulds was also wood (trunks, logs, stumps, twigs) and fallen leaves of *Quercus* and *Carpinus*. It corresponds with reports by other authors, e.g., Stojanowska & Panek (2004) and Salamaga & Drozdowicz (2010). The variety of microhabitats offering different moisture, temperature and light conditions, decide of the slime

moulds species diversity. However, it is impossible to point the direct relationship of a particular plant association with myxomycete species composition. These observations correspond with those by other authors (e.g., Stojanowska, Panek 2002; Panek, Romański 2010). The wood of coniferous trees, especially of *Pinus sylvestris* needs a special attention as a substrate for slime moulds.

As the areas of occurrence of *Fagus sylvatica*, *Abies alba* and *Picea abies* in Central Poland are among its most valuable natural sites, and they were most thouroughly examined in terms of myxomycetes diversity, the knowledge of slime moulds in Central Poland is mainly restricted to nature reserves. There are still a lot of other places that might be rich in myxomycetes and provide interesting information about this group of organisms, like various areas of other types of forests as well as sites of anthropogenic origin. It is difficult to make any generalizations based on the data summarized in the presented checklist, but a proper programme of research focused on slime moulds collections data could bring interesting and realistic results.

CONCLUSIONS

The presented survey shows that the area of Central Poland is an attractive and valuable object of studies on myxomycetes. The results of the observations and collections that has been made for the last period of more than 50 years are an important input to the knowledge of slime moulds biodiversity. The checklist provided in the paper may serve as a source of information about the myxomycetes occurrence, species diversity, distribution and ecological relationships. It is a good starting point for further thorough qualitative and quantitative studies on slime moulds at present and in the future.

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Zweryfikowane dane o występowaniu śluzowców w Polsce Środkowej

Streszczenie

Kolekcja śluzowców z lat 1958-2009 z terenu Polski Środkowej przechowywana w Herbarium Uniwersytetu Łódzkiego (LOD F) była przedmiotem weryfikacji taksonomicznej z uwzględnieniem danych ekologicznych i chorologicznych. Zbiory gromadzone były z różną intensywnością, najczęściej w czasie badań mykologicznych prowadzonych na terenach leśnych, głównie w rezerwatach przyrody chroniących stanowiska jodły, buka i świerka na granicy występowania tych drzew w Polsce.

Na podstawie analizy 750 eksykatów zidentyfikowano 81 taksonów śluzowców. Materiał pochodził z 34 stanowisk reprezentujących szerokie zróżnicowanie siedliska od rezerwatów przyrody do skrajnie zmienionych terenów w warunkach miejskich i podmiejskich Łodzi. Podsumowanie wyników zawiera krytyczna lista śluzowców Polski Środkowej.

Obecnie, w związku z podejmowaniem szczegółowych badań nad śluzowcami tego terenu, stanowić może punkt wyjścia do badań nad bioróżnorodnością, ekologią i rozmieszczeniem śluzowców Polski Środkowej oraz służyć do porównania z innymi obszarami obecnie i w przyszłości.