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INVESTIGATION OF THE BRYOFLORA OF SOME STREAMS IN GREECE

B. PAPP

Dept. Botany, Hungarian Natural History Museum
H–1476 Budapest, Pf. 222, Hungary

Five liverwort and 36 moss species were collected from 4 Greek streams. Out of these 9 are new to certain regions, rare in Greece or otherwise interesting. On the basis of floristical comparison and characterisation Mt Pilion seems to be a very interesting area, the bryophyte flora of its stream has similarity with that of certain Hungarian streams. This area is worthy of further investigations.

Key words: bryophytes, Greece, streams

INTRODUCTION

Greece is a bryologically scarcely explored area. The first comprehensive list was published at the beginning of this century by COPPEY (1907, 1909). The bryological part of the "Flora Aegea" (BAUMGARTNER 1943) is the first extended work on the bryoflora of the Aegean islands. With respect to bryological explorations, much more attention was paid to the popular tourist areas as the Ionian and Aegean islands, Crete and Mt Olympos. Among these Crete is the most extensively explored area from bryological point of view. A monograph is available on the bryophyte flora and vegetation of Corfu (HARARAS 1976).

Recently a complete check-list of Greek mosses and liverworts was published by PRESTON (1981, 1984*a*, *b*) and a comprehensive publication including several new records from Greece by DÜLL (1995).

In the course of our collecting trip the bryophyte flora of four Greek streams were studied in July 1992. The streams are situated in different parts of Greece and at different altitudes. Three of them are located in bryologically almost unknown areas (Parga, Mirtia, Mt Pilion). From Mt Pilion 21 species were published by COPPEY (1907). The fourth stream is found in Mt Olympos, which is a bryologically well-known mountain of Greece.

Following the evaluation of the collections in these sites in Greece, a floristical comparison was made with the bryophyte flora of some Hungarian streams: Apátkút Valley (Visegrád Mts – siliceous area), Jósva and Telekes Valley (Aggtelek karst – calcareous area), Pécsely Stream (Transdanubian Range – calcareous area) and some Mediterranean streams in Spain as well: upper part of Ter (Ter1) and Muga (Pyrenees Mts – siliceous area), lower part of Ter (Ter2) and

Fluvi (Pyrenees Mts – calcareous area), Urdón (Cordillera Cantabrica Mts – calcareous area) (for the Spanish data see PENUELAS 1984, PENUELAS and CATALAN 1983, PENUELAS and SABATER 1987, and FUERTES LASALA and MARTINEZ-CONDE 1988).

METHODS

Mosses were collected from the stones of streams in July of 1992. For the analysis of florae life strategy (DURING 1979, ORBÁN 1984) and European distribution character (DÜLL 1983, 1984, 1985) patterns were used. Hierarchical cluster analysis (Jaccard coefficient and UPGMA) was used for the comparison of florae (SYNTAX III program package, PODANI 1988).

THE INVESTIGATED AREAS

Parga village is situated at about 20 m a.s.l. on the western coast of North Greece in Epirus (Fig. 1). The investigated stream flows into the sea by the vil-

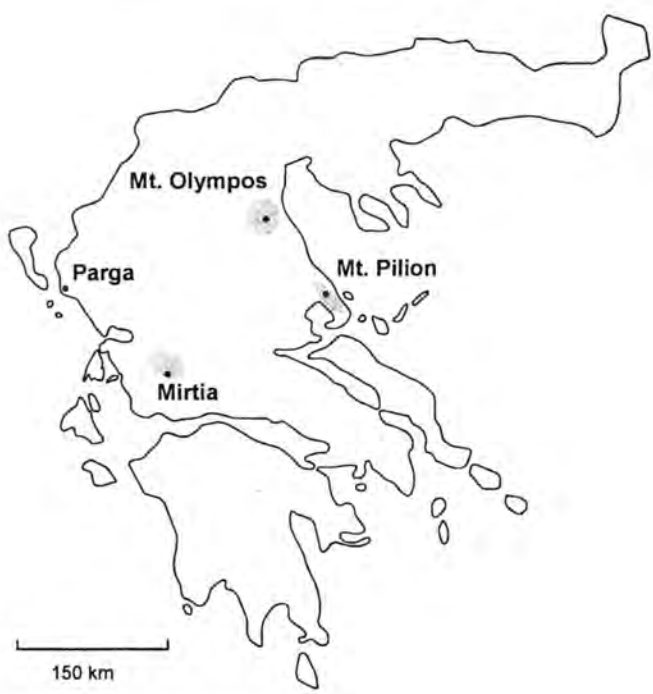


Fig. 1. The location of the investigated streams.

lage among plantations of olive and lemon trees. *Vitex agnus-castus* shrubs and *Platanus orientalis* trees can be found around it. Its bed is characterised by calcareous rocks.

The sources near Mirtia village are situated in central Greece, at the southern foot of the calcareous Mt Panetolikon near lake Trichomanis. The rocks around the sources are covered by *Adiantum capillus-veneris* and above them large *Platanus orientalis* trees can be seen.

The stream and its waterfall by Prionia refuge in Mt Olympos (Thessaly) were investigated at about 1100 m a.s.l. (calcareous). The area is situated in the zone of *Pinus nigra – Abies borisii-regis – Fagus sylvatica* forest.

Mt Pilion is situated at the east coast of Thessaly. The investigated stream flows by Hania village and it is bedded into siliceous rocks at about 1200 m above sea level. In the Mediterranean region very rare pure *Fagus sylvatica* forests cover almost the whole of the mountain and they can be seen around the stream as well.

RESULTS

Altogether 5 liverwort and 36 moss species were collected from the investigated Greek streams (Table 1). Only the species rare in Greece and new or rare in the given area (according to PRESTON 1981, 1984*a*) are listed in the following discussion.

Table 1. List of the bryophytes collected in the investigated streams.

Species\locality	Parga	Mirtia	Olympos	Pilion
HEPATICAE				
Chiloscyphus polyanthus (L.) Corda				+
Conocephalum conicum (L.) Lindb.		+		+
Marchantia polymorpha L.				+
Pellia endiviifolia (Dicks.) Dum.	+	+		+
Preissia quadrata (Scop.) Nees				+
MUSCI				
Brachythecium rivulare B., S. et G.				+
Brachythecium rutabulum (Hedw.) B., S. et G.			+	+
Bryum alpinum With.				+
Bryum pseudotriquetrum (Hedw.) Gaertn., Meyer et Scherb.			+	+
Bryum sp.				+

Table 1 (continued)

Species\locality	Parga	Mirtia	Olympos	Pilion
Calliergonella cuspidata (Hedw.) Loeske	+			+
Cinclidotus fontinaloides (Hedw.) P. Beauv.			+	
Cratoneuron commutatum (Hedw.) Roth var. *commutatum*		+	+	+
Cratoneuron commutatum (Hedw.) Roth var. *falcatum* (Brid.) Moenk.		+	+	
Cratoneuron filicinum (Hedw.) Spruce		+	+	+
Dichodontium pellucidum (Hedw.) Schimp.				+
Didymodon fallax (Hedw.) Zander	+			+
Didymodon tophaceus (Brid.) Lisa			+	
Didymodon vinealis (Brid.) Zander var. *flaccida* (Bruch et Schimp.) Zander				+
Eurhynchium hians (Hedw.) Sande Lac.				+
Eurhynchium praelongum (Hedw.) B., S. et G. var. *praelongum*	+			
Eurhynchium speciosum (Brid.) Jur.	+			+
Eurhynchium striatum (Hedw.) Schimp.			+	
Fissidens crassipes Wils. ex B., S. et G.	+			
Fissidens taxifolius Hedw.	+			
Hygroamblystegium tenax (Hedw.) Jenn.		+		+
Hygrohypnum luridum (Hedw.) Jenn.			+	+
Leskea polycarpa Hedw.				+
Mnium stellare Hedw.				+
Philonotis fontana (Hedw.) Brid.				+
Plagiomnium affine (Bland.) T. Kop.				+
Plagiomnium ellipticum (Brid.) T. Kop.			+	
Plagiomnium undulatum (Hedw.) T. Kop.	+			+
Plagiothecium denticulatum (Hedw.) B., S. et G.				+
Rhizomnium punctatum (Hedw.) T. Kop.				+
Rhynchostegiella curviseta (Brid.) Limpr.	+			
Rhynchostegium riparioides (Hedw.) C. Jens.		+	+	+
Schistidium apocarpum (Hedw.) B. et S.			+	
Scorpiurium circinatum (Brid.) Fleisch. et Loeske	+			
Thamnobryum alopecurum (Hedw.) Gang. var. *alopecurum*			+	
Trichostomum crispulum Bruch	+			

Preissia quadrata (Scop.) Nees – It was collected in the stream of Mt Pilion. Second location for Thessaly. Formerly it was recorded from Mt Olympos (DÜLL 1995). It was published also from Mt Parnassos (COPPEY 1907) and Thasos (DÜLL 1995).

Dichodontium pellucidum (Hedw.) Schimp. – Now it was found in the stream of Mt Pilion. Second location for Thessaly. Formerly it was recorded from Mt Olympos (PRESTON and AKEROYD 1979, DÜLL 1995), the Ionian Islands and East Macedonia (PRESTON 1984*a*).

Eurhynchium speciosum (Brid.) Jur. – I collected it in the stream at Parga and in Mt Pilion. New to northwestern Greece (Epirus) and represents the second location for Thessaly. Formerly it was recorded from Mt Olympos (DÜLL 1995). Other records were known from Crete, central Greece (PRESTON 1984*a*), the Ionian Islands (PRESTON 1984*a*, DÜLL 1995), Thrakia and East Macedonia (DÜLL 1995).

Fissidens crassipes Wils. – I collected its big patches in the stream of Parga. New to northwestern Greece (Epirus). It was published from central Greece, Crete (PRESTON 1984*a*), the Ionian Islands (PRESTON 1984*a*, DÜLL 1995), Thessaly, Thrakia and East Macedonia (DÜLL 1995).

Hygroamblystegium tenax (Hedw.) Jenn. – It was known from Crete (PRESTON 1984*a*), the Ionian Islands (PRESTON 1984*a*, DÜLL 1995) and Mt Olympos (ADE and KOPPE 1955). I found it at the sources of Mirtia (first record for central Greece) and in the stream of Mt Pilion as the second record for Thessaly.

Hygrohypnum luridum (Hedw.) Jenn. – Its occurrence was reported from Mt Olympos (ADE and KOPPE 1955, PRESTON and AKEROYD 1979, DÜLL 1995) and the Ionian Islands (PRESTON 1984*a*). Beside Mt Olympos I collected it from the stream of Mt Pilion as well.

Leskea polycarpa Hedw. – Second record for Thessaly. It was reported from the Pinios river (DÜLL 1995). I found it in the stream of Mt Pilion. It was recorded earlier from Macedonia, Crete (PRESTON 1984*a*) and the Ionian Islands (PRESTON 1984*a*, DÜLL 1995).

Plagiomnium ellipticum (Brid.) T. Kop. – Now it was collected in Mt Olympos. New for Thessaly. It was reported from Macedonia, the Aegean Islands, Euboea (PRESTON 1984*a*) and the Ionian Islands (DÜLL 1995).

Most of the novelties were collected in Thessaly, Mt Pilion. According to these data this mountain seems to be a bryologically very interesting area, which is most probably due to its siliceous rocks (being rare in Greece) and the relatively humid climate.

FLORISTICAL COMPARISON

The cluster analysis carried out on the basis of flora lists shows that the floristical composition of Parga's stream is very different from that of the other streams (Fig. 2). The Mirtia sources and Olympos's stream form a common cluster with the Spanish streams (Ter, Fluviá, Muga, Urdón). This group represents the streams with bryologically Mediterranean character. The stream of Mt Pilion is in the cluster of 3 Hungarian streams (Jósva, the stream of Apátkút Valley and Pécsely Stream). These are the streams with central European character. The stream of Telekes Valley occupies an intermediate place, which can be explained by the Mediterranean-like character of this karst area.

FLORISTICAL CHARACTERISATION OF THE STREAMS' BRYOFLORA

The main components of the bryophyte flora of the stream at Parga are *Calliergonella cuspidata*, *Eurhynchium speciosum*, *Fissidens crassipes*, and *Pla-*

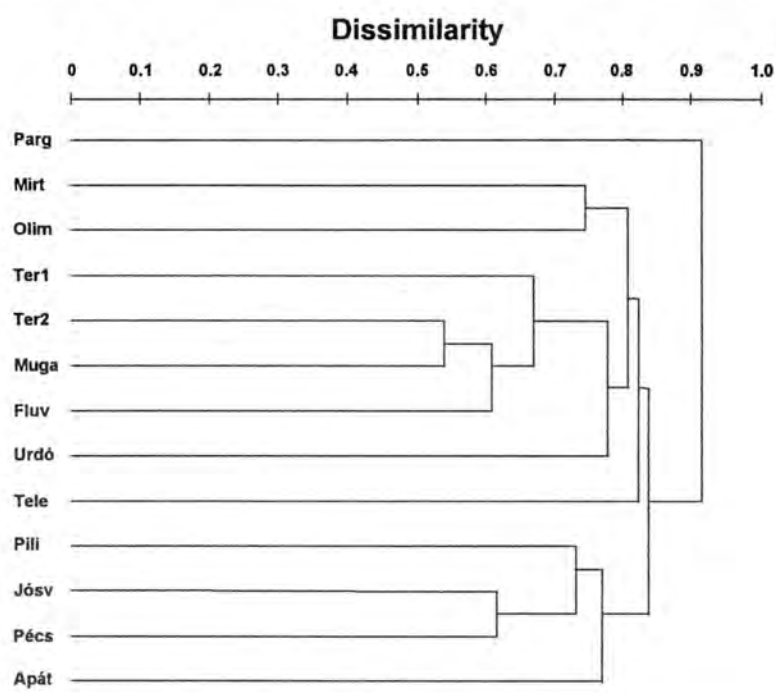
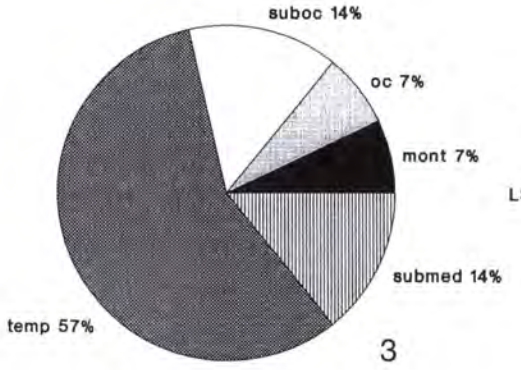
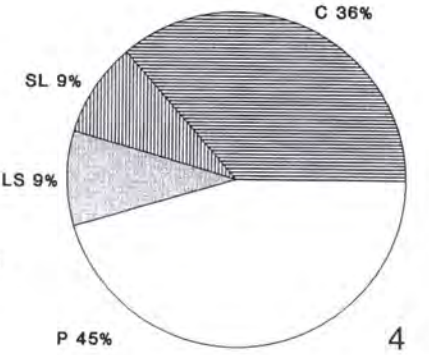
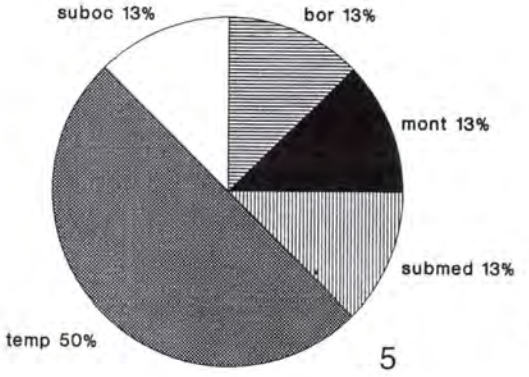
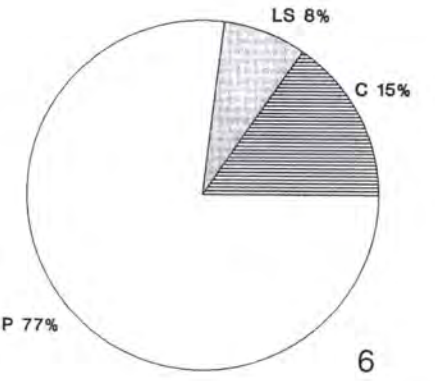


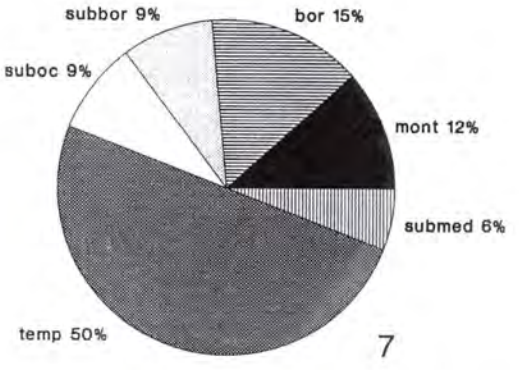
Fig. 2. Result of cluster analysis carried out using the bryophyte flora lists. (Abbreviations are the first 4 letters of the stream names).

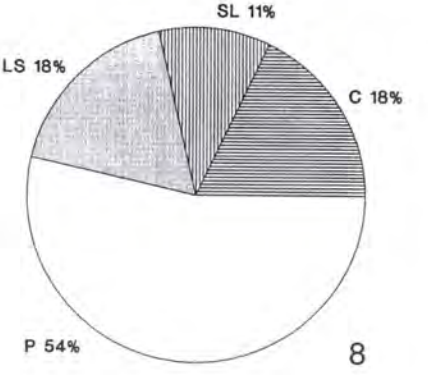












Figs 3–8. Patterns of the bryophyte flora of the studied streams: Parga 3 = flora elements, 4 = life strategy pattern; Mt Olympos 5 = flora elements, 6 = life strategy pattern; Mt Pilion 7 = flora elements, 8 = life strategy pattern. Abbreviations: bor = boreal, subbor = subboreal, mont = montane, oc = oceanic, submed = sub-Mediterranean, suboc = suboceanic, temp = temperate; C = colonist, LS = long lived shuttle, SL = short lived shuttle, P = perennial.

giomnium undulatum. Its floristical composition is very different from that of the other investigated streams (Fig. 2) due to its situation at low altitude close to the sea. This is why the quantity of montane species is very low and a high proportion of suboceanic, sub-Mediterranean species can be observed. Although the species of temperate areas of Europe predominate (Fig. 3).

The high proportion of colonists (Fig. 4) and the frequent, well-developed patches of *Fissidens crassipes*, a β-mesosaprobic indicator species, indicate disturbing effects derived from the fluctuation of water supply and from human activity (plantations, domestic waste from the village).

At the sources of Mirtia the most abundant species are *Cratoneuron commutatum*, *Pellia endiviifolia*, *Conocephalum conicum*, *Hygroamblystegium tenax*, and *Rhynchostegium riparioides*. The flora is similar to that of the stream of Mt Olympos (Fig. 2).

Here only species of the temperate areas of Europe can be found. The lack of colonists and the high proportion of perennial species (71%) show unchanging good environmental conditions at this source area. Beside the perennial species only a few short lived shuttle species were present (29%).

The main components of the bryophyte flora of the stream in Mt Olympos are *Cinclidotus fontinaloides*, *Cratoneuron commutatum*, *Didymodon tophaceus*, *Rhynchostegium riparioides*, *Brachythecium rutabulum*, *Thamnobryum alopecurum*. The bryophyte flora of this stream and the sources of Mirtia are similar and they show close relations with some Spanish streams as well (Fig. 2).

The floristical composition is predominated by temperate species, beside them boreal, montane and sub-Mediterranean, suboceanic species can be found representing the same proportion (Fig. 5).

The bryoflora is mostly characterized by perennial species, the proportion of colonists is lower than in the flora of Parga's stream (Fig. 6). No remarkable disturbing effect can be detected by means of the aquatic bryophyte flora.

The bryoflora of the stream of Mt Pilion is different from the other Greek streams investigated, but it is similar to some Hungarian streams (Fig. 2). The flora is very diverse. The presence of the north-suboceanic *Rhizomnium punctatum*, the subboreal *Philonotis fontana* and several species of Mniaceae (*Mnium*, *Plagiomnium*) is remarkable here beside the occurrence of several above mentioned species, such as *Cratoneuron commutatum*, *Conocephalum conicum*, *Pellia endiviifolia*, *Brachythecium rutabulum*, and *Rhynchostegium riparioides*.

The floristical composition shows more central European features than the bryophyte flora of the stream in Mt Olympos. The total quantity of montane, boreal, subboreal species is considerable, while the presence of sub-Mediterranean, suboceanic, oceanic species and the proportion of temperate species is lower than in the Olympos's stream (Fig. 7).

The quantity of perennial species is lower than in the Olympos's stream, but many long lived shuttle species are present (Fig. 8). The somewhat higher proportion of colonists and of short lived shuttle species indicate a moderate disturbance in this area possibly caused by forestry activity, *i.e.* the clear-felling which had reached the close vicinity of the stream.

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