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MOSSES IN GREENHOUSE OF TSITSIN MAIN BOTANICAL GARDEN IN MOSCOW

МХИ В ОРАНЖЕРЕЕ ГЛАВНОГО БОТАНИЧЕСКОГО САДА В МОСКВЕ

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Abstract

Mosses in the greenhouse of the Tsitsin Main Botanical Garden in Moscow are represented by 25 species, two of them being identified only up to the genus level. Most of them belong to the local flora and likely penetrated into the greenhouse by spores through windows or with soil. Species from the local moss flora occur mainly in compartments with subtropical climate. The most widespread are *Amblystegium serpens, Leptodictyum riparium* and *Leptobryum pyriforme*. Among four exotic species occurring in the greenhouse, two are common aquarium species, *Taxiphyllum barbieri* and *Vesicularia dubyana*. *Barbula consanguinea* was found in bonsai pots, while *Fissidens dissitifolius* has recently spread over soil and concrete floor in tropical and subtropical parts of the greenhouse. Specific geliotropism of the latter species is briefly discussed.

Резюме

Изучен видовой состав и особенности произрастания мхов в оранжерее Главного ботанического сада им. Н.В.Цицина Российской академии наук в Москве. Выявлено 25 видов, из которых 2 определены только до рода. Большинство видов являются общими с видами флоры Московской области и, очевидно, проникают в оранжерею в виде спор при проветривании или с землей. Местные виды более многочисленны в отделениях с субтропическим, нежели тропическим климатом. Наиболее массово встречаются *Amblystegium serpens, Leptodictyum riparium* и *Leptobryum pyriforme*. В оранжерее растут четыре вида из тропических областей: два известных аквариумных мха, *Taxiphyllum barbieri* и *Vesicularia dubyana*, и два наземных: *Barbula consanguinea* найден в горшке одного из бонсаев, а неотропический *Fissidens dissitifolius* широко расселился на почве под высокими деревьями и на цементном полу. Кратко обсуждается специфический гелиотропизм последнего вида.

KEYWORDS: bryophytes, *Fissidens,* geliotropism, greenhouse, plant introduction

INTRODUCTION

The new greenhouse in the Tsitsin Main Botanical Garden of Russian Academy of Sciences is nearing completion so far, and its collection is going to develop in conditions quite different from those of the old greenhouse. In view of great reconstruction of the old greenhouse which has partly already started in some of its compartments, we decided to make an inventory of mosses growing there in 2012.

The greenhouse was constructed in 1948-52, and since 1959 has been open to public. It includes five bigger compartments for public exhibition and 14 smaller "special collection sections", 5000 m^2 in total, areas of section is shown in Fig. 1. Special collection sections have many shelves densely covered by pots with mostly young plants, used for experiments and supplying the public exhibition areas. Shelves have concrete surface, as well as the floor.

All compartments are divided into two groups according to their climate. In tropical compartments, winter temperature is kept at 18° to 20°C, while in subtropical sections it is lower, from 6° to 18°C. In summer time, the temperature raises to 25-30(-33)°C in both climates, following outdoor temperature.

For watering in the old greenhouse, the general Moscow water supply system is used. Having an overall limestone background in the areas near Moscow, water is somewhat richer in calcium than it is desired for tropical plants. Therefore, time by time procedures of acidification are undertaken by adding soil from the pine forest situated in immediate proximity to the greenhouse. This practice explains the presence of a number of moss species in subtropical and, to a lesser extent, in tropical compartments.

Gardeners in the greenhouse ordinarily remove mosses which appear in pots, although in some cases they consider them as rather useful helpers in keeping moisture in large pots; this is especially the case for *Amblystegium serpens*, which was retained and spread in some compartments. Some reduction of soil pH is especially useful for the Ericaceae s.l., where *Amblystegium* is commonly retained in pots (*e.g.* in Fig. 1).

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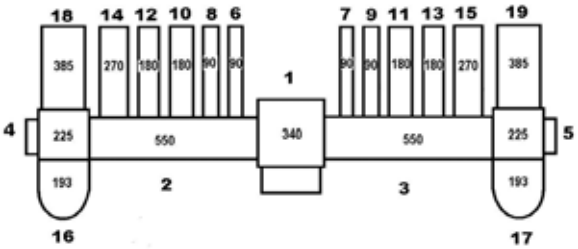


Fig. 1 The scheme of greenhouse with numbers of compartments and their area (written within, in m^2).

Table 1. List of moss species in greenhouse, distribution is given by tropical/subtropocal compartments. The contents of compartments is as follow:

Public exibitions: 1 – tropics of the Old World, 2 – dry subtropics, 3 – subtropics, especially Cycadales, 4 – tropics of the New World, 5 – humid subtropics.

Special collection compartments: 6,8 – sub-tropical orchids, 7 – nursery for subtropical flora of South Africa and the collection of bulbs, 9 – nursery of various tropical plants, 10,12 – tropical orchids, 11 – Araceae, 13 – ferns, 14, 16 – Bromeliaceae, 15 – Cactaceae, 17 – previously tropical water plants, mostly relocated to new green house and awaiting reconstruction; 18 – Azaleas (*Rhododendron*) and bonsai collections, 19 – Begoniaceae, Piperaceae, Acanthaceae and some other tropical herbaceous plants.

Species	Tropical compartments ##1,4,9-13,16,17,19	Subtropical compartments ##2,3,5-8,14-15, 18
Amblystegium serpens (Hedw.) Bruch et al.	4, 12, 17, 19	2, 3, 5, 18
Barbula convoluta Hedw.	4, 12	14
Barbula consanguinea (Thwaites & Mitt.) Hilp.		14
Barbula unguiculata Hedw.		2
Bryum argenteum Hedw.		7
Bryum capillare Hedw.	12, 17	2
Bryum pseudotriquetrum (Hedw.) P.Gaertn., B.Mey. & Scherb.		18
Bryum sp. (narrow leaved one)	12	
Callicladium haldanianum (Grev.) H.A.Crum		2
Ceratodon purpureus (Hedw.) Brid.		2
Didymodon rigidulus Hedw.		2, 14
Didymodon sp.		3
Fissidens taxifolius Hedw.	4	3, 14, 18
Fissidens dissitifolius Sull.	1, 17	3
Funaria hygrometrica Hedw.		6, 7
Leptobryum pyriforme (Hedw.)Wilson	4, 9, 12, 17	2, 6, 7, 14
Leptodictyum riparium (Hedw.) Warnst.	1, 4, 9, 12, 19	2, 3, 6, 18
Oxyrrhynchium hians (Hedw.) Loeske	4	2, 3
Philonotis cf. *falcata* (Hook.) Mitt.		18
Physcomitrium pyriforme (Hedw.) Hampe		7
Pohlia nutans (Hedw.) Lindb.	9	
Pohlia wahlenbergii (F.Weber & D.Mohr) A.L.Andrews		7, 18
Sciuro-hypnum curtum (Lindb.) Ignatov		2
Taxiphyllum barbieri (Cardot & Copp.) Z. Iwats.		5
Vesicularia dubiana (Müll. Hal.) Broth.		7

SPECIES LIST

Our inventory revealed 25 species, summarized in Table 1.This diversity is rather low, comparatively with, *e.g.*, the greenhouse in Bonn, where Frahm & Ho (2009) listed 61 moss species. In our greenhouse 2 species remain unidentified, being representatives of taxonomically difficult groups of *Bryum* and *Didymodon*.

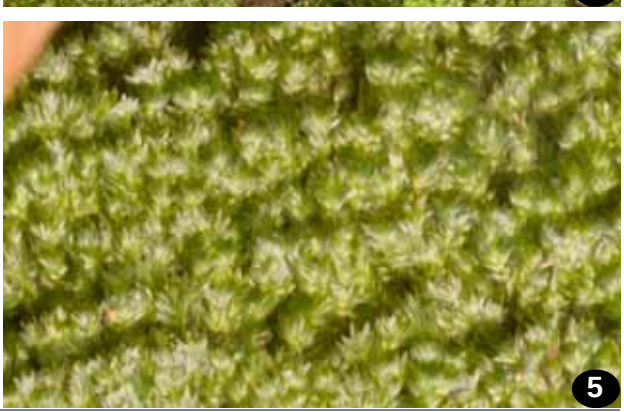
Among mosses identified to species level, there are a number of species widespread in Middle European Russia and Moscow Province, and almost all of them are rather common in the park area of the Tsitsin Main Botanical Garden: *Fissidens taxifolius, Bryum argenteum, B. capillare, Ceratodon purpureus*, *Oxyrrhynchium hians, etc*. *Barbula convoluta* is an exception, being rather rare in Moscow Province as a whole, and being absent in the territory of the Main Botanical Garden (Ignatov & Ignatova, 1986). However, in recent decades it increased occurrence in Moscow Province, thus this species is quite likely of local origin as well.

Only four exotic species were found in the greenhouse. Two of them are aquatic, *Vesicularia dubiana* and *Taxiphyllum barbieri*, a widespread mosses from aquaria, which had earlier grown rather abundantly in the tropical aquatic plant compartment (#17), before it was abandoned. At the moment, *Taxiphyllum barbieri* occurs in a small pool of comparment 5 (Fig. 3), while *Vesicularia* grows in a very wet pot with fern (compartment 7).

Two terrestrial species are less expected and need some discussion.

Barbula consanguinea was collected in one pot with bonsai, which often have abundant *Amblystegium serpens* and *Barbula convoluta* mats/tufts in their pots. *B. consanguinea* is known, among others, on the Japanese Archipelago, where at least some bonsai kept in the greenhouse are from.

Fissidens dissitifolius, a neotropical species, is known from Mexico and Central America (Pursell, 1994a,b) to Argentina (http://www.tropicos.org/Name/35180783?tab



Figs. 1-5. Mosses in the greenhouse. #1: *Amblystegium serpens* in the pot under *Rhododendron*). #2 – base of *Phoenix sylvestris*, with *Sciuro-hypnum curtum, Callicaldium haldanianum* and *Amblystegium serpens* (compartment 2); #3: *Taxiphyllum barbieri* inside a pool and on rocks and sticks at its bank (compartment 4); #4: *Fissidens dissitifolius* under *Caryota* palm and high tropical trees in compartment 1: note a vawy growth of plants and uniform direction of shoots (see discussion in text); #5: *Fissidens dissitifolius*, close up from #4.

=specimens). It was found in a rather great quantity in the main tropical exposition area, as well as in some others.

As this species has not been reported from other greenhouses in the world, we provide its illustrations (Figs. 4-6).

Of interest is a regular arrangement of shoots of *Fissidens*: all turn in one direction to the north. We assume that this exposes leaves perpendicular to sun light, so the negative geotropism results in this case in a maximal light supply.

Discussion

Summing up, exotic mosses are very few in the Tsitsin Botanical Garden greenhouse. There are probably several reasons for that, including (1) rather few expeditions bringing living plants, and acquisition of new plants mostly via seeds; (2) strict quarantine of living plants brought from tropical areas, with ca. 1 year keeping in a separate quarantine greenhouse; (3) gardening practice of removing "weedy mosses"; and (4) absence of special efforts for cultivating bryophytes in this greenhouse.

In the last decade, the first author made several attempts of moss introduction, but they were all unsuccessful, despite the most wet, orchid and fern, compartments were used for this cultivation. Both temperate species (*Leucodon, Neckera, Isothecium, Pylaisia*), and epiphytic mosses from Singapore (*Syrrhopodon, Calymperes, Isopterygium minutirameum* (Müll. Hal.) A. Jaeger), or Malaisia

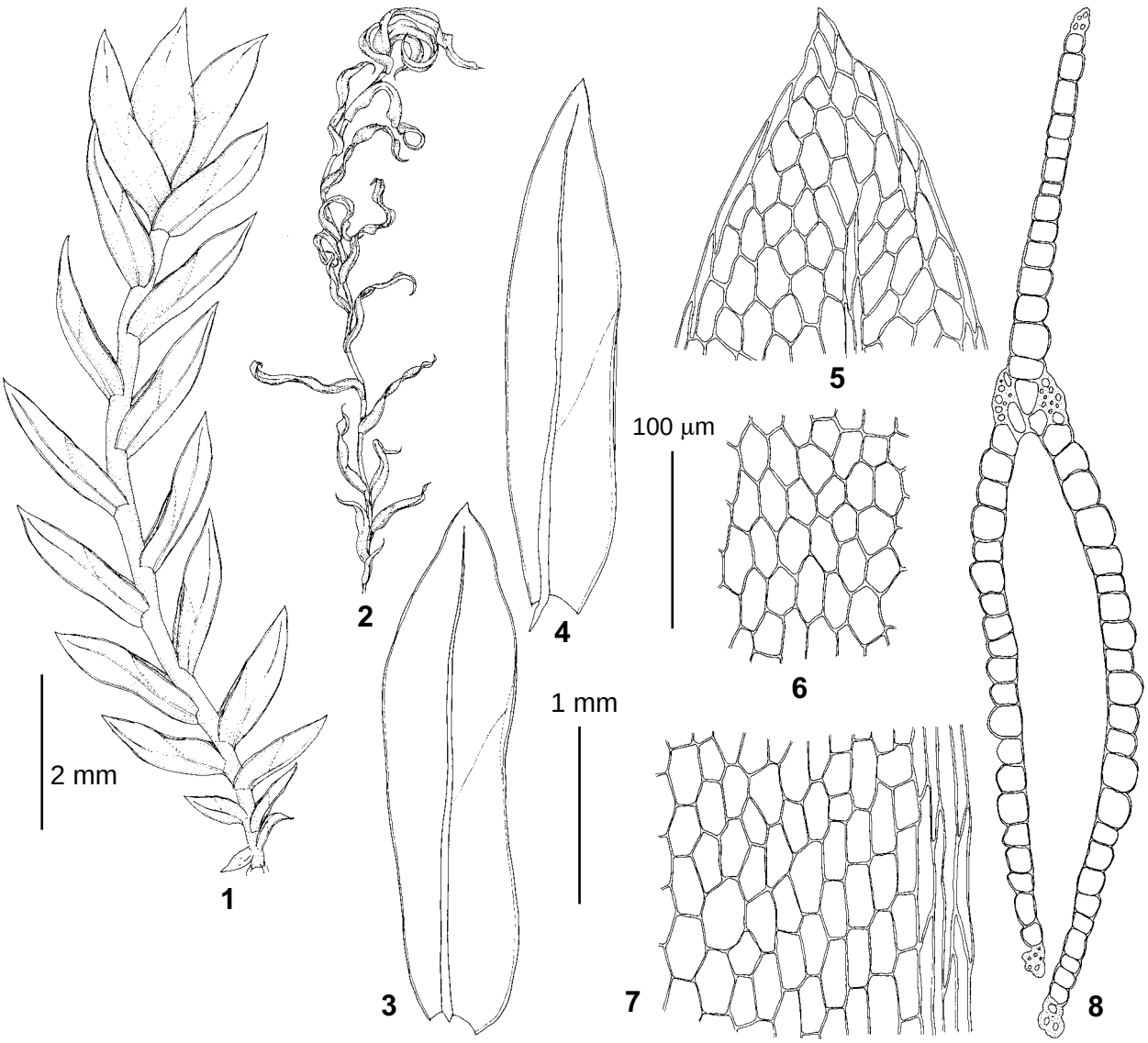


Fig. 6. *Fissidens dissitifolius* (Müll. Hal.) A. Jaeger (from compartment #1): 1 – habit, wet; 2 – habit, dry; 3-4 – leaves; 5 – cells of leaf apical part; 6 – cells of ventral lamina; 7 – cells of vaginant lamina; 8 – leaf transverse section at proximal 1/3 of leaf. Scale bars: 2 mm for 1-2; 1 mm for 3-4; 100 μm for 5-8.

(*Meteorium, Barbella, Trismegistia, Acroporium,* etc.) gave no positive results, probably because of comparatively long dry periods in the greenhouse.

Local mosses (Table 1) are more abundant and more diverse in subtropical climatic conditions than in tropical ones; however, three species, *Amblystegium serpens, Leptodictyum riparium* and *Leptobryum pyriforme,* are the most common and widespread, surviving in any climatic regimes of the greenhouse.

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