

Bryological notes from the Vistula Spit (Poland)

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Abstract: The paper presents the contribution to the bryoflora of the Vistula Spit, a bryologically poorly known region located in northern Poland. As a result, localities of 59 species and 2 varieties of bryophytes were found, including regionally rare, interesting and protected in Poland bryophytes, such as *Aulacomnium androgynum* (Hedw.) Schwägr., *Orthodontium lineare* Schwägr., *Orthodicranum tauricum* (Sapjegin) Smirnova, *Rhodobryum roseum* (Hedw.) Limpr. and *Ulota crispa* (Hedw.) Brid.

Key words: bryophytes, threatened species, protected species, distribution, Vistula Spit, Mierzeja Wiślana, Pomerania, Poland

Introduction

Vistula Spit (Mierzeja Wiślana) is an aeolian sand spit, which separates Vistula Lagoon from Gdańsk Bay in the Baltic Sea (Fig 1.). It is about 96 km long and 1-2 km wide. Its area is poorly populated and nowadays used mainly for tourism. Overwhelming majority of Mierzeja Wiślana is overgrown by forest communities, mainly pine (Fig. 2). In the small hollows peat bog vegetation occurs (Fig. 3) and in open places – patches of grassland. Along the Baltic seashore a belt of coastal dunes stretches (Fig 4). Since 1985 Vistula Spit has been protected as an landscape park. Central part of this area, where the field investigation was conducted, is bryologically poorly known and till this time the only paper including information about mosses and liverworts concerns 'Buki Mierzei Wiślanej' nature reserve (Sulma 1958).

Material and methods

The field investigations were carried out in the summer of 2011 in four points in the central part of the Vistula Spit. For each locality habitat and GPS coordinates were noted. List of taxa are arranged alphabetically. The species names follow Ochyra et al. (2003) for mosses and Klama (2006) for liverworts. Protected species in Poland are given after 'Regulation of the Minister of the Environment' (Anonymus 2012), whereas threatened species after Żarnowiec et al. (2004).

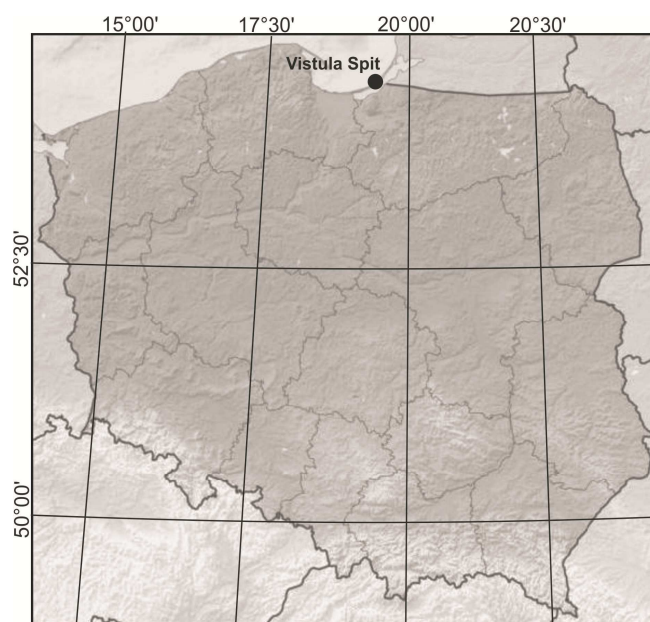


Fig 1: Location of the Vistula Spit in Poland.

Results

As a result, localities of 59 species and 2 varieties were noted. They are mainly common species in Poland, but, due to poor bryological knowledge of the Vistula Spit, vast majority of them are new for this area.

LIST OF SPECIES

List of species is set in alphabetical order. For each locality ATMOS grid square (Ochyra, Szmajda 1981), GPS coordinates and topography information are given.

Key: ! – species partly protected in Poland; !! – species strictly protected in Poland; * - species threatened in Poland.

Liverworts / Marchantiophyta

- Cephaloziella divaricata* (Sm.) Schiffn.: Skowronki [Ad 84; 54°21'27.31"N, 19°15'46.89"E], soil on dune near Baltic shore.
- Frullania dilatata* (L.) Dumort.: Nowy Świat [Ad 85; 54°21'26.6"N, 19°18'39.19"E], bark of wayside *Acer pseudoplatanus*.
- Lophocolea bidentata* (L.) Dumort.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E], wayside in mixed forest.
- L. heterophylla* (Schr.) Dumort.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E], rotten wood.
- Lophozia excisa* (Dicks.) Dumort.: Skowronki [Ad 84; 54°21'27.31"N, 19°15'46.89"E], soil on dune near Baltic shore, c. per.
- Marchantia polymorpha* L. subsp. *ruderalis* Bischl. & Boisselier: Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], wet soil, felling site.
- Metzgeria furcata* (L.) Dumort.: Przebrno [Ad 85], bark of *Fagus sylvatica* in the 'Buki Mierzei Wiślanej' nature reserve (leg. P. Nejfeld, Sept 2011).
- ! *Ptilidium ciliare* (L.) Hampe: Nowy Świat [Ad 85; 54°21'44.36"N, 19°18'29.6"E], on ground in dry place in *Pinus sylvestris* forest.
- P. pulcherrimum* (Weber) Vain.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E]; Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E]. Bark of deciduous trees in forest.
- Radula complanata* (L.) Dumort.: Nowy Świat [Ad 85; 54°21'26.6"N, 19°18'39.19"E], bark of wayside *Acer pseudoplatanus*.

Mosses / Bryophyta

- Atrichum undulatum* (Hedw.) P.Beauv.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E], wayside in mixed forest.
- Aulacomnium androgynum* (Hedw.) Schwägr.: Piaski [Ad 77; 54°26'35.2"N, 19°37'08.1"E], bark of *Betula pendula* in mixed forest; Skowronki [Ad 84; 54°21'24.4"N, 19°15'45.1"E], slope, humic soil in coniferous forest.
- ! *A. palustre* (Hedw.) Schwägr.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E], wet place in *Pinus sylvestris* forest.
- Brachythecium albicans* (Hedw.) Schimp.: Piaski [Ad 76; 54°26'33.6"N, 19°36'35.8"E], grassland.
- B. rutabulum* (Hedw.) Schimp.: Piaski [Ad 77; 54°26'35.2"N, 19°37'08.1"E], log of *Populus tremula* in mixed forest.
- Bryum argenteum* Hedw.: Piaski [Ad 76; 54°26'19.97"N, 19°37'0.07"E], concrete wall in rest centre.
- Ceratodon purpureus* (Hedw.) Brid.: Nowy Świat [Ad 85; 54°21'44.36"N, 19°18'29.6"E]; Piaski [Ad 76; 54°26'33.6"N, 19°36'35.8"E]; Przebrno [Ad 85; 54°21'54.48"N, 19°21'31.53"E]; Skowronki [Ad 84; 54°21'24.4"N, 19°15'45.1"E].
- Dicranella heteromalla* (Hedw.) Schimp.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E], wayside in mixed forest.
- ! *Dicranum polysetum* Sw. ex anon.: Nowy Świat [Ad 85; 54°21'33.7"N, 19°18'34.0"E] and [Ad 85; 54°21'44.36"N, 19°18'29.6"E]; Piaski [Ad 76; 54°26'33.6"N, 19°36'35.8"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°21'54.48"N, 19°21'31.53"E]; Skowronki [Ad 84; 54°21'24.4"N, 19°15'45.1"E]. On ground in *Pinus sylvestris* forest.
- ! *D. scoparium* Hedw.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°21'1.57"N, 19°22'1.73"E] and [Ad 85; N 54°21'54.48" E 19°21'31.53"]; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E] and [Ad 84; 54°21'24.4"N, 19°15'45.1"E]. On ground in *Pinus sylvestris* forest, wayside slopes, grasslands, rotten wood and bark of trees.



Fig 2: Pine forest near Skowronki (photo by A. Stebel, 11 August 2011).



Fig 3: Peat bog vegetation near Nowy Świat (photo by A. Stebel, 11 August 2011).



Fig 4: Coastal dunes near Skowronki (photo by A. Stebel, 11 August 2011).

Drytodon pulvinatus (Hedw.) Limpr.: Piaski [Ad 76; 54°26'19.97"N, 19°37'0.07"E], concrete wall in rest centre.

! *Eurhynchium angustirete* (Broth.) T.J.Kop.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E], on ground in mixed forest; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E], wayside in *Picea abies* forest.

Herzogiella seligeri (Brid.) Z.Iwats.: Piaski [Ad 77; 54°26'26.0"N, 19°37'09.3"E]. Rotten log in mixed forest.

! *Hylocomium splendens* (Hedw.) Schimp.: Nowy Świat [Ad 85; 54°21'33.7" 19°18'34.0"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°22'9.15"N, 19°21'29.24"E]; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E]. On ground in *Pinus sylvestris* forest, wayside slopes (Fig. 5).

Hypnum cupressiforme Hedw. var. *cupressiforme*: Nowy Świat [Ad 85; 54°21'33.7" 19°18'34.0"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E]; Przebrno [Ad 85; 54°22'9.15"N, 19°21'29.24"E]; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E]. On ground in forest, rotten log, bark of deciduous trees.

H. cupressiforme Hedw. var. *filiforme* Brid.: Przebrno [Ad 85], bark of *Fagus sylvatica* in the 'Buki Mierzei Wiślanej' nature reserve (leg. P. Nejfeld, Sept 2011).

H. cupressiforme var. *lacunosum* Brid.: Skowronki [Ad 84; 54°21'27.31"N, 19°15'46.89"E]; Piaski [Ad 76; 54°26'33.6"N, E 19°36'35.8"]. Grasslands.

! *Leucobryum glaucum* (Hedw.) Ångstr.: Nowy Świat [Ad 85; 54°21'39.7"N, 19°18'31.2"E] and [Ad 85; 54°21'44.36"N, 19°18'29.6"E]; Przebrno [Ad 85; 54°22'1.57"N, 19°22'1.73"E] and [Ad 85; 54°21'40.7"N, 19°21'16.2"E]; Skowronki [Ad 84; 54°21'24.4"N, 19°15'45.1"E]. On ground in *Pinus sylvestris* forest and wayside slopes.

Niphotrichum canescens (Hedw.) Ochyra & Bednarek-Ochyra: Przebrno [Ad 85; 54°21'54.48"N, 19°21'31.53"E], grassland.

Orthodicranum tauricum (Sapjegin) Smirnova: Nowy Świat [Ad 85; N 54°21'21.4" E 19°18'42.7"], bark of *Betula pubescens* near wet place in *Pinus sylvestris* forest.

Orthodontium lineare Schwägr.: Nowy Świat [Ad 85; 54°21'39.7"N, 19°18'31.2"E] and [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Przebrno [Ad 85; 54°21'40.7"N, 19°21'16.2"E] and [Ad 85; 54°21'1.57"N, 19°22'1.73"E]; Skowronki [Ad 84; 54°21'17.62"N, 19°15'56.51"E]. Rotten wood and humic soil in *Pinus sylvestris* forest. Always with sporophytes.

Orthotrichum affine Brid.: Piaski [Ad 77; 54°26'35.2"N, 19°37'08.1"E], bark of *Sorbus aucuparia* and log of *Populus tremula* in mixed forest; Przebrno [Ad 85; 54°22'1.57"N, 19°22'1.73"E], bark of *Fagus sylvatica*, c. spor.

O. pumilum Sw. ex anon.: Przebrno [Ad 85; 54°21'50.62"N, 19°22'9.43"E], bark of wayside *Betula pendula*.

O. speciosum Nees: Nowy Świat [Ad 85; 54°21'26.6"N, 19°18'39.19"E], bark of wayside *Acer pseudoplatanus*.

Plagiomnium affine (Funck) T.J.Kop.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]. On ground in pine forest.

Plagiothecium curvifolium Limpr.: Nowy Świat [Ad 85; 54°21'39.7"N, 19°18'31.2"E]; Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E]. Rotten wood, bark of trees.

P. denticulatum (Hedw.) Schimp.: Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E], bark of *Frangula alnus* in mixed forest.

Platygyrium repens (Brid.) Loeske: Przebrno [Ad 85; 54°21'50.62"N, 19°22'9.43"E], bark of wayside *Betula pendula*.

! *Pleurozium schreberi* (Brid.) Mitt.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°21'1.57"N, 19°22'1.73"E] and [Ad 85; 54°21'54.48"N, 19°21'31.53"E]; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E]. On ground in *Pinus sylvestris* forest and wayside slopes.

Pohlia nutans (Hedw.) Lindb.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Piaski [Ad 76; 54°26'21.44"N, 19°36'50.46"E]; Przebrno [Ad 85; 54°21'1.57"N, 19°22'1.73"E] and [Ad 85; 54°21'54.48"N, 19°21'31.53"E]; Skowronki [Ad 84; 54°21'11.0"N, 19°16'23.7"E]. On ground in pine forest, wayside slopes.

Polytrichastrum formosum (Hedw.) G.L.Sm.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E]; Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E] and [Ad 85; 54°21'50.62"N, 19°22'9.43"E]; Skowronki [Ad 84; 54°21'11.0"N, 19°16'23.7"E]. On ground in *Pinus sylvestris* forest.

! *Polytrichum commune* Hedw.: Nowy Świat [Ad 85; 54°21'28.2"N, 19°18'35.4"E], wet place in *Pinus sylvestris* forest; Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], felling site.

P. piliferum Hedw.: Przebrno [Ad 85; 54°21'54.48"N, 19°21'31.53"E], grassland.

Polytrichum juniperinum Hedw.: Skowronki [Ad 84; 54°21'26.63"N, 19°15'52.41"E]. Sandy place in *Pinus sylvestris* forest.

- ! *Pseudoscleropodium purum* (Hedw.) Broth.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E]; Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E] and [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°21'54.48"N, 19°21'31.53"E]; Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E]. On ground in *Pinus sylvestris* forest, margins of paths and wayside slopes.
- ! *Ptilium crista-castrensis* (Hedw.) De Not.: Skowronki [Ad 84; 54°21'6.17"N, 19°16'8.38"E], on ground in young *Picea abies* forest.
- Pylaisia polyantha* (Hedw.) Schimp.: Nowy Świat [Ad 85; 54°21'26.6"N, 19°18'39.19"E], bark of wayside *Acer pseudoplatanus*; Piaski [Ad 77; 54°26'35.2"N, 19°37'08.1"E], log of *Populus tremula* in mixed forest.
- Rhodobryum roseum* (Hedw.) Limpr.: Skowronki [Ad 84; 54°21'3.33"N, 19°16'12.17"E], wayside slope in *Pinus sylvestris* forest.
- ! *Rhytidiadelphus squarrosus* (Hedw.) Warnst.: Piaski [Ad 76; 54°26'16.04"N, 19°36'37.54"E], grassy wayside in *Pinus sylvestris* forest.
- Sciuro-hypnum oedipodium* (Mitt.) Ignatov & Huttunen: Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], bark of lower part of *Sorbus aucuparia* trunk; Skowronki [Ad 84; 54°21'07.8"N, 19°16'07.9"E], on ground in young *Picea abies* forest.
- !! *Sphagnum capillifolium* (Ehrh.) Hedw.: Nowy Świat [Ad 85; 54°21'39.19"N, 19°18'37.01"E] and [Ad 85; 54°21'28.2"N, 19°18'35.4"E]; Piaski [Ad 77; 54°26'41.5"N, 19°37'07.9"E]; Przebrno [Ad 85; 54°21'50.62"N, 19°22'9.43"E]; Skowronki [Ad 84; 54°21'07.8"N, 19°16'07.9"E], [Ad 84; 54°21'12.71"N, 19°16'23.31"E], [Ad 84; 54°21'14.28"N, 19°16'0.81"E] and [Ad 84; 54°21'11.0"N, 19°16'23.7"E]. Wet places in coniferous forest (Fig. 6).
- ! *S. fallax* (H.Klinggr.) H.Klinggr.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E] and [Ad 85; 54°21'28.2"N, 19°18'35.4"E]; Skowronki [Ad 84; 54°21'11.0"N, 19°16'23.7"E]. Wet places in coniferous forest.
- !! *S. girgensohnii* Russow: Piaski [Ad 85; 54°26'30.01"N, 19°36'42.8"E], wet places in coniferous forest; Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], wet place on felling site and [Ad 85; 54°21'50.62"N, 19°22'9.43"E], wet place in *Picea abies* forest.
- !! *S. palustre* L.: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E] and [Ad 85; 54°21'28.2"N, 19°18'35.4"E]; Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], [Ad 85; 54°21'40.7"N, 19°21'16.2"E] and [Ad 85; 54°21'50.62"N, 19°22'9.43"E]; Skowronki [Ad 84; N 54°21'11.00"N, 19°16'23.7"E]. Wet places in coniferous forest.
- !! *S. russowii* Warnst.: Nowy Świat [Ad 85; 54°21'28.2"N, 19°18'35.5"E]. Wet place in coniferous forest.
- ! *S. squarrosus* Crome: Przebrno [Ad 85; 54°21'50.62"N, 19°22'9.43"E], wet place in *Picea abies* forest.
- Straminergon stramienum* (Brid.) Hedenäs: Nowy Świat [Ad 85; 54°21'21.4"N, 19°18'42.7"E], wet place in *Pinus sylvestris* forest.
- Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr: Piaski [Ad 76; 54°26'19.97"N, 19°37'0.07"E], grassland.
- Tetraphis pellucida* Hedw.: Nowy Świat [Ad 85; 54°21'39.7"N, 19°18'31.2"E]; Przebrno [Ad 85; N 54°22'1.57"N, 19°22'1.73"E]. Rotten wood and humic soil.
- Tortula muralis* Hedw.: Piaski [Ad 76; 54°26'19.97"N, 19°37'0.07"E], concrete wall in rest centre.
- !! *Ulota crispa* (Hedw.) Brid.: Przebrno [Ad 85; 54°21'46.57"N, 19°21'38.05"E], bark of *Sorbus aucuparia*.

Discussion

The flora of bryophytes of Vistula Spit is not especially rich. The main reason is poor differentiation of habitats. Similar situation is in the neighbouring Hel Peninsula (Ochyra 1986). The most interesting are species protected and threatened in Poland (totally 19). They are mainly partly protected, generally frequent in Poland. The only strictly protected and threatened in Poland, epiphytic moss *Ulota crispa*, in the recent years has increased a number of its localities (Stebel, unpublished data). Localities of two spreading in Europe mosses were discovered: *Othodontium lineare* and *Orthodicranum tauricum*. At present, they are the most north-eastern locations of these species in Poland (Fudali et al. 2009; Stebel et al. 2012 a, b).

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