

Substrate Groups of Bryophytes of Karatepa Mountains (Uzbekistan)

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Abstract: On soil (epigey) surface of Karatepa mountains 20 species of the mosses from 12 genera and 8 families were recorded during research work. On the bark of alive trees (epiphyte) 10 moss species from 6 genera and 5 families were registered. On decayed wood (epilith) it was registered 7 species of moss species from 4 genera and 3 families. On stone (epilith) substrates of the Karatepa mountains 23 species of the mosses from 13 genera and 10 families were registered. According to research results it was found out that all type of bryoflora are distributed on four substrate ecological groups: hydrophytes, hygrophytes, mesophytes, xerophytes.

Keywords: moss species, substrate types, bryophytes, diversity

1. Introduction

Mosses possess wide ecological plasticity that allows them to grow in territories of any latitudes and in various habitats. Certain roles in some vegetation groups should be related to the share of the mosses occurring in stream water, at exits of fount, along the streams, in a forest belt of mountains in dry slopes, on parent materials of rocks and other environmental factors [2]. Many moss species occur only in certain coenoses. However, the same species of bryophytes in vegetation community can occupy various types of substrates, and with another - within different communities there can be the ecotypes similar on temperature, illumination, nature of moistening, to richness of the soil and having similar structure of bryophytes. All these facts make very complicated studying the ecological features of bryophytes distribution [7].

The purpose of our researches is the distribution analysis of the bryophytes on types of substrates on territories of the Karatepa Mountains and comparison of the substrate groups with each other.

2. Material and Methods

Collection processing of the mosses, collected by the author during 2011-2017 formed a basis for carrying out the ecological analysis. In total it is processed about 300 herbaria samples. All samples are stored in the Herbarium of the Samarkand State University. The volume of genera and families of liverworts is given according to U.K. Mamatkulov [6] of Bryopsida (leaf stalks mosses) - according to M. S. Ignatov, E.A. Ignatova [5].

According to A.P. Dyachenko [3], the substratum is uniform in physical and chemical properties and uncertain in the morphological and dimensional relation the mass of monolithic or more or less fine substance. It is possible to allocate four types of a substratum on which the mosses settle for territories of the Samarkand region: soil, bark of alive trees, decayed wood, stones. According to types of substrata, four substrate groups of bryophytes are allocated: above of soil (or epigay), epixyle, epiphyte and epilyte.

3. Discussion and Results

During researches on the soil (epigay) of the Samarkand region had registered 20 species of the mosses from 12 genera and 8 families that makes more than 40% of the general area bryoflora. From 8 families noted on a above soil cover of region (tab. 1), the greatest variety are possesses *Pottiaceae* (on 4 species), *Dicranaceae*, *Bryaceae* (3), *Brachytheciaceae*, *Meesiaceae* (on 2 species), *Polytrichaceae*, *Mniaceae*, *Funariaceae* (on 1specie). Big participation of *Pottiaceae* and *Orthotrichaceae* families in addition of above soil bryoflora reflects considerable moistening and marshiness of soils of region. The most multispecific genera (tab. 2) are *Tortula* (4), *Bryum*, *Barbula* (on 3 species), *Distichium*, *Dicranum* (on 2 species), *Brachythecium*, *Dicranella* (on 1specie).

The originality of above soil bryoflora of Karatepa Mountains was shown first of all in more active role of families *Pottiaceae*, *Bryaceae* *Meesiaceae* *Dicranaceae*, and *Mniaceae* and such genera, as *Bryum*, *Brachythecium* and, *Dicranella*. The high provision of the sorts *Tortula* and *Bryum* point not only to high moisture content of soils, but also to considerable degree of disturbances of a soil cover.

Above soil bryoflora play a significant role in various types of the woods and inundated meadows. For example, in riparian inundated forests above soil cover forming by such known dominants, as *Tortula obtusifolia* Schleich., *Fissidens grandifrons* (Brid.) Limpr., *Polytrichum juniperinum* Willd., *Dicranum brevifolium* Lindb. Many bryophytes the first appear on the broken sites and form pioneer communities (*Funaria hygrometrica* Hedw., *Bryum caespitium* Hedw., *B. argenteum* Hedw., etc.).

The role of the epigay bryophytes is considerable. So, according to L.V. Bardunov [1], the moss cover in the forest reduces scope and speed of fluctuations of temperature, humidity, illumination and, thus, conditions for germination of seeds, and also for growth of young plants improve.

The general projective cover of the above soil bryophytes averages about 30-50%, is more rare in the tygai forests, the general projective cover reaches 50-60%. The majority of the epigay bryophytes is coincide with mesohygrophyte

Volume 7 Issue 3, March 2018

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conditions. Quite often above soil mosses settle in the basis of trunks of trees. The similar behavior of the above soil bryophytes is explained by humus accumulation at the basis of trunks and acting roots, and also trampling of sites of the forests.

On decayed (epsilsil) wood in Karatepa Mountains had registered 7 types of the mosses from 4 genera and 3 families. From 3 families noted on decayed wood, the greatest variety *Bryaceae* (3), *Amblystegiaceae*, *Brachytheciaceae* (on 3 look), *Dicranaceae* (2), *Mniaceae* (1) possess. The most multi specific genera are *Bryum* (3), *Brachythecium* (3).

Bryophyte of decayed wood are best of all presented in the tygai forests. Obligate episcyls are *Mnium cuspidatum* (L.) Leyss., *Brachythecium salebrosum* (Hoffm.) Br., *B. velutinum* (Hedw.) Schimp. and *Dicranum elongatum* Schleich. ex Schwaegr. Other types meet and on other substrata. Their settlement significantly depends on conditions of environment, type of vegetation, humidity of air, shading, etc.

The specific structure can be changed depending on extent of decomposition of wood. At an initial stage of decomposition of wood here continue to grow mosses-epiphytes and the types meeting on cloddy part of trunks of trees *Dicranum brevifolium* Lindb., *D. muehlenbeckii* Bruch et Schimp., an also enough often are present *Tortula muralis* Hedw., *Brachythecium salebrosum* (Hoffm.) Br. and other types. In process of further decomposition of wood there is its settling by usual mosses of an above soil cover - *Dicranum elongatum* Schleich. ex Schwaegr., *Hygrohypnum luridum* (Hedw.) Jenn., *Pleurozium schreberi* (Brid.) Mitt., etc. With the greatest variety of types bryophytes differs average decomposition wood. Very usual moss on brushwood is *Brachythecium albicans* (Hedw.). The abundance of dead organic substance gives originality to ecological features of a convict and therefore bryophytes of decaying wood appears some lines of the saprophyte organisms.

Epiphytes bryophytes have some features allowing them to catch atmospheric moisture and a sunlight. So, for catching of atmospheric moisture to the epiphytes employed following: pinnate cladous stalks with plentiful rhizoids, as at *Seligeria pusilla* (Hedw.) Bruch et Schimp., *Pseudoleskeella papillosa* (Lindb.) Kindb.; wavy or folded leaves with turn off edges (*Isothecium alopecuroides* (Lam. ex Dubois) Isov., *Callialaria curvicaulis* (Juz.) Ochyra); papillose cells, amentaceous and reniform leaf-bearing shoots (*Orthotrichum cupulatum* Brid.).

On bark of live trees in the Karatepa mountains had registered the 10 species of the mosses from 6 genera and 5 families. From 5 families of the epiphyte mosses the greatest variety possess *Bryaceae*, *Dicranaceae* (on 3 species), *Brachytheciaceae*, *Mniaceae* (on 2 species). The most multispecific genera are *Bryum*, *Brachythecium*, *Dicranum*.

Epiphytes prefer to settle on deciduous breeds of trees, such as an ailanthus (*Ailanthus*), a poplar (*Populus*), and some other. Thus epiphyte mosses form the rugs (sinuziya) which

are usually consisting from 3-6 (is more rare 10) species of the mosses. On tygai breeds, such as willow (*Salix*) sucker (*Elaeagnus L.*) epiphyte mosses settle less often. In most cases they form small groups on acting roots, in the basis of a trunk and seldom higher than 60 cm rise. Such "limitation" of the settlement can be explained with features of bark: where bark smooth, not desquamate - characteristically more development of moss sinuziya.

For a walnut (*Juglans L.*) *Seligeria pusilla* (Hedw.), *Orthotrichum anomalum* Hedw., *Dicranellasubulata* (Hedw.) Schimp., *Cratoneurum glaucum* (Lam.) Broth. are especially characteristic. Here meet typical episcyls (*Dicranum elongatum* Schleich. ex Schwaegr.), and various on specific structure the above soil mosses.

For an ailanthus are characteristic: *Dicranum elongatum* Schleich. ex Schwaegr., *D. brevifolium* Lindb., *Cratoneurum glaucum* (Lam.) Broth., *Orthotrichum anomalum* Hedw. and in impurity are frequent *Anisothecium varium* (Hedw.) Mitt. On a poplar it is possible to meet: *Seligeria pusilla* (Hedw.), *Cratoneurum glaucum* (Lam.) Broth., *Brachythecium* (Hedw.) Schimp.; on an apple-tree - *Funaria hygrometrica* Hedw.; on a willow - *Mnium cuspidatum* (L.) Leyss., *Cratoneurum glaucum* (Lam.) Broth.

Also for coniferous breeds is inherent joint growth of the epiphyte and above soil mosses. On the sucker are frequent: *Bryum caespiticum* Hedw., *Isothecium alopecuroides* (Lam. ex Dubois) Isov.

Thus, from the description of specific structure of the epiphyte bryophytes it is visible that to a strict coincides to certain tree species among them it isn't established though a certain inclination of a number of mosses to some tree species is noted (*Orthotrichum anomalum* Hedw., *Dicranum elongatum* Schleich. ex Schwaegr.).

On height of growth it is possible to allocate 2 groups of the epiphyte mosses: 1) cloddy epiphytes, 2) own epiphytes. The border of division is determined in the winter by the average height of snow cover, and in the summer - height of a raising of moisture by a trunk. Above this border (higher than 60 cm) grow own epiphytes.

Cloddy epiphytes grow at the height from 0 to 60 cm. Different species of the sort *Brachythecium plumosum* (Hedw.), *Anisothecium varium* (Hedw.) Mitt., As impurity to them mosses of an above soil cover meet: *Pleurozium schreberi* (Brid.) Mitt., *Hygrohypnum luridum* (Hedw.) Jenn.. Above them usually replace obligate epiphytes: *Dicranella subulata* (Hedw.) Schimp., *Orthotrichum crenulatum* Mitt.

Epiphyte bryophytes settle on stony substrata. On stony substrata of the Samarkand region 23 species of the mosses from 13 genera and 10 families are registered. The greatest variety possess *Brachytheciaceae* families (on 3 species), *Amblystegiaceae* (2), *Bryaceae*, *Pottiaceae* (on 2 species). The most multispecific genera are *Bryum* (on 6 species) and *Brachythecium* (4). High position of *Pottiaceae* family reflects specificity of ecology of his representatives.

Obligate epiphytes presented only by 3 species (*Grimmia laevigata* (Brid.) Brid., *Schistidium apocarpum* (Hedw.) Bruch et Schimp., *S. Pulvinatum* Hedw.). Other species of bryophytes met by us on stones, settle on the broken soil (*Barbula unguiculata* (Huds.)Hedw., *Bryum pseudotriquetrum* (Hedw.) Gaertn.) or on trunks of trees (*Bryum caespiticum* Hedw., *Orthotrichum cupulatum* Brid.).

Table 1: Families of mosses that leaders on number of species on different types of substrata of Karatepa Mountains

Families	Types of substrate			
	1	2	3	4
<i>Pottiaceae</i>	6±0.03	-	-	3±0.015
<i>Bryaceae</i>	4±0.02	2±0.01	3±0.015	4±0.02
<i>Orthotrichaceae</i>	2±0.01	-	-	2±0.01
<i>Dicranaceae</i>	-	3±0.015	2±0.01	-
<i>Mniaceae</i>	-	-	2±0.01	3±0.015
<i>Amblystegiaceae</i>	-	1±0.005	-	2±0.01
<i>Brachytheciaceae</i>	-	-	2±0.01	4±0.02
<i>Polytrichaceae</i>	1±0.05	-	-	3±0.015
<i>Grimmiaceae</i>	2±0.01	-	-	4±0.02
<i>Funariaceae</i>	1±0.05	-	-	-
<i>Encalyptaceae</i>	-	-	-	3±0.015
<i>Fissidentaceae</i>	-	-	-	2±0.01
<i>Lembophyllaceae</i>	-	1±0.05	-	1±0.05
<i>Hylocomiaceae</i>	1±0.05	-	-	1±0.05

Note. 1 – The soil (epigey), 2–desayed wood (epsilsil), 3–bark of alive trees (epiphide) 4–stones (epilit)

The charred soil quickly enough grows by bryophytes, especially in the conditions of sufficient moistening. So the soil on which made fire during the whole summer, the next year in the spring was completely covered with *Funaria hygrometrica* Hedw. with sporogones.

On the basis of the results received at studying of the substrate groups of the mosses of the Samarkand region, we carried out comparison of the substrate groups considered for the purpose of detection of their characteristics. Position of leading families in a bryoflora of the epigey briophytes significantly differ from those in the bryoflora of others of the substrate groups (tab.1). So, leading positions among the above soil of the mosses are taken by representatives of *Mniaceae* and *Brachytheciaceae* families.

Table 2: Conducting on number of genera types of the mosses on different types of substrate of Karatepa Mountains

Genera	Type of substrate			
	1	2	3	4
<i>Tortula</i>	4	1	-	3
<i>Bryum</i>	3	-	1	4
<i>Pohlia</i>	1	2	-	-
<i>Brachythecium</i>	3	2	-	3
<i>Dicranum</i>	1	-	2	1
<i>Barbula</i>	3	-	-	3
<i>Cratoneurum</i>	-	1	1	2
<i>Pleurozium</i>	1	-	-	1
<i>Isothecium</i>	1	-	2	-
<i>Grimmia</i>	1	-	-	3
<i>Schistidium</i>	-	-	1	3
<i>Mnium</i>	2	-	-	1
<i>Fissidens</i>	2	-	-	2
<i>Funaria</i>	1	1	-	-

<i>Hygrohypnum</i>	1	1	-	-
<i>Seligeria</i>	-	1	1	-

Note. 1 – The soil (epigey), 2–desayed wood (epsilsil), 3–bark of alive trees (epiphide) 4–stones (epilit)

The role of *Mniaceae* family in other substrate groups decreases to 5-7 places. And, on the contrary, the role of *Brachytheciaceae* family - to 1-2 places increases. Also leading families of other substrate groups are among families *Amblystegiaceae*, *Bryaceae*, *Dicranaceae*. Among leading families of the epiphyte bryophytes is marked out increase of a role of the *Grimmiaceae* family which representatives are only obligate epilytes in a bryoflora of the Samarkand region.

Table 3: Distribution of the bryophyte species of various types of substrate on ecological groups

Ecological groups	Types of substrates							
	1		2		3		4	
	A	Б	A	Б	A	Б	A	Б
Hydrophytes	6	10,34	3	16,6	2	15,4	4	20
Hygrophytes	8	13,79	4	22,2	3	23,1	5	25
Mesophytes	30	51,72	8	44,4	5	38,5	7	35
Xerophytes	14	24,13	3	16,6	3	23,1	4	20

Note. 1 soils, 2–decayed wood, 3 bark of alive trees, 4 stones. And - number of types, B - %.

The provision of leading genera for different substrate groups is variously (see tab. 2). So, leading positions in a bryoflora of the epigey mosses are taken by *Tortula* (4 species), *Bryum*, *Barbula* (on 3 species), *Dicranum* (2 species) genera. In the bryoflora of other substrate groups the leading role keeps only the genera *Bryum*.

Distribution of bryophyte species of various types of substrata on ecological groups is presented on (table 3). Thus in a bryoflora of the above soil bryophytes had noted the bigger quantity of hygrophytes in comparison with mesophytes. And, on the contrary, in the bryoflora of epicycles, epiphytes and epilytes the mesophyte bryoflora are presented better. Also among the epilyte bryophytes quite big percent the species of xerophytes.

4. Conclusions

Thus, all species of bryoflora of the Samarkand region are distributed on four substrate groups. Distribution of species of the mosses on substrata characterizes the bryoflora of region as mainly epilyte. The characteristic the substrate groups becomes complicated rather wide ecological valence of the mosses. Many species choose for the settlement not one substratum, but several. Stenotype species most often happen rare in a region bryoflora. However, despite the general for the substrate groups species, groups considerably differ from each other on taxonomical indicators, and also on the relation of types to water, light factors.

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