

THE BRYOPHYTES OF THE SOUTHERN CURONIAN SPIT
(BALTIC SEA COAST)

МОХООБРАЗНЫЕ ЮГА КУРШСКОЙ КОСЫ
(БАЛТИЙСКОЕ ПОБЕРЕЖЬЕ)

CHRISTIAN DOLNIK¹ & MAXIM G. NAPREENKO²

ХРИСТИАН ДОЛЬНИК¹, МАКСИМ Г. НАПРЕЕНКО²

Abstract

We present a first overview of the bryophyte flora of the Russian part of the Curonian Spit as part of the Kaliningrad Province, Baltic Sea region. Based on more than ten years of field investigation, herbarium revisions and literature studies, a total of 223 taxa of bryophytes are recorded, of which 203 species, one subspecies and three varieties were found within the past 30 years and 15 species are known only from old literature quotations. *Bryum elegans*, *B. klinggraeffii*, *Dicranum tauricum*, *Ephemerum minutissimum*, *Rhynchostegium megalopolitanum* and *Schistidium crassipilum* are recorded as new for the territory of the Kaliningrad Province. We give comments on main habitats and distribution of all species and additional notes on invasive and rare species.

Резюме

На основе обработки и анализа бриологических материалов, собранных в ходе десятилетнего полевого исследования в национальном парке «Куршская коса» (южная часть, относящаяся к Калининградской области РФ), а также с учётом ревизии литературных и гербарных данных впервые после 1945 г. приводится список мохообразных для данной территории, отнесённой к объектам всемирного наследия ЮНЕСКО. Список насчитывает 223 вида и внутривидовых таксонов из всех трёх классов отдела Bryophyta, из которых 203 вида, 1 подвид и 3 формы найдены за последние 30 лет; 15 видов известны только по старым литературным источникам. Виды *Bryum elegans*, *B. klinggraeffii*, *Dicranum tauricum*, *Ephemerum minutissimum*, *Rhynchostegium megalopolitanum* и *Schistidium crassipilum* являются новыми для Калининградской области. Список снабжён комментариями о распространении видов и основных местообитаниях, а для адвентивных и редких видов – дополнительными примечаниями.

INTRODUCTION

The Curonian Spit is a unique natural area where a number of picturesque landscapes are situated on a rather small territory. It is a 98 km long and 0.4 to 4 km broad sand barrier at the South-Eastern part of the Baltic Sea coast (Fig. 1). The geographical range is between 54°57'N, 20°29'E near the town Zelenogradsk and 55°43.3'N, 21°05.7'E near the town Klaipeda. The Southern part of the Curonian Spit belongs to the Russian National Park "Kurschskaya Kosa" (6621 ha),

Kaliningrad Province, the Northern part belongs to the Lithuanian Neringa National Park. Since 2000 the Curonian Spit became an area of UNESCO World Natural Heritage.

There are only few and scattered literature data about the bryophytes of the area cited in a monograph about bryophytes of Prussia by Dietzow (1938). Most records are from a small raised bog near the town Zelenogradsk, known as 'Cranzer Moor' or 'Schwendlunder Moor' in the Eastern Prussian periode or as today's Svinoye boloto. This

¹ – Department of Landscape Ecology, Ecology Centre Kiel University, Olshausenstr. 4, D-24098 Kiel, Germany

² – Department of Botany and Plant Ecology, Immanuel Kant State University of Russia, Universitetskaja str. 2, 236040 Kaliningrad, Russia



Fig. 1. Study area.

bog was famous in Eastern Prussia for records of *Splachnum ampullaceum* and *Odontoschisma sphagni* and visited by bryologists like H. Groß, H. Preuß, H. Steffen, H. Gams, E. Boehm, G. Führer, K. Koppe, C. Konopka, L. Dietzow, E. Weber and W. Benrath. Only recently the bryological studies in the area were continued by records of *Sphagnum* species by Napreenko & Razguljajeva (1999) or the confirmation of *Odontoschisma sphagni* by Potemkin (1998) and new records of the invasive bryophytes *Orthodontium lineare* and *Campylopus introflexus* for Russia (Razgulyaeva & al. 2001). After extensive studies of the bog, forest, dune and ruderal vegetation (Dolnik, 2003) and several field excursions, we present the first list of all bryophytes found in the area of the Southern Curonian Spit.

INVESTIGATION AREA

Main habitats for bryophytes on the Curonian Spit are forest plantations (71%) of *Pinus sylvestris* L., *Alnus glutinosa* (L.) Gaertn., *Alnus incana* (L.) Moench., *Betula pendula* Roth, *Betula pubescens* Ehrh., *Populus tremula* L., *Picea abies* (L.) Karst., *Pinus mugo* var. *rotundata* (Link) Hoopes, *Pinus mugo* var. *rostrata* (Ant.) Gord., *Pinus nigra* Arnold and *Pinus banksiana* Lamb., dry grasslands on sand and drifting dunes, a 250 ha peatbog (Cranzer Moor), and the villages Lesnoye (Sarkau), Rybachy (Rossitten) and Morskoye (Pillkopen). Old broad-leaved forest with *Quercus robur* L., *Fraxinus excelsior* L., *Acer platanoides* L., *Acer pseudoplatanus* L., *Ulmus laevis* Pall., *Tilia cordata* Mill., *Carpinus betulus* L. and *Corylus avellana* L. are northward of the town Zelenogradsk and southward of Rybachy.

The spit was formed in the post glacial period (Paul, 1944). Due to several periods of aeolic sand accumulation the soils of the area are rather young. The oldest soil surfaces are few thousand years

old podsols southwards of Lesnoye (old Kings Forest Sarkauer Wald). Northward of Lesnoye soil development started only within the last 150 years when after the anthropogenic forest destruction of the 18th and 19th century the drifting dunes where stabilised with pine plantations and pioneer grassland vegetation (Paul, 1944). The pH of soil of drifting dunes is 6.5 to 7.0 and the thin Ah-horizon layer in open grasslands has still a pH between 5.5 and 6.5. Only in older pine forests with developed podsol soils southward of Lesnoye and in old plantations around Rybachy pH of the Ae-horizon falls down between 3.0 to 4.0.

The climate is strongly influenced by the Baltic Sea and characterised by mild summer (average July temperature 17°C) and mild winter (average January temperature -3°C) and a high annual precipitation of 643 mm (Motiejūnaitė et al., 1998).

METHODS AND NOMENCLATURE

The nomenclature for mosses follows Hill & al. (2006), for hornworts and liverworts Grolle & Long (2000) with additions for the *Lophozia ventricosa* group in Bakalin (2001). For determination we used the keys of Savicz-Lyubitskaya & Smirnova (1968, 1970); Melnichuk (1970); Smith (1978); Nyholm (1986, 1989, 1993, 1998); Frahm & Frey (1992), Frey & al. (1995), Dierßen (1996); Paton (1999); Nebel & Philippi (2000, 2001); Ignatov & Ignatova (2003, 2004).

Specimens of all found species are placed in the Herbarium of the Immanuel Kant State University of Russia (Kaliningrad).

Most data were collected during geobotanical field investigations of the authors in the years 1998 to 2005. Several records are based on 130 geobotanical relevés published in Dolnik (2003). Location of the geobotanical investigation sites as well as sites of single gatherings are given by the

number of the 174 forest management units of the forest districts “Zoloty’ye Dyuny”, or Rybachy (R) and Zelenogradsk (Z). The size of such units varies between 12 and 297 ha. Forest district Rybachy starts at the border to Lithuania (1R) and ends at road kilometre 28.5 (83R) and includes the non forested village districts Morskoye (84R) and Rybachy (85R). Forest district Zelenogradsk starts at road km 28.5 (1Z) and ends at the beginning of the spit with forestry units 76/77Z northwards of the grave yard of Zelenogradsk. For administrative reasons the bog and mire at the Curonian Lagoon near Zelenogradsk (units 78Z to 89 Z) belong to the forest district Pionerskij. At the moment the raised bog is not a part of the National Park.

No location is given for common species with more than 10 records in the whole area. These species can surely be found as well in other suitable areas of the Curonian Spit.

INVASIVE BRYOPHYTES *ORTHODONTIUM LINEARE* AND *CAMPYLOPUS INTROFLEXUS* ON THE CURONIAN SPIT

Since *Orthodontium lineare* (in 1990) and *Campylopus introflexus* (in 2000) were collected on the Curonian Spit for the first time in Russia (Razgulyaeva et al. 2001), we collected more information about the distribution of these species in the area.

Orthodontium is a widespread species in pine plantations. It is most common on humus litter and trunk bases in young pine plantations around the raised bog ‘Svinoye Boloto’ (forestry units 82Z, 83Z, 84Z), where it grows also on rotten wood or epiphytic on bark. It was also found scattered in forests southwards of Lesnoye (48Z, 59Z) and near Rybachy (38R, 52R, 64R).

A large population of *Campylopus introflexus* was discovered in 2001 in a forest gap of a *Pinus mugo*-plantation on Müllers dune near Rybachy (leg. C. Dolnik, 2001, LE and Hb. Im. Kant Univ., 55°08.88’N, 20°48.66’E, 50 m southwards of old tower on dune top, 62R). Here, along a forest trail about 9 sq.m were densely covered by *Campylopus introflexus*, other plants of the stand were *Corynephorus canescens*, *Festuca filiformis*, *Dicranum scoparium*, *Polytrichum piliferum*, *Cladonia macilenta* ssp. *floerkeana*, *C. gracilis*, *C. phyllophora*, *C. foliacea*, *C. arbuscula* ssp. *mitis*. The size of the population indicates that the species arrived at the Curonian Spit several years ago.

Two other localities, one southwards of Lesnoye and another one northwards of Rybachy are mentioned in Razgulyaeva & al. (2001).

CHANGES IN BRYOPHYTE VEGETATION

About half of the species were not recorded from the Spit before, but according to Dietzow (1938) most of them were common in the region and probably also occurred on the Curonian Spit. We can refer changes in the bryophyte vegetation only to the raised bog ‘Cranzer Moor’ (‘Svinoye boloto’), because only there the bryophytes were studied in detail before. Continuous melioration of the bog in the 20th century and afforestation of areas with former peat digging as well as repeated fires reduced the open raised bog from 150 to about 55 ha. The former dominance of *Sphagnum fuscum* with *S. magellanicum* and *S. fallax* (Groß, 1914) changed to a dominance of *S. rubellum* with *S. fallax* and *S. magellanicum* and a vegetation cover of *Calluna vulgaris* of 60-70%. Only 5 tiny patches of *Sphagnum fuscum* were rediscovered in 2001 after intensive seeking. If the process of melioration and frequent burning continues, the species will become extinct soon. The peat moss *S. imbricatum* was already rare at the beginning of the 20th century, recorded by Groß (1914), Dietzow and Boehm in Dietzow (1938) and can be considered as extinct now. According to the peat analysis of Benrath (1934), *S. imbricatum* is the main peat moss within the upper peat layer. Recent investigations by Napreenko in 2003 showed another dominance peak in peat depths of 4 m.

Also some other bryophytes were not found any more. *Splachnum ampullaceum*, recorded by Groß (1914) on elk’s dung, is probably extinct now, although elks are still common in the area. Other probably extinct bryophytes of the raised bog are *Calliargon stramineum*, *Polytrichum longisetum*, recorded by Preuß (1912), *Jamsoniella autumnalis*, *Gymnocolea inflata*, *Sphagnum teres*, *Campylopus flexuosus*, *Dicranodontium denudatum*, *Warnstorfia fluitans* by Groß (1914), *Cephalozia lunulifolia* by Führer and K. Koppe (Koppe & Steffen, 1927) and *Cephalozia loitlesbergeri*, *Sphagnum subnitens* by L. Dietzow, G. Führer 1918 in Dietzow (1938). Records of *Lophozia porphyroleuca* (Nees) Schiffn. by Dietzow (1938) probably belong to *Lophozia ventricosa* sensu Bakalin (2001). The samples of *L. ventri-*

cosa (leg. C. Dolnik 2001) show nonbiconcentric oil bodies, a feature of the neotypified *Lophozia ventricosa* by Grolle & Long (2000) but in the past often connected with *L. silvicola* and *L. longifolia* (Paton, 1999). Other peat bog species like *Sphagnum obtusum*, *Sphagnum molle* and *Cephaloziella spinigera* were recorded only recently (Napreenko & Razguljajeva, 1999; Dolnik, 2003).

The data regarding bryophytes in other habitats on the Curonian Spit are poor. Only Steffen (1931) gave some interesting vegetation relevés with a profound bryological background, whereas Paul (1953) mentioned only well known and common species. Steffen, for instance, described *Fissidens adianthoides* from wet meadows near the raised bog. Today's locality of that species is restricted to mortar of a ruin near the raised bog. Further old records of species which were not found anymore are *Pohlia annotina* mentioned by Preuß (1912: 216) from spruce forest near Cranz (Zelenogradsk) and *Bryum intermedium* (leg. Konopka, near Sarkau (Lesnoye), in Dietzow, 1938).

Other species were not mentioned from the Curonian Spit before but are remarkable because they had not been recorded for the Kaliningrad region yet or were always rare. Old coastal *Ammophila* dunes and dry grassland vegetation cover large parts of the Curonian spit and host *Rhynchostegium megapolitanum* and *Bryum elegans*, which are new to the Kaliningrad Province. Remarkable is also the red-listed *Bryum warneum*, which was found on sand deposits on the Curonian Lagoon near Morskoye. Rare forest species are *Cynodontium strumiferum* and *Dicranum tauricum* in alder carrs and *Dicranum flexicaule* on birch and pine trees. On dead wood in the pine forest surrounding the raised bog Swinoje, we have found *Odontoshisma denudatum*. Loamy soil and silt is restricted to the old moraine island of the Rybachy Plateau, where *Anthoceros agrestis*, *Bryum klinggraeffii*, *Ephemerum minutissimum* and *Pohlia lescuriana* have been found on former arable land and old hay meadows; these species were associated with the more common *Riccia sorocarpa*, *Tortula modica*, *Weissia brachycarpa* and others. Finally, due to recent taxonomical studies and changes, the common and widely distributed *Racomitrium elongatum* and *Schistidium*

crassipilum are recorded as new for the region, but have been collected by other authors under different names before. Further details about all these species are provided in the following list.

LIST OF BRYOPHYTES OF THE SOUTHERN CURONIAN SPIT (RUSSIA)

This list presents 223 taxa of bryophytes from the Russian part of the Southern Curonian Spit that we accept after our field investigations, literature studies and a critical herbarium revision. The species concepts follow the European checklist of Hill & al. (2006) and Grolle & Long (2000). About 204 species, one subspecies and three varieties were recorded from the area within the past 30 years and 15 species are known only from old German literature quotations. In total, 178 mosses, 44 liverworts and one hornwort are known from this rather small territory. This underlines the high value of the Curonian Spit for bryophyte diversity and nature protection in Russia. Species known only from old literature are marked by an asterisk (*). For all species we give short comments on commonness, main habitats and distribution on the spit. Additionally we localize rare species by the number of the forest management units and give short comments on literature records. Some commonly used bryophyte names (cf. Ignatov & Afonina, 1992) were changed in the checklist of Hill et al. (2006), so we included some synonyms in the list in brackets.

ANTHOCEROTHAEE - HORNWORTS

Anthoceros agrestis Paton – one record with few plants from a small disturbed patch in the meadows southwards of Rybachy, on sandy clay, leg. C. Dolnik 2001 (85R).

HEPATICAEE - LIVERWORTS

Barbilophozia barbata (Schreb.) Loeske – few records on humus rich sandy soil in pine plantations (13R, 76R, 65R).

B. kunzeana (Huebener) Müll. Frib. – single record from an old sand pit in pine plantations near the road, 65R, leg. Dolnik 1999.

B. lycopodioides (Wallr.) Loeske – few records in old pine plantations on sand (13R, 64R, 70R) .

Blasia pusilla L. – only two records, one from disturbed sandy soil in an alder plantation near lake Lebed (9R) and another from wet humus rich sand of a lane, forest road (64R).

Calypogeia integristipula Steph. – few records, sandy ditch for melioration of forest, King Forest southwards of Lesnoye (leg. Dolnik 2000, 57Z) .

- C. muelleriana* (Schiffn.) Müll.Frib. – few records on plant debris in a spruce forest (45Z), in pine forest and heath of the raised bog Swinoje (82Z, 84Z, 85Z, 87Z); mentioned already by Preuß (1912).
- C. sphagnicola* (Arnell & Perss.) Warnst. & Loeske – common on peat and plant debris, but restricted to the raised bog Swinoje (79Z, 83Z, 84Z, 86Z, 87Z); mentioned already by Groß (1914).
- Cephalozia bicuspidata* (L.) Dumort. – few records on wet soil of alder carrs near lake Lebed (8R, 9R) and wet soil near a track (82Z).
- C. connivens* (Dicks.) Lindb. – common on peat and plant debris, but restricted to the raised bog Swinoje (79Z, 83Z, 84Z, 85Z, 86Z, 87Z, 88Z), recorded already by Preuß (1912) and Groß (1914).
- **C. loitlesbergeri* Schiffn. – only one old record by L. Dietzow and G. Führer 1918 (in Dietzow, 1938) from the raised bog Swinoje.
- **C. lunulifolia* (Dumort.) Dumort. – only one old record by Führer and K. Koppe (in Koppe & Steffen, 1927).
- Cephalozia divaricata* (Sm.) Schiffn. – very common in dry grassland vegetation throughout the spit.
- C. elachista* (Jack ex Gott. & Rabenh.) Schiffn. – common on peat and plant debris, but restricted to the raised bog Swinoje (83Z, 84Z, 86Z, 87Z, 88Z), recorded already by Dietzow 1918 (in Dietzow, 1938).
- C. hampeana* (Nees) Schiffn. – scattered on peat and plant debris, but restricted to the raised bog Swinoje (83Z, 85Z, 86Z), leg C. Dolnik 2001, conf. L. Meinunger 2005.
- C. rubella* (Nees) Warnst. – scattered on humus, peat and dead wood (58R, 64R, 72R, 76R, 87R).
- C. spinigera* (Lindb.) Warnst. – rare on peat of the raised bog Swinoje (85Z, 86Z).
- Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. – few records from wet humus in alder swamp forests (9R, 59R, 74Z).
- Conocephalum conicum* (L.) Und. – rare, but mentioned already by Groß (1914) from a birch forest of the bog Swinoje.
- Frullania dilatata* (L.) Dumort. – scattered in broad-leaved forest of the Spit (66R, 67R, 70Z, 75Z, 76Z).
- **Gymnocolea inflata* (Huds.) Dumort. – only old records from Groß (1914) and Dietzow & Führer in Dietzow (1938) from the raised bog Swinoje; probably extinct due to melioration.
- **Jamsoniella autumnalis* (DC.) Steph. – only one old record (Groß, 1914) from the raised bog Swinoje.
- Kurzia pauciflora* (Dicks.) Grolle – rare on peat and dead wood of the raised bog Swinoje (79Z, 85Z, 87Z) but already mentioned by Koppe & Steffen (1927).
- Lepidozia reptans* (L.) Dumort. – fairly common on humus and dead wood in spruce forests as well as in birch and pine forests in the surrounding of the raised bog Swinoje.
- Lophocolea bidentata* (L.) Dumort. – fairly common in the ground floor vegetation of pine plantations and *Salix daphnoides* stands on acidic dune sand.
- L. heterophylla* (Schrad.) Dumort. – very common on dead wood, humus and trunk bases in forest and dry grassland vegetation throughout the area.
- Lophozia exisa* (Dicks.) Dumort. – scattered on humus in dry grasslands and open patches between pine plantations on sand dunes (76R, 7Z, 8Z, 13Z, 24Z).
- L. ventricosa* (Dicks.) Dumort. – rare on peat of the raised bog Swinoje (83Z, 85Z); old records of *Lophozia porphyroleuca* (Nees) Schiffn. by Dietzow (1938) may belong to *L. ventricosa* sensu Bakalin (2001), because of inconsistent separation of *L. ventricosa* and its varieties in older literature and confusion of names.
- Marchantia polymorpha* subsp. *polymorpha* L. – rare in alder carrs (26R, 59R), but already mentioned by Groß (1914) and Steffen (1931) from alder carrs near the raised bog Swinoje.
- subsp. *ruderalis* Bischl. & Boisselier – scattered in disturbed places under anthropogenic influence (84R, 85R).
- Metzgeria furcata* (L.) Dumort. – only scattered as epiphyte in old broad-leaved forests (66R, 67R) on the Curonian Spit, although frequent elsewhere.
- Mylia anomala* (Hook.) Gray – common on peat and plant debris, often in ditches, but restricted to the raised bog Swinoje (79Z, 83Z, 86Z, 87Z), recorded already by Preuß (1912) and Groß (1914).
- Odontoschisma denudatum* (Mart.) Dumort. – recorded only once from dead wood in a pine forest of the bog Swinoje (84Z, Oberjägerdamm, 54°58.12'N, 20°31.35'E, leg. C. Dolnik 2001).
- O. sphagni* (Dicks.) Dumort. – common on peat and plant debris, but restricted to the raised bog Swinoje, where it was frequently found since the records of Groß 1914 (79Z, 83Z, 84Z, 85Z, 86Z, 87Z, 88Z).
- Pallavicinia lyellii* (Hook.) Carruth. – one record from a ditch in a birch carr at the Curonian Lagoon (88Z).
- Pellia neesiana* (Gottsche) Limpr. – one record from a spring in an alder forest at lake Lebed (9R).
- Plagiochila asplenioides* (L.) Dumort. – rare, on humus in birch and spruce forest (45Z) southwards of Lesnoje.
- P. porelloides* (Torrey ex Nees) Lindenb. – rare epiphyte on deciduous trees.
- Ptilidium ciliare* (L.) Hampe – common mainly in pine plantation on humus rich sand and dead wood, but also in older dry grassland vegetation.
- P. pulcherrimum* (G. Web.) Vaino – common on dead wood and acidic bark, mainly of birch and mountain pine.
- Radula complanata* (L.) Dumort. – common only in broad-leaved forest northwards of Zelenogradsk and

- near Rybachy (66R, 67R, 76Z, 78Z).
- Riccia cavernosa* Hoffm. – very local on lake sediments of dried ponds around Rybachy, but sometimes frequent (66R).
- R. fluitans* L. – very local on lake sediments of dried ponds around Rybachy, but sometimes frequent (66R, 85R), and in wet alder carrs.
- R. sorocarpa* Bisch. – rare in open soil patches of hay meadows (disturbed by wild boar) southwards of Rybachy, on sandy loam (85R).
- Ricciocarpos natans* (L.) Corda – local on lake sediments of dried ponds southwards of Rybachy (66R).

MUSCI - MOSSES

- Abietinella abietina* (Hedw.) M.Fleisch. (= *Thuidium abietinum* (Hedw.) Schimp.) – rare in small meso-xerophytic swards of the Rybachy Plateau near the Curonian Lagoon (85R) and in dune vegetation at the central road northwards of Lesnoye (30Z).
- Amblystegium serpens* (Hedw.) Schimp. (incl. *Amblystegium juratzkanum* Schimp.) – common epiphyte in birch and alder forests and also epilithic on concrete and other anthropogenic substrates. Larger forms with a strong leaf nerve (*A. s. var. rigescens* (Limpr.) Loeske) and slightly denticulate leaf margin (*A. juratzkanum* Schimp.) are recognized by some authors as distinct taxa but are treated in Hill & al. (2006) as synonyms of *A. serpens*. They are fairly common in the ground floor vegetation of wet meadows, in alder carrs and on dead wood.
- A. subtile* (Hedw.) Schimp. – rare epiphyte on *Ulmus laevis* in a broad-leaved forests southwards of Rybachy (66R).
- Anomodon attenuatus* (Hedw.) Huebener – rare epiphyte on deciduous trees.
- Atrichum undulatum* (Hedw.) P.Beauv. – very common in damp forests and meadows.
- Aulacomnium androgynum* (Hedw.) Schwägr. – very common on log bases and on humus in all types of forests.
- A. palustre* (Hedw.) Schwägr. – common in wet forests, meadows and on raised bog.
- Barbula convoluta* Hedw. – scattered in rural habitats around the settlements.
- B. unguiculata* Hedw. – common in rural habitats around settlements.
- Brachytheciastrum velutinum* (Hedw.) Ignatov & Hutunen (= *Brachythecium velutinum* (Hedw.) Schimp.) – common on dead wood, humus and humus rich soil in broad-leaved forests, birch and alder carrs.
- Brachythecium albicans* (Hedw.) Schimp. – very common in dry grassland vegetation on sand dunes and ruderal dry places around settlements.
- B. mildeanum* (Schimp.) Schimp. ex Milde – rare, in damp meadows.
- B. rutabulum* (Hedw.) Schimp. – very common in wet and mesic forest ground floor vegetation and meadows, but also on dead wood and trunk bases. Forms in wet habitats are very similar to the dioicous *B. rivulare* Schimp., but all samples were autoicous. Following Wigh (1976) they are treated here as modifications of *B. rutabulum*.
- B. salebrosum* (Hoffm. ex F.Weber & D.Mohr) Schimp. – common in the ground floor vegetation of forests, on dead wood and more rare as epiphyte on deciduous trees.
- Bryoerythrophyllum recurvirostrum* (Hedw.) P.C.Chen – rare in ruderal places on anthropogenic substrates.
- Bryum algovicum* Sendt. ex Müll. Hall. var. *rutheanum* (Warnst.) Crundw. – rare in wet depressions of coastal meadows on the Curonian Lagoon in Rybachy (leg. C. Dolnik 1998).
- B. archangelicum* Bruch & Schimp. (= *Bryum inclinatulum* (Brid.) Turton) – one record from a wet dune slack northwards of Rybachy (28R) (leg. C. Dolnik 2000).
- B. argenteum* Hedw. – very common on walls, mortar and ruderal places around settlements but also in dry grassland vegetation.
- B. caespiticium* Hedw. – scattered in dry grassland and disturbed places in forests and meadows as well as ruderal in settlements.
- B. capillare* Hedw. – scattered in ruderal places around settlements but also in dry grasslands.
- B. dichotomum* Hedw. (= *Bryum bicolor* Dicks.) – scattered in ruderal places around settlements and along roads.
- B. elegans* Nees – this species was found on humus rich dune sand with low pH values. Such material was also described as *Bryum stirtonii* Schimp. in contrast to “typical forms” from basic rocks. The material from the Curonian spit matches the description of *B. elegans* in Zolotov (2000), who also treats *B. stirtonii* as a synonym of *B. elegans*. The species belongs to the *Bryum capillare* complex and was probably not distinguished before. Vegetation descriptions from dry grasslands are given by Dolnik (2006). In Dietzow (1938) only two records for the southern part of Eastern Prussia (now Poland) are mentioned, and this species is new for the territory of Kaliningrad Province.
- **B. intermedium* (Brid.) Bland. – collected by C. Konopka, near Sarkau (Lesnoye) (cited in Dietzow, 1938) but not found since that time.
- B. klinggraeffii* Schimp. – was found on loamy sand in a hay meadow southwards of Rybachy, together with *Dicranella schreberiana*, *Phascum cuspidatum*, and *Ephemerum minutissimum*. Probably it is a widespread species in the region but it was not mentioned by Dietzow (1938) for Eastern Prussia (leg. C. Dolnik, 2000, 55°08.38'N, 20°49.96'E). In the Curonian Spit suitable habitats with loamy soil are restricted to the Rybachy area.

- B. moravicum* Podp. (= *Bryum subelegans* non Kindb., *B. flaccidum* auct.) – it is a widespread species in young dry grassland vegetation along the coastal dunes of the Curonian Spit. The diagnostic filamentous gemmae in leaf axils are common only in autumn, and it is difficult to separate it from *B. capillare*. The differences between *Bryum subelegans* and *B. flaccidum*, stressed by Nyholm (1993), were not accepted by other authors. Holyoak (2004) discovered that the lectotype of *B. subelegans* Kindb. actually belongs to *Bryum oeneum* Blytt ex Bruch. & Schimp. Plants similar to typical *Bryum flaccidum* were found on dead wood in a swampy forest north of Morskoye.
- B. pseudotriquetrum* (Hedw.) P. Gaertn., E.Mey. & Scherb. – rare, only few recent records from dune slacks (31R) and other damp places; already recorded by Preuß (1912).
- B. rubens* Mitt. – common, on loamy soil in meadows and former arable land around Rybachy (84R).
- B. warneum* (Röhl.) Brid. – found on sand barriers at the shore of the Curonian Lagoon in Morskoye. Large population grew here, with *Bryum argenteum*, *Pohlia nutans*, *Marchantia polymorpha* ssp. *ruderalis*, *Juncus acicularis*, *J. bufonius*, *Sagina nodosa*, *S. procumbens* and *Limosella aquatica* (c. fr., leg. C. Dolnik & A.A. Sokolov, 2000). *B. warneum* is the only species on the Curonian spit listed in the Red Data Book of European Bryophytes (Schumacker & Martiny, 1995) as endangered.
- Buxbaumia aphylla* Hedw. – few records from open patches with dry grassland vegetation in pine plantations (27R, 75R, 76R, 12Z), but probably also overlooked.
- Calliargon cordifolium* (Hedw.) Kindb. – common in wetlands and wet birch, spruce and alder forests.
- Calliargonella cuspidata* (Hedw.) Loeske – common in wetlands, meadows, birch, spruce and alder forests.
- **Campylopus flexuosus* (Hedw.) Brid. – recorded by Groß (1914) from wetlands around the raised bog but not found since that time, probably overlooked.
- C. introflexus* (Hedw.) Brid. – neophyte known from three places on the Curonian spit (41R, 62R, 56Z), (Razgulyaeva et al. 2001).
- C. pyriformis* (Schultz) Brid. – common on humus and peat, mainly in forests.
- Ceratodon purpureus* (Hedw.) Brid. subsp. *purpureus* – most common moss in dry grassland vegetation but also in meadows, forests and ruderal places around settlements.
- Cirriphyllum piliferum* (Hedw.) Grout – scattered in the ground floor vegetation of broad-leaved (67R) and birch forests (10R, 18R, 60R, 76R) and in alder forests (41Z, 43R).
- Climacium dendroides* (Hedw.) F.Weber & D.Mohr – common in most vegetation types.
- Cynodontium strumiferum* (Hedw.) Lindb. – very rare, few cushions on trunk of *Alnus glutinosa* in an alder carr around lake Lebed (9R) north of Morskoye (55°14.78'N, 20°56.59'E).
- Dicranella cerviculata* (Hedw.) Schimp. – common on wet peat in ditches of the raised bog, grows also on humus in spruce forests.
- D. heteromalla* (Hedw.) Schimp. – common in dry ground floor vegetation in forests.
- D. schreberiana* (Hedw.) Dix. – rare, restricted to the area with loamy soils around Rybachy, in meadows (85R).
- **Dicranodontium denudatum* (Brid) Britt. – only one historical record by Groß (1914) from the raised bog area.
- Dicranoweisia cirrata* (Hedw.) Lindb. – rare epiphyte in alder carrs (59R).
- Dicranum flagellare* Hedw. – rare on rotten logs of *Pinus sylvestris*, in pine forest (81Z).
- D. flexicaule* Brid. – rare epiphyte on *Pinus sylvestris* and *Betula pendula* (69R, 81Z).
- D. fuscescens* Sm. – scattered on pine and birch trees or on humus and wood (10R, 13R, 17R).
- D. majus* Turn. – common in spruce forests, but also in birch and pine woods.
- D. montanum* Hedw. – very common epiphyte on acidic bark (*Pinus* sp., *Betula* sp., *Alnus glutinosa*), grows also on humus and dead wood.
- D. polysetum* Sw. – very common in conifer plantations, grows also in dry grasslands.
- D. scoparium* Hedw. – very common moss of the ground floor vegetation in forests and older dry grasslands, also common on dead wood and on tree trunks.
- D. tauricum* Sap. – very rare, only one record on trunk of *Alnus glutinosa*, near lake Chaika (62R, 55°08.79'N, 20°48.88'E, leg. C. Dolnik 1999), in small quantity. This species was not mentioned by Dietzow (1938) for Eastern Prussia and is probably new in the area. An increase of distribution range of that species was recorded for England (Smith, 1978) and Germany (Düll & Meinunger, 1989).
- D. undulatum* Schrad. ex Brid. (= *Dicranum bergeri* Blandow ex Hoppe) – rare, only in small cushions on *Sphagnum* hummocks of the raised bog (79Z, 83Z, 85Z, 86Z, 87Z).
- Didymodon fallax* (Hedw.) R.H. Zander – rare, restricted to places with basic soil. Introduced to pine plantations on clay with planting soil for pine trees.
- D. rigidulus* Hedw. – rare, but probably overlooked, on concrete of a ruin on Epha's Dune near Morskoye (14R), sterile, but with plenty of globose gemmae in leaf axils.
- Drepanocladus aduncus* (Hedw.) Warnst. – common

- in wetlands along the Curonian Lagoon and near ponds and lakes.
- Encalypta streptocarpa* Hedw. – rare, on basic soil.
- Ephemerum minutissimum* Lindb. – common ephemeral moss in the hay meadows southwards of Rybachy, best recognized in autumn. In Dietzow (1938) it was mentioned only for the area of Western Prussia but was probably not distinguished from *E. serratum* in other areas. The latter was mentioned already by Preuß (1912: 195) for the Curonian Spit.
- Eurhynchium angustirete* (Broth.) T.J. Kop. – common in damp birch, alder and pine woods. In former times not separated from *E. striatum*.
- Fissidens adianthoides* Hedw. – mentioned already by Steffen (1931) from damp meadows around the raised bog, but today known only as epilithic from mortar of a ruin (86R).
- F. taxifolius* Hedw. – scattered on clay in alder carrs and meadows around Rybachy (85R).
- Funaria hygrometrica* Hedw. – common ephemere on disturbed places and nutrient enriched soil in ruderal grasslands and forests.
- Grimmia pulvinata* (Hedw.) Sm. – common epilithic moss on walls, buildings and concrete.
- Herzogiella seligeri* (Brid.) Z.Iwats. – very common on rotten wood in forests.
- Homalia trichomanoides* (Hedw.) Schimp. – scattered, on rotten stumps in an alder carr (25Z) and in broad-leaved forests north of Zelenogradsk (76Z, 78Z).
- Homalothecium lutescens* (Hedw.) H.Rob. – rare, in dry birch forest north of Morskoye and in *Avenula pubescens* grassland near Rybachy (10R, 85R).
- H. sericeum* (Hedw.) Schimp. – rare epiphyte on deciduous trees near Zelenogradsk and Rybachy (66R), but very common outside the Curonian Spit.
- Hylocomium splendens* (Hedw.) Schimp. – very common in birch and conifer forests.
- Hypnum cupressiforme* Hedw. var. *curessiforme* – very common epiphyte, but grows also on other substrates. – var. *lacunosum* Brid. – common in humus rich dry grasslands on sand.
- H. jutlandicum* Holmen & Warncke – in pine plantations and *Calluna vulgaris* heath on the raised bog Swinoje.
- H. pallescens* (Hedw.) P. Beauv. – rather common epiphyte in *Alnus glutinosa* forests (9R, 26R, 28R, 66R).
- Isothecium alopecuroides* (Dubois) Isov. – rare, on dead wood (85R, 76Z).
- Isothecium myosuroides* Brid. – rare epiphyte on deciduous trees.
- Kindbergia praelonga* (Hedw.) Ochyra (= *Eurhynchium praelongum* (Hedw.) Schimp.) – very common in most habitats of the Curonian Spit.
- Leptobryum pyriforme* (Hedw.) Wils. – common on humid soil in alder carrs, at ponds and disturbed places on tracks and around settlements.
- Leptodictyum riparium* (Schimp.) Warnst. (= *Amblystegium riparium* (Hedw.) Schimp.) – common in wetlands along the Curonian Lagoon, also in alder carrs.
- Leskea polycarpa* Ehrh. ex Hedw. – rare epiphyte on trees near the lagoon (85R).
- Leucobryum glaucum* (Hedw.) Ångstr. – fairly common in older pine plantations.
- Leucodon sciuroides* (Hedw.) Schwägr. – rare on the Curonian Spit, recorded as epiphyte from *Ulmus laevis* in a lime tree wood southwards of Rybachy (66R), but much more common in other regions of Kalinin-grad Province.
- Mnium hornum* Hedw. – very common in forests on humus and rotten wood.
- Neckera pennata* Hedw. – rare epiphyte, one gathering from deciduous forest northwards of Zelenogradsk.
- Orthodontium lineare* Schwägr. – neophyte, common on humus litter and trunk bases in young pine plantations around the raised bog Swinoje, where it grows on rotten wood or as epiphyte on bark.
- Orthotrichum affine* Brid. – common epiphyte on deciduous trees.
- O. anomalum* Hedw. – epilithic on walls and rocks, but restricted to anthropogenic substrates.
- O. diaphanum* Brid. – common epiphyte on deciduous trees, but also on rocks and concrete near the Curonian Lagoon.
- O. obtusifolium* Brid. – scattered, epiphyte on deciduous trees.
- O. pallens* Bruch ex Brid. – scattered, epiphyte on deciduous trees (10R, on *Betula pendula* and *Populus tremula*; 85R, Rybachy, on *Fraxinus excelsior*), mentioned by Dietzow (1938) from the Lithuanian part of the Curonian Spit.
- O. pumilum* Sw. – scattered, epiphyte on deciduous trees, (77R, on *Acer pseudoplatanus*).
- O. speciosum* Nees – common epiphyte on deciduous trees.
- O. stramineum* Hornsch ex Brid. – rare epiphyte in broad-leaved forests of the spit, on *Quercus robur* southwards of Rybachy (66R).
- Oxyrhygium hians* (Hedw.) Loeske (= *Eurhynchium hians* (Hedw.) Sande Lac.) – very common in forests and meadows.
- Phascum cuspidatum* Hedw. – common only in ruderal places and meadows around Rybachy.
- Philonotis caespitosa* Jur. – only one recent record from a small spring water creek at lake Lebed north of Morskoye (55°14.98'N, 20°55.39'E). Paul (1953) mentioned already *Philonotis fontana* from the Curonian Spit. Because *P. caespitosa* is a member of the *P. fontana* group, we suggest that the record refers to *P. caespitosa*.

- Phycomitrium pyriforme* (Hedw.) Brid. – scattered on humus rich soil in wetlands and alder carrs (85R, 41Z, 50Z).
- Plagiomnium affine* (Funck) T.J. Kop. – very common in humid to dry forests and grasslands.
- P. cuspidatum* (Hedw.) T.J. Kop. – common in humid to dry forests and grasslands, already recorded by Steffen (1931).
- P. elatum* (Bruch & Schimp.) T.J. Kop. – very common in humid grasslands and deciduous forests.
- P. ellipticum* (Brid.) T.J. Kop. – common in alder carrs and fens.
- P. medium* (Bruch & Schimp.) T.J. Kop. – common in alder carrs and fens.
- P. undulatum* (Hedw.) T.J. Kop. – very common in forests.
- Plagiothecium cavifolium* (Brid.) Iwats. – rather scattered in deciduous forests (66R, 74Z).
- P. curvifolium* Schlieph. – very common on humus and dead wood in forests, sometimes epiphytic.
- P. denticulatum* (Hedw.) Schimp. var. *denticulatum* – fairly common on humus in forests.
– var. *undulatum* R. Ruthe ex Geh. (= *Plagiothecium ruthei* Limpr.) – very common in birch and alder carrs.
- P. laetum* Schimp. – very common epiphyte, but also on humus rich soil and dead wood in forests and woods.
- P. latebricola* Schimp. – very common epiphyte in alder carrs.
- P. nemorale* (Mitt.) A. Jaeger – scattered in alder carrs on trunk bases of alder or on humus (9R, 68R, 78Z).
- P. succulentum* (Wils.) Lindb. – common in deciduous forests on trunk bases, dead wood or humus.
- P. undulatum* (Hedw.) Schimp. – scattered in spruce forests on humus (59Z, 65Z).
- Platygyrium repens* (Brid.) Schimp. – common epiphyte on deciduous trees, mainly on *Alnus glutinosa*.
- Pleuridium subulatum* (Hedw.) Rabenh. – common only in meadows around Rybachy, on loamy soil.
- Pleurozium schreberi* (Brid.) Mitt. – one of the most common bryophytes in the forest floor vegetation, but also common in grasslands.
- **Pohlia annotina* (Hedw.) Warnst. – mentioned by Preuß (1912) from spruce forest but was not recorded since.
- P. lescuriana* (Sull.) Grout – rare, only one record from a loamy ditch in an alder carr near Rybachy (85R), leg. Dolnik 2000.
- P. melanodon* (Brid.) J. Shaw – rare, only one record from a loamy ditch in an alder carr near Rybachy (85R).
- P. nutans* (Hedw.) Lindb. – common on humus and peat in forest and bog vegetation.
- **P. sphagnicola* (Bruch & Schimp.) Lindb & H. Arnell – recorded by K. Koppe (in Koppe & Steffen, 1927) and L. Dietzow & G. Führer (in Dietzow, 1938) from the raised bog Swinoje. This species is difficult to separate from *P. nutans* and it is not clear, whether the old records refer to dioicous *P. sphagnicola* or to modifications of *P. nutans*. It was not recorded since, and severe drainage of the bog could have led also to its extinction.
- P. wahlenbergii* (F. Weber & D. Mohr) Andrews – scattered on basic sand in an alder carr (9R) and on loamy soil of the Rybachy plateau (85R), but common outside the Curonian Spit.
- Polytrichastrum formosum* (Hedw.) G.L. Sm. (= *Polytrichum formosum* Hedw.) – common in forests and dry grasslands.
- **P. longisetum* (Sw. ex Brid.) G.L. Sm. (= *Polytrichum longisetum* Sw. ex Brid.) – recorded by Preuß (1912) from the raised bog Swinoje, but not found since.
- Polytrichum commune* Hedw. – common in wet spruce, pine and birch forests.
- P. juniperinum* Hedw. – common in dry grasslands.
- P. piliferum* Schreb. ex Hedw. – common in dry grasslands.
- P. strictum* Menz. ex Brid. – common in bog vegetation and surrounding forests, frequent on recently burned sites.
- Pseudoscleropodium purum* (Hedw.) M. Fleisch. (= *Scleropodium purum* (Hedw.) Limpr.) – very common in coniferous and birch forests and older dune vegetation.
- Ptilium crista-castrensis* (Hedw.) De Not. – only scattered in spruce and pine plantations.
- Pylaisia polyantha* (Hedw.) Schimp. – common epiphyte on deciduous trees.
- Racomitrium canescens* (Hedw.) Brid. – according to the herbarium revision *R. canescens* s.str. is widely distributed in dry grassland vegetation, were it was already mentioned by Steffen (1931), and also grows on mortar of a ruin (14R). It is the most frequent member of the *Racomitrium canescens* complex in the area.
- R. elongatum* Ehrh. ex Frisvoll – this species of the *Racomitrium canescens* group was first recognized on the Curonian Spit in open patches of a pine plantation southwards of Rybachy (leg. C. Dolnik 2001, R76, 55°08,08'N, 20°48,34'E); it is probably more common on acidic dune sands but was not distinguished from *Racomitrium canescens* s.str. before. It was frequently found also in other areas of the Kaliningrad Province (coastal dry grassland near Wsmorye, Vistula Lagoon, 54°41'31"N, 20°14'31"E, leg. C. Dolnik 1998). In Dietzow (1938) it was summarized under *Racomitrium canescens* var. *ericoides* (Web.) Brid., which is now treated as distinct species *Racomitrium ericoides* (Brid.) Brid. with a more arctic and alpine distribution and is not expected to

occur in Kaliningrad Province.

Rhizomnium punctatum (Hedw.) T.J. Kop. – very common in alder carrs.

Rhodobryum roseum (Hedw.) Limpr. – very common in alder carrs.

Rhynchoszegium megapolitanum (F. Weber & D. Mohr) Schimp. – it is a rather common species in old stages of coastal *Ammophila arenaria* dunes along the Baltic Sea coast of the Spit (Dolnik, 2003). Nevertheless without sporophytes it is easily mistaken for the very common *Sciuro-hypnum oedipodium*. The species is best recognised in late autumn when sporogones are frequently developed. Dietzow (1938) had doubts that this species occurs in the area and gave no localities. Therefore we count the records as new for the region.

R. murale (Hedw.) Schimp. – rare, on concrete of a ruin on dune Haskeberg near Müllers dune (65R).

Rhytidadelphus squarrosus (Hedw.) Warnst. – very common in forests, meadows and lawns.

R. triquetrus (Hedw.) Warnst. – common in birch forests, scattered in pine plantations.

Sanionia uncinata (Hedw.) Loeske – scattered in the ground floor vegetation of birch forests, more common as epiphyte on deciduous trees.

Schistidium crassipilum H.H. Blom – was newly described in 1996 and is recorded for the area for the first time (soil on mortar, ruin on Ephas dune near Morskoye, forest quarter 14 Rybachy, leg. C. Dolnik 2000). Common on concrete and therefore more frequent in settlements. This species is probably much more common in the region than *Schistidium apocarpum* s. str. All seen gatherings of the *S. apocarpum* complex from the Curonian spit belong to *S. crassipilum*.

Sciuro-hypnum oedipodium (Mitt.) Ignatov & Huttunen (= *Brachythecium oedipodium* (Mitt.) A. Jaeger, *B. curtum* (Lindb.) Lindb.) – very common in dry pine plantations and birch and willow stands. There are no old records from the Curonian spit, but we suggest it was not distinguished from *Brachythecium rutabulum* before. Most areas where it covers large patches were afforested during the past 120 years.

S. populeum (Hedw.) Ignatov & Huttunen (= *Brachythecium populeum* (Hedw.) Schimp.) – rare epiphyte on deciduous trees.

S. reflexum (Starke) Ignatov & Huttunen (= *Brachythecium reflexum* (Starke) Schimp.) – common epiphyte on trunk bases of deciduous trees in damp woods.

**Sphagnum affine* Renaud & Cardot (= *Sphagnum imbricatum* Hornsch. ex Russow p.p.) – only old records by H. Groß (86Z) and L. Dietzow & E. Boehm (79Z) from the raised bog Swinoje (Groß, 1914; Dietzow, 1938), not found since. Most probably it is

extinct now due to extensive melioration and burning in the past.

S. angustifolium (C.E.O. Jensen ex Russow) C.E.O. Jensen – very common in the raised bog Swinoje and surrounding birch and pine forests.

S. balticum (Russow) C.E.O. Jensen – common in the raised bog Swinoje and surrounding birch and pine forests.

S. capillifolium (Ehrh.) Hedw. – common in damp parts of birch, pine and spruce forests and in the raised bog Swinoje. Morphotypes recognized as *Sphagnum capillifolium* var. *tenerum* auct. were also recorded from the raised bog Swinoje (Dolnik 2003: 176) but they are not distinguished as separate taxon by Hill & al. (2006).

S. centrale C.E.O. Jensen – scattered in damp parts of birch (10R) and spruce forests (56R) and around the raised bog Swinoje (84Z, 88Z).

S. cuspidatum Ehrh. ex Hoffm. – common in wet depressions and ditches of the raised bog Swinoje.

S. fallax (H. Klinggr.) H. Klinggr. – common in the raised bog Swinoje and surrounding birch and pine forests and scattered in damp spruce and birch forests in other parts of the spit.

S. fimbriatum Wilson – very common in the raised bog Swinoje and surrounding birch and pine forests as well as in damp forests in other parts of the spit.

S. flexuosum Dozy & Molk. – rare in ditches of damp birch forests surrounding the raised bog Swinoje.

S. fuscum (Schimp.) H. Klinggr. – rare, only few cushions in the raised bog Swinoje; according to Groß (1914) it was much more common a hundred years ago.

S. girgensohnii Russow – common in damp birch, pine and spruce plantations as well as in the raised bog Swinoje.

S. magellanicum Brid. – common in the raised bog Swinoje and surrounding birch and pine forests, rare in damp spruce plantations.

S. molle Sull. – very rare, only one record from the raised bog Swinoje (54°57.94'N, 20°31.01'E, 83R) and probably new to the area.

S. obtusum Warnst. – very rare, only one record from the ditch in the raised bog Swinoje.

S. palustre L. – common in damp forests and the raised bog Swinoje.

S. riparium Ångstr. – rare in ditches of damp birch forests surrounding the raised bog Swinoje.

S. rubellum Wilson (incl. *S. rubellum* var. *subtile* (Russow) Amann) – common in damp places of pine, birch and spruce forests as well as in the raised bog Swinoje. *Sphagnum rubellum* var. *subtile* (Russow) Amann is not accepted by Hill & al. (2006) as distinct taxon in Europe. Therefore we mention here that plants of this morphotype have been repeatedly found in the raised bog Swinoje (Groß, 1914;

- Napreenko & Razguljajeva, 1999; Dolnik, 2003).
- S. russowii* Warnst. – common in damp places of pine, birch and spruce forests as well as in the raised bog Swinoje.
- S. squarrosus* Crome – common in damp places of pine, birch, and spruce forests and scattered in alder woods.
- **S. subnitens* Russow & Warnst. – recorded by Dietzow (1938) from the raised bog Swinoje but not found since. According to Dietzow the species was already rare in former times, and it is confirmed now for the Kaliningrad Province by Napreenko & Razguljajeva (1999).
- S. tenellum* (Brid.) Pers. ex Brid. – scattered in the raised bog Swinoje (79Z, 84Z, 85Z, 87Z) and mentioned already by Groß (1914).
- **S. teres* (Schimp.) Ångstr. – mentioned by Groß (1914) as frequent in damp birch and alder woods surrounding the raised bog Swinoje but not found since.
- **Splachnum ampullaceum* Hedw. – mentioned by Groß (1914) from the raised bog Swinoje but not found since.
- **Straminergon stramineum* (Dicks. ex Brid) Hedenäs (= *Calliergon stramineum* (Brid.) Kindb.) – recorded only by Preuß (1912) from the raised bog Swinoje and probably extinct now due to drainage and afforestation.
- Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr var. *ruraliformis* (Besch.) Delogne (= *Tortula ruraliformis* (Besch.) Ingham) – common in older dunes and dry grasslands and also epilithic on mortar and slate roofs. Most common member of the *S. ruralis* complex in the area and should be better treated at the species level.
- var. *ruralis* (= *Tortula ruralis* (Hedw.) Gärtner, Meyer & Scherb.) – fairly common in older dunes and dry grassland vegetation, also on concrete, but less common than the previous taxon.
- Syntrichia virescens* (De Not.) Ochyra (= *Tortula virescens* (De Not.) De Not.) – rare, only one record from an slate roof of a barn in Rybachy (85R), but probably more common on roofs of the settlement.
- Tetraphis pellucida* Hedw. – very common on rotten wood and humus in damp forests.
- Thuidium assimile* (Mitt.) A. Jaeger (= *Thuidium philiberti* Limpr.) – rather rare in open pine forests (13 Z) and hay meadows (85R).
- T. recognitum* (Hedw.) Lindb. – rare, one record from a *Salix repens* stand on dunes in open pine forest (C. Dolnik 2000, 13Z).
- T. tamariscinum* (Hedw.) Schimp. – scattered in damp birch and spruce forests.
- Tortula modica* R.H. Zander (= *Pottia intermedia* (Turner) Fühnr.) – rare, on loamy soil in the meadows of the Rybachy Plateau, near lake Chaika.
- T. muralis* Hedw. – common on mortar and concrete in the settlements and surrounding.
- T. truncata* (Hedw.) Mitt. (= *Pottia truncata* (Hedw.) Bruch & Schimp.) – common only on loamy soil in the meadows and ruderal places of the Rybachy Plateau.
- Ulota bruchii* Hornsch. ex Brid. – common epiphyte on deciduous trees.
- U. crispata* (Hedw.) Brid. – fairly common epiphyte on deciduous trees, but not as common as the previous species.
- **Warnstorfia fluitans* Loeske – mentioned by Groß (1914) from pine wood on peat from the raised bog Swinoje, but not found since.
- Weissia brachycarpa* (Nees & Hornsch.) Jur. – rare on silt in open gaps of the meadows southwards of Rybachy (85R).

ACKNOWLEDGEMENTS

We are grateful to Dr. Ludwig Meinunger and Wiebke Schröder (Ludwigstadt, Germany) for the confirmation of *Cephaloziella elachista*, *C. hampeana*, *Cynodontium strumiferum* and *Bryum elegans* and identification of *Amblystegium serpens* var. *juratzkanum*.

LITERATURE CITED

- BAKALIN, V.A. 2001. Notes on *Lophozia* III. Some taxonomic problems in *Lophozia* sect. *Lophozia*. – *Arctoa* **10**: 207-218.
- BENRATH, W. 1934. Untersuchungen zur Pollenstatistik und Mikrostratigraphie von Tonen und Torfen in Randgebieten des Kurischen Haffs unter Berücksichtigung methodischer Fragen. – *Dissertation Univ. Königsberg*, 124 pp.
- DIETZOW, L. 1938. Die Moose Altpreußens und ihre Standorte. – *Jahresber. Preuss. Bot. Ver., Königsberg*, 84 pp.
- DIERBEN, K. 1996. Bestimmungsschlüssel der Torfmoose in Norddeutschland. – *Mitt. Arbeitsgem. Geobot. Schleswig-Holstein Hamb.* **50**, 86 pp.
- DOLNIK, Ch. 2003. Artenzahl-Areal-Beziehungen von Wald- und Offenlandgesellschaften – Ein Beitrag zur Erfassung der botanischen Artenvielfalt unter besonderer Berücksichtigung der Flechten und Moose am Beispiel des Nationalparks Kurische Nehrung (Russland). – *Mitt. Arbeitsgem. Geobot. Schleswig-Holstein Hamb.* **62**, 183 pp.
- DOLNIK, Ch. 2006. Artenreichtum in Küstensandtrockenerasen der Kurischen Nehrung und des Samlandes auf unterschiedlichen räumlichen Skalenebenen. – *Arbeiten aus dem Institut für Landschaftsökologie Münster* **15**: 83-95.
- DÜLL, R. & L. MEINUNGER 1989. Deutschlands Moose – 1. Teil: Anthocerotae, Marchantiatae, Bryatae: Sphagnidae, Andreaeidae, Bryidae: Tetraphidales – Pottiales. – *IDH*,

- Bad Münstereifel*, 368 pp.
- FRAHM, J.-P. & W. FREY 1992. Moosflora. – 3rd. ed., *UTB Ulmer, Stuttgart*, 528 S.
- FREY, W., J.-P. FRAHM, E. FISCHER, & W. LOBIN 1995. Die Moos- und Farnpflanzen Europas. – In: *Kleine Kryptogamenflora (Gams, H., Begr.)*, 6th ed., G. Fischer, Stuttgart u.a., 426 S.
- GROLLE, R. & D.G. LONG 2000. An annotated check-list of the Hepaticae and Anthocerotae of Europe and Macronesia. – *J. Bryol.* **22**: 103-140.
- GROß, H. 1914. Zwei bemerkenswerte Moore in Königsbergs Umgebung. – *Schriften d. Physik.-ökonom. Gesellschaft Königsberg* **54**: 25-75.
- HILL, M.O., N. BELL, M.A. BRUGGEMAN-NANNENGA, M. BRUGUÉS, M.J. CANO, J. ENROTH, K.K. FLATBERG, J.-P. FRAHM, M.T. GALLEGU, R. GARILLETI, J. GUERRA, L. HENDENÄS, D.T. HOYOAK, J. HYVÖNEN, M.S. IGNATOV, F. LARA, V. MAZIMPAKA, J. MUÑOZ & L. SÖDERSTRÖM 2006. An annotated check-list of the mosses of Europe and Macaronesia. – *J. Bryol.* **28**: 198-267.
- HOLYOAK, D.T. 2004. Taxonomic notes on some European species of *Bryum* (Bryopsida: Bryoaceae). – *J. Bryol.* **26**: 247-264.
- IGNATOV, M.S. & O.M. AFONINA 1992. Check-list of mosses of the former USSR. – *Arctoa* **1**: 1-85.
- [IGNATOV, M.S. & E.A. IGNATOVA] ИГНАТОВ М.С., Е.А. ИГНАТОВА 2003-2004. Флора мхов средней части европейской России. Т. 1-2. – [Moss flora of the Middle European Russia. Vols. 1-2] *М., КМК [Moscow, KMK]*: **1** (2003): 1-608; **2** (2004): 609-960.
- KOPPE, K. & H. STEFFEN 1927. Beiträge zu einer Moosflora Ostpreußens. – *Bot. Archiv* **19**: 136-162.
- [MELNICHUK, V. M.] МЕЛЬНИЧУК, В.М. 1970. Определитель листовных мхов средней полосы и юга европейской части СССР. – [Handbook of mosses of middle and south parts of European USSR] *Киев, Наукова Думка [Kiev, Naukova Dumka]*, 444 с.
- МОТИЕJŪNAITĖ, J., A. NORDIN, A. ZALEWSKA, T. BJELAND, H. HEDENES, M. WESTBERG, S. HEIDMARSSON & I. PRIGODINA 1998. Materials on lichens and allied fungi of Neringa National Park (Lithuania) – *Botanica Lithuanica* **4**: 285-305.
- [NAPREENKO, M.G. & L.V. RAZGULAJEVA] НАПРЕЕНКО, М.Г., Л.В. РАЗГУЛЯЕВА. 1999. Сфагновые мхи Калининградской области. – [Sphagna of Kaliningrad Province (European Russia)] *Arctoa* **8**: 27-34.
- NEBEL, M. & G. PHILIPPI (Hrsg.) 2000, 2001. Die Moose Baden-Württembergs. – Vol. 1, 512 pp., Vol. 2, 529 pp., *Ulmer, Stuttgart*.
- NYHOLM, E. 1986, 1989, 1993, 1998. Illustrated Flora of Nordic Mosses. – *Fasc. 1-4, Nordic Bryological Soc., Copenhagen, Lund*.
- PATON, J.A. 1999. The Liverwort Flora of the British Isles. – *Harley Books, Colchester*, 626 pp.
- PAUL, K.H. 1944. Morphologie und Vegetation der Kurischen Nehrung, I. Gestaltung der Bodenformen in ihrer Abhängigkeit von der Pflanzendecke. – *Nova Acta Leopoldina, Neue Folge* **13**: 217-378.
- PAUL, K.H. 1953. Morphologie und Vegetation der Kurischen Nehrung, II. Entwicklung der Pflanzendecke von der Besiedlung des Flugsandes bis zum Wald. – *Nova Acta Leopoldina, Neue Folge* **16**: 261-378.
- [POTEMKIN, A. D.] ПОТЕМКИН А. Д. 1998. Об *Odontoschisma sphagni* (Dicks.) Dum. (Hepaticae, Cephaloziaceae) в России, с ключом и обсуждением отличий российских видов *Odontoschisma*. – [On *Odontoschisma sphagni* (Dicks.) Dum. (Hepaticae, Cephaloziaceae) in Russia, with the key and consideration of differentiation of the Russian species of *Odontoschisma*] *Arctoa* **7**: 197-202.
- PREUß, H. 1912. Die Vegetationsverhältnisse der deutschen Ostseeküste. – *Schr. d. Naturforschenden Ges. Danzig, Neue Folge* **13**: 45-257.
- RAZGULYAEVA, L.V., M.G. NAPREENKO, Ch. WOLFRAM & M.S. IGNATOV 2001. *Campylopus introflexus* (Dicranaceae, Musci) – an addition to the moss Flora of Russia. – *Arctoa* **10**: 185-188.
- САВИЧ-ЛЮБИЦКАЯ, Л. И., З. Н. СМИРНОВА [SAVICZ-LJUBITSKAYA, L. I. & Z. N. SMIRNOVA] 1968. Определитель сфагновых мхов СССР. – [Handbook of Sphagna of the USSR] *Л., Наука [Leningrad, Nauka]*, 112 pp.
- [SAVICZ-LYUBITSKAYA, L.I. & Z.N. SMIRNOVA] САВИЧ-ЛЮБИЦКАЯ Л.И., З.Н. СМИРНОВА 1970. Определитель листостебельных мхов СССР. Верхоплодные мхи. – [Handbook of mosses of the USSR. The acrocarpous mosses] *Л., Наука [Leningrad, Nauka]*, 822 pp.
- SCHUMACKER, R. & Ph. MARTINY 1995. Red data book of European bryophytes Part 2: Threatened bryophytes in Europe including Macronesia. – In: *European Committee for Conservation of bryophytes (ed.)*, *Red data book of European bryophytes, ECCB, Trondheim*: 28-193.
- SMITH, A.J.E. 1978. The Moss Flora of Britain and Ireland. – *Cambridge Univ. Press, Cambridge*, 706 pp.
- STEFFEN, H. 1931. Vegetationskunde von Ostpreussen. – *Pflanzensoziologie* **1**, 406 pp.
- WIGH, K. 1976. Scandinavian species of the genus *Brachythecium* (Bryophyta), II. Morphology, taxonomy and cytology in the *B. rutabulum* – *B. rivulare* complex. – *Bot. Notiser* **128**: 476-496.
- ZOLOTOV, V. I. 2000. The genus *Bryum* (Bryaceae, Musci) in Middle European Russia. – *Arctoa* **9**: 155-232.