

CONTRIBUTIONS TO THE BRYOFLORA OF THE PONTIC MTS, NORTH ANATOLIA, TURKEY

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A collecting trip was made in July 2001 in the northeastern part of the Pontic Mts. Mainly the mixed evergreen–deciduous forest zone was visited between 600–1,200 m a.s.l. Altogether 151 bryophyte taxa (38 liverworts and 113 mosses) were collected during the field trip. Five species (3 hepatics and 2 mosses) are reported for the first time from Turkey. These are *Harpanthus scutatus*, *Nardia scalaris*, *Scapania subalpina*, *Blindia caespiticia* and *Taxiphyllum densifolium*. Careful comparison of the old and recent literature showed 53 taxa (10 liverworts and 43 mosses) new to the A4 grid square of HENDERSON (1961).

Key words: A4 grid square, bryoflora, Pontic Mts, Turkey

INTRODUCTION

The Pontic mountain range belongs to the North Anatolia region of Turkey. In the eastern part (called Lazistan) the range is high, continuous and lies close to the Black Sea, with several peaks over 3,000 m. Most of the bedrocks are of volcanic origin (granite, granodiorite, andesite). On the northern side of the mountains the rivers cut deep gorges flowing down to the sea. Thanks to the moist climate, this area supports the largest tracks of closed forests in Turkey. Here, the most striking climatic feature is the heavy rainfall (2,350 mm/yr), distributed all year round; when it is not raining, the hills are frequently hidden in mist. The mean yearly temperature is 18.5 °C, the coldest month is January with 6 °C and the warmest one is July with 24 °C average temperature. On the southern side the range falls steeply to the plateau of Eastern Anatolia. The climate on this part is much drier, hence there is a big contrast in the vegetation of the two sides of the mountain (DAVIS 1965).

In Lazistan many higher plant species occur that do not extend further west. The flora of Lazistan is connected with that of adjacent western Georgia, including the western part of the main ranges of the Caucasus. The flora of the montane coniferous forests and the alpine zone shows close links with the same zones in the Caucasus and with the mountains of Central Europe. The northern slopes of the Pontic mountain range are covered by mixed forests dominated by *Alnus glutinosa*, *Fagus orientalis* and *Picea orientalis*. The main constituents of the undergrowth are *Rhododendron ponticum*, *R. flavum*, *Buxus sempervirens*, *Rubus platyphyllos* (DAVIS 1965).

The first description about the bryophyte vegetation of the area was provided by HANDEL-MAZZETTI (1909). Besides of higher plants, fungi and lichens, numerous bryological records can be found in this paper in relation to the elevation zones of the mountains and their higher plant vegetation. 138 mosses are listed in the paper and the list of hepatics elaborated by V. Schiffner contains 50 taxa. Before Handel-Mazzetti's study only some sporadic bryological records were known from the region (e.g. Knapp in 1884 around Trabzon). Later, REIMERS (1927) added a few species to the bryophyte flora of the Pontic Mts with a record of 31 species published, among which 18 were new to the region. Later on in Henderson's papers (HENDERSON and MUIRHEAD 1955, HENDERSON 1964) further bryological records of the mountain range were compiled mainly from the surroundings of Giresun, Rize, Trabzon and Artvin. The paper of ROBINSON and GODFREY (1960) also contains about 40 species from the region collected mainly around Trabzon. A summarisation of the knowledge on the bryophytes of Turkey was published in 1961 by HENDERSON (1961), who established 15 distributional grid squares, which coincide roughly with the major floristical regions of the country. This grid system is highly accepted by Turkish bryologists and used in their recent publications as well. According to Henderson the eastern part of the Pontic Mts belongs to the A4 grid square (40–42° N; 38–42° E). Thanks to the increasing interest in bryophyte research in the last 10 years in the country, several papers were published by Turkish bryologists dealing with the area (ÖZDEMİR 1994, 2001, ÖZDEMİR and BAYDAR 1997, BAYDAR and ÖZDEMİR 1996, GÖKLER 1998, ERDAĞ 2000), and giving new records to the bryophyte list of HENDERSON (1961) which contains 273 taxa from the A4 square.

Covering the whole of the Turkish bryoflora, a comprehensive work about the bryophyte flora of southwestern Asia was published by FREY and KÜRSCHNER (1991).

MATERIALS AND METHODS

Collections were made in July of 2001 in the northeastern part of the Pontic Mts. Mainly the mixed evergreen-deciduous forest zone was visited between 600–1,200 m a.s.l. Several different habitats were thoroughly investigated for bryophytes (e.g. shaded and exposed volcanic rocks, rock walls, streamsides, tree barks and decaying logs). The collected material is deposited in the herbarium of the Hungarian Natural History Museum (BP).

The nomenclature of the mosses follows CORLEY *et al.* (1981), CORLEY and CRUNDWELL (1991), and that of the liverworts follows SCHUMACKER and VÁNA (2000).

SITE DETAILS

1. Turkey, Pontic Mts, Altındere valley National Park at Trabzon town, between Maçka village and Sumela monastery, *Quercetum*, 600 m a.s.l. 18.07.2001.

2. Turkey, Pontic Mts, Altındere valley National Park at Trabzon town, at Sumela monastery, volcanic bedrock, 1,080–1,280 m a.s.l. 18 and 19.07.2001.

3. Turkey, Pontic Mts, at Ardeşen town, between Çamlıhemşin village and Zil Kale castle, at Hasan Yıldızın spring, 630 m a.s.l., 19.07.2001.

4. Turkey, Pontic Mts, at Ardeşen town, stream valley near Zil Kale castle after Çamlıhemşin village, volcanic bedrock, 700 m a.s.l., 20.07.2001.

5. Turkey, Pontic Mts, at Ardeşen town, Zil Kale castle after Çamlıhemşin village, 700 m a.s.l., 20.07.2001.

6. Turkey, Pontic Mts, at Firtına river between Çamlıhemşin village and Zil Kale castle at Senyuva village, 380 m a.s.l., 20.07.2001.

7. Turkey, Pontic Mts, at Ardeşen town, rock walls in Çamlıhemşin village, 320 m a.s.l., 20.07.2001.

8. Turkey, Pontic Mts, at Ardeşen town, between Ayder and Kavron village, picnic spot (Hakaki Ayder Bali Satis reyonu S. S. Tarımsal Kalkınma Kooperatifi), 5 km from Ayder, 1,570 m a.s.l., 20.07.2001.

9. Turkey, Pontic Mts, at Ardeşen town, from Ayder to Kavron village, 6 km from Kavron, alpine-subalpine vegetation, 1,740 m a.s.l., 21.07.2001.

RESULTS

Altogether 151 bryophyte taxa (38 liverworts and 113 mosses) were collected during the field trip. 5 species (3 hepatics and 2 mosses) are reported for the first time from Turkey based on FREY and KÜRSCHNER (1991) and Erdağ (pers. comm.). These are as follows: *Harpanthus scutatus*, *Nardia scalaris*, *Scapania subalpina*, *Blindia caespiticia* and *Taxiphyllum densifolium*. Careful comparison of the old and recent literature showed 53 taxa (10 liverworts and 43 mosses) new to the A4 grid square of HENDERSON (1961). Two of them, *Encalypta streptocarpa* and *Leucodon immersus*, were reported earlier from the neighbouring A3 square (HENDERSON 1961), which also belongs to the area of Pontic Mts but situated westward from our area of investigation.

In the following record the species name is followed by the number of location and substrate. The asterisks mark the species that have been first recorded from the A4 grid square.

Hepaticae

- Apometzgeria pubescens* (Schränk.) Kuwah. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- **Barbilophozia hatcheri* (Evans) Loeske – 9: on soil
- **Bazzania flaccida* (Dum.) Grolle – 4: on volcanic rocks at the stream
- Bazzania tricrenata* (Wahlenb.) Lindb. – 9: on soil
- Blasia pusilla* L. – 9: on soil
- Blepharostoma trichophyllum* (L.) Dumort. – 4: on decaying wood at the stream
- **Calypogeia fissa* (L.) Raddi – 3: on soil; 4: on decaying wood at the stream
- Cephalozia catenulata* (Hüb.) Lindb. – 4: on decaying wood at the stream
- Chiloscyphus polyanthos* (L.) Corda – 4: on volcanic rocks at the stream; 6: on rock in the river
- **Cololejeunea rosettiana* (C. Massal.) Schiffn. – 2: on shaded volcanic rocks; 5: on rock wall
- Conocephalum conicum* (L.) Dumort. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- Diplophyllum albicans* (L.) Dumort. – 4: on volcanic rocks at the stream
- Frullania jackii* Gottsche – 2: on shaded volcanic rocks
- Frullania tamarisci* (L.) Dumort. – 5: on rock wall
- **Harpanthus scutatus* (Web. et Mohr) Spruce – 4: on decaying wood at the stream
- Jamesoniella autumnalis* (DC.) Steph. – 3: on soil
- Jubula hutchinsiae* (Hook.) Dum. subsp. *javanica* (Steph.) Verd. – 4: on volcanic rocks and decaying wood at the stream
- Lejeunea cavifolia* (Ehrh.) Lindb. – 4: on volcanic rocks at the stream
- Lophozia bantriensis* (Hook.) Steph. – 4: on volcanic rocks at the stream
- **Lophozia bicrenata* (Schmid. ex Hoffm.) Dumort. – 8: on decaying wood
- **Lophozia sudetica* (Nees ex Hüb.) Grolle – 9: on soil
- Marchantia paleacea* Bertol. – 7: on rock wall
- Metzgeria conjugata* Lindb. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream; 5: on rock wall
- Metzgeria furcata* (L.) Dumort. – 2: on the bark of *Corylus* and *Fagus*; 4: on volcanic rocks at the stream
- **Nardia scalaris* S. F. Gray – 9: on soil
- Nowellia curvifolia* (Dicks.) Mitt. – 4: on decaying wood at the stream
- Pellia endiviifolia* (Dicks.) Dumort. – 4: on volcanic rocks at the stream
- Pellia epiphylla* (L.) Corda – 4: on decaying wood at the stream
- Plagiochila asplenioides* (L. emend. Taylor) Dumort. – 4: on volcanic rocks at the stream
- Plagiochila porelloides* (Torrey ex Nees) Lindenb. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- Porella platyphylla* (L.) Pfeiff. – 2: on the bark of *Corylus*
- Radula lindenbergiana* Gott. ex C. Hartm. – 2: on shaded volcanic rocks and on the bark of *Fagus*; 5: on rock wall
- Riccardia palmata* (Hedw.) Carruth. – 4: on decaying wood at the stream
- Scapania aequiloba* (Schwaegr.) Dumort. – 2: on shaded volcanic rocks
- Scapania nemorea* (L.) Grolle – 3: on soil; 4: on volcanic rocks at the stream
- **Scapania subalpina* (Nees ex Lindenb.) Dumort. – 9: on soil
- Scapania undulata* (L.) Dumort. – 4: on volcanic rocks at the stream
- **Tritomaria exsecta* (Schräd.) Schiffn. ex Loeske – 4: on decaying wood at the stream

Musci

- **Amblystegium serpens* (Hedw.) B., S. et G. – 2: on shaded volcanic rocks and on the bark of *Fagus*; 5, 7: on rock wall
- Amphidium mougeotii* (B. et S.) Schimp. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- Anomodon attenuatus* (Hedw.) Hüb. – 2: on shaded and exposed volcanic rocks and on the bark of *Fagus*; 3: on the bark of *Juglans*
- Anomodon rugelii* (C. Muell.) Keissl. – 2: on shaded volcanic rocks; 3: on volcanic rocks
- Anomodon viticulosus* (Hedw.) Hook. et Taylor – 1: on volcanic rock in *Quercetum*; 2: on shaded volcanic rocks; 3: on the bark of *Juglans*
- Atrichum undulatum* (Hedw.) P. Beauv. – 2: on soil; 4: on volcanic rocks at the stream
- **Barbula convoluta* Hedw. var. *commutata* (Jur.) Husn. – 5: on rock wall
- Bartramia halleriana* Hedw. – 2: on shaded volcanic rocks
- **Blindia caespiticia* (Web. et Mohr) C. Muell. – 9: on soil
- Brachythecium glareosum* (Spruce) B., S. et G. – 1: on volcanic rock in *Quercetum*
- Brachythecium plumosum* (Hedw.) B., S. et G. – 4: on volcanic rocks at the stream
- Brachythecium populeum* (Hedw.) B., S. et G. – 1: on soil in *Quercetum*; 3: on volcanic rocks
- Brachythecium rivulare* B., S. et G. – 4: on volcanic rocks at the stream
- Brachythecium rutabulum* (Hedw.) B., S. et G. – 1: on soil in *Quercetum*; 4: on volcanic rocks at the stream; 9: on soil
- Brachythecium velutinum* (Hedw.) B., S. et G. – 2: on shaded volcanic rocks
- Bryum capillare* Hedw. – 4: on volcanic rocks at the stream; 5: on rock wall
- Bryum elegans* Nees in Brid. – 1: on volcanic rock in *Quercetum*
- **Bryum subelegans* Kindb. – 2: on shaded volcanic rocks
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn., B. Meyer et Scherb. – 4: on volcanic rocks at the stream; 6: on rock in the river
- **Campylium calcareum* Crundw. et Nyh. – 1: on soil in *Quercetum*
- **Campylium stellatum* (Hedw.) C. Jens. – 9: on soil
- Ceratodon purpureus* (Hedw.) Brid. – 5: on rock wall; 9: on soil
- **Crossidium squamiferum* (Viv.) Jur. – 1: on volcanic rock in *Quercetum*
- Ctenidium molluscum* (Hedw.) Mitt. – 2: on shaded volcanic rocks; 3: on the bark of *Juglans*; 4: on volcanic rocks at the stream
- **Ctenidium molluscum* (Hedw.) Mitt. var. *robustum* Boul. in Braithw. – 9: on soil
- Dichodontium pellucidum* (Hedw.) Schimp. – 2: on shaded volcanic rocks; 3: on soil; 6: on rock in the river
- **Dicranella palustris* (Dicks.) Crundw. ex E. F. Warb. – 9: on soil
- Dicranodontium denudatum* (Brid.) Britt. – 4: on decaying wood at the stream; 8: on decaying wood
- Dicranum majus* Sm. – 9: on soil
- Dicranum scoparium* Hedw. – 4: on decaying wood at the stream
- **Didymodon ferrugineus* (Schimp. ex Besch.) M. O. Hill – 2: on exposed volcanic rocks
- Didymodon insulanus* (De Not.) M. O. Hill – 4: on volcanic rock at the stream; 5: on rock wall; 7: on rock wall
- Didymodon luridus* Hornsch. ex Spreng. – 1: on volcanic rock in *Quercetum* and at the stream
- Didymodon rigidulus* Hedw. – 1: on volcanic rock in *Quercetum*; 5, 7: on rock wall
- **Drepanocladus exannulatus* (B., S. et G.) Warnst. – 9: on soil
- **Dryptodon patens* (Hedw.) Brid. – 4: on volcanic rocks at the stream
- **Encalypta streptocarpa* Hedw. – 5: on rock wall

- Eurhynchium angustirete* (Broth.) T. J. Kop. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream; 5: on rock wall
- **Eurhynchium flotowianum* (Sendtn.) Kartt. – 2: on shaded volcanic rocks
- Eurhynchium hians* (Hedw.) Sande Lac. – 4: on volcanic rocks at the stream
- **Eurhynchium meridionale* (B., S. et G.) De Not. – 5: on rock wall
- Eurhynchium striatum* (Hedw.) Schimp. – 4: on volcanic rocks and decaying wood at the stream
- Fissidens dubius* P. Beauv. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- **Fissidens limbatus* Sull. – 5: on rock wall
- Fontinalis antipyretica* Hedw. – 4: on volcanic rocks at the stream
- Funaria hygrometrica* Hedw. – 7: on rock wall
- **Gyroweisia tenuis* (Hedw.) Schimp. – 1: on volcanic rock in *Quercetum*; 7: on rock wall
- **Homalia besseri* Lobarz. – 2: on shaded volcanic rocks
- Homalia trichomanoides* (Hedw.) Brid. – 2: on shaded volcanic rocks
- Homalothecium sericeum* (Hedw.) B., S. et G. – 5: on rock wall
- **Hygrohypnum eugyrium* (Schimp.) Broth. – 4: on volcanic rocks at the stream
- Hygrohypnum luridum* (Hedw.) Jenn. – 6: on rock in the river
- Hylocomium brevirostre* (Brid.) B., S. et G. – 3: on volcanic rocks
- Hylocomium splendens* (Hedw.) B., S. et G. – 5: on rock wall
- **Hymenostylium recurvirostrum* (Hedw.) Dix. – 2: on exposed volcanic rocks
- Hypnum cupressiforme* Hedw. – 1: on volcanic rock in *Quercetum*; 4: on volcanic rocks at the stream
- Hypnum lacunosum* (Brid.) Hoffm. – 9: on soil
- **Hypnum lindbergii* Mitt. – 9: on soil
- **Isopterygiopsis pulchella* (Hedw.) Iwats. – 2: on shaded volcanic rocks
- Isothecium alopecuroides* (Dubois) Isov. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- Isothecium alopecuroides* (Dubois) Isov. f. *robustum* – 9: on soil
- **Lescuraea patens* (Lindb.) H. Arn et C. Jens. – 9: on soil
- Leucobryum glaucum* (Hedw.) Aongstr. – 4: on volcanic rocks and on decaying wood at the stream
- **Leucodon immersus* Lindb. – 2: on the bark of *Corylus* and *Fagus*; 3: on the bark of *Juglans*; 5: on rock wall
- Leucodon sciuroides* (Hedw.) Schwaegr. – 1: on volcanic rock in *Quercetum*
- **Mnium ambiguum* H. Müll. – 2: on shaded volcanic rocks
- **Mnium spinosum* (Voit) Schwaegr. – 2: on shaded volcanic rocks
- Mnium stellare* Hedw. – 5: on rock wall
- Neckera complanata* (Hedw.) Hüb. – 2: on shaded volcanic rocks and on the bark of *Fagus*; 3: on the bark of *Juglans*; 5: on rock wall
- Neckera crispa* Hedw. – 2: on shaded volcanic rocks; 5: on rock wall
- Orthotrichum anomalum* Hedw. – 1: on volcanic rock in *Quercetum*
- **Oxystegus tenuirostris* (Hook. et Taylor) A. J. E. Sm. – 2: on shaded volcanic rocks and on the bark of *Fagus*; 4: on volcanic rocks at the stream
- Palamocladium euchloron* (C. Müll.) Wijk et Marg. – 2: on shaded volcanic rocks
- Philonotis fontana* (Hedw.) Brid. – 8, 9: on soil
- Plagiomnium affine* (Blandow) T. J. Kop. – 3: on soil
- Plagiomnium elatum* (Bruch et Schimp.) T. J. Kop. – 4: on volcanic rocks at the stream
- **Plagiomnium ellipticum* (Brid.) T. J. Kop. – 1: on soil in *Quercetum*
- Plagiomnium rostratum* (Schröd.) T. J. Kop. – 5: on rock wall
- Plagiomnium undulatum* (Hedw.) T. J. Kop. – 3: on soil
- **Plagiothecium laetum* B., S. et G. – 2: on shaded volcanic rocks; 4: on decaying wood at the stream

- Plagiothecium succulentum* (Wilson) Lindb. – 4: on volcanic rocks at the stream; 2: on shaded volcanic rocks
- **Platydictya subtilis* (Hedw.) Crum – 3: on the bark of *Juglans*
- **Pleuridium subulatum* (Hedw.) Rabenh. – 3: on soil
- Pleurochaete squarrosa* (Brid.) Lindb. – 1: on volcanic rock in *Quercetum*
- Pogonatum urnigerum* (Hedw.) P. Beauv. – 2: on soil; 3: on volcanic rocks
- Polytrichum juniperinum* Hedw. – 2: on soil
- **Pseudoleskeella nervosa* (Brid.) Nyh. – 2: on shaded volcanic rocks and on the bark of *Fagus*; 3: on the bark of *Juglans*
- **Pterigynandrum filiforme* Hedw. – 2: on shaded volcanic rocks and on the bark of *Fagus*
- Racomitrium aciculare* (Hedw.) Brid. – 4: on volcanic rocks at the stream
- Racomitrium aquaticum* (Schrad.) Brid. – 4: on volcanic rocks at the stream
- Racomitrium canescens* (Hedw.) Brid. – 2: on soil; 3: on volcanic rocks; 8: on soil
- Racomitrium heterostichum* (Hedw.) Brid. – 3: on volcanic rocks; 9: on soil
- Rhizomnium punctatum* (Hedw.) T. J. Kop. – 4: on volcanic rocks at the stream
- **Rhodobryum ontariense* (Kindb.) Kindb. – 3: on volcanic rocks
- Rhynchostegium riparioides* (Hedw.) Card. – 4: on volcanic rocks at the stream; 6: on rock in the river
- **Rhynchostegium rotundifolium* (Brid.) B., S. et G. – 2: on shaded volcanic rocks
- Rhytidiadelphus squarrosus* (Hedw.) Warnst. – 3: on soil
- Rhytidiadelphus triquetrus* (Hedw.) Warnst. – 5: on rock wall; 9: on soil
- Schistidium apocarpum* (Hedw.) Bruch et Schimp. – 1: on volcanic rock in *Quercetum*
- **Taxiphyllum densifolium* (Lindb. ex Broth.) Reim. – 2: on shaded volcanic rocks; 5: on rock wall
- **Taxiphyllum wissgrillii* (Garov.) Wijk et Margad. – 2: on shaded volcanic rocks
- Tetraphis pellucida* Hedw. – 4: on decaying wood at the stream
- Thamnobryum alopecurum* (Hedw.) Gang. – 2: on shaded volcanic rocks; 4: on volcanic rocks at the stream
- Thuidium abietinum* (Hedw.) B., S. et G. – 1: on volcanic rock in *Quercetum*; 5: on rock wall
- Thuidium delicatulum* (Hedw.) Mitt. – 3: on soil; 4: on decaying wood at the stream
- **Thuidium philibertii* Limpr. – 2: on shaded volcanic rocks
- **Timmia austriaca* Hedw. – 5: on rock wall
- **Tortella nitida* (Lindb.) Broth. – 1: on volcanic rock in *Quercetum*
- Tortella tortuosa* (Hedw.) Limpr. – 2: on shaded and exposed volcanic rocks; 9: on soil
- **Tortula atrovirens* (Sm.) Lindb. – 1: on volcanic rock in *Quercetum*
- **Tortula laevipila* (Brid.) Schwaegr. – 5: on rock wall
- Tortula muralis* Hedw. – 1: on volcanic rock in *Quercetum* and at the stream
- Weissia controversa* Hedw. – 1: on volcanic rock in *Quercetum*

CONCLUSIONS

Thanks to the good habitat conditions – high rainfall, acidic bedrocks and the presence of large tracks of old-growth forests – the bryophyte flora of the Pontic mountains is unique and species rich. The number of hepatics in the species composition is much higher than in other areas of Turkey. Several Eurasian woodland species reach here their southern limit. The Mediterranean elements of the Black Sea coast and the Colchic elements migrating towards west also enrich the flora.

Such interesting Near and Middle Eastern endemic species are *Palamocladium euchloron* and *Leucodon immersus* (FREY and KÜRSCHNER 1979).

Taxiphyllum densifolium is also treated as Pontic-montane element by DÜLL (1985), but it was not reported from Turkey so far. This species was described from the forests of the Caucasus Mts by Brotherus in 1892, then it was sporadically recorded in Central and Eastern Europe (Czech Republic, Hungary, Poland, Romania) (VAJDA 1955, DÜLL 1985). It is red-listed in Europe (ECCB 1995) in the rare (R) category.

Some other species found in the Pontic Mts are also included in the Red Data Book of European Bryophytes. These are *Hygrohypnum eugyrium*, *Leucodon immersus*, *Rhynchostegium rotundifolium* in the rare (R) category, *Jubula hutchinsiae* subsp. *javanica* in the vulnerable (V) category and *Marchantia paleacea* in the insufficiently known, but threatened (K) category. Due to the rarity of adequate habitats (forests) in their distribution area in Asia, too, it is supposed that these species are threatened world-wide.

Although some areas of the Pontic Mts are national parks or other form of nature reserves, its rich higher plant and cryptogamic vegetation would make sufficient support for large-scale protection; perhaps the whole mountain range should be declared conservation land.

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