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On the *Bryum bicolor* complex in Italy including *Bryum gemmilucens* Wilcz. & Dem., new species to the Italian bryological flora

Abstract

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The ecology, morphology and distribution of the Italian species of the *Bryum bicolor* complex is presented, and a key for their identification is given. *Bryum gemmilucens* Wilcz. & Dem. is a new record for the bryoflora of Italy.

Although the first observations on high polymorphism of *Bryum bicolor* (sub. *B. atropurpureum* Web. & Mohr.) date from the fifties (Rilstone 1949, Warburg 1963), only on 1976 a complete study was finished by Wilczek and Demaret on *Bryum bicolor* complex. Using as key characters morphology of bulbils and rhizoid colour they distinguish five species and one forma: *Bryum bicolor* Dicks., *B. bicolor* f. *gracilentum* (Braithw.) Podp., *Bryum versicolor* A. Braun, *Bryum gemmiferum* Wilcz. & Dem., *Bryum barnesii* Wood, *Bryum gemmilucens* Wilcz. & Dem.

Almost at the same time, English searchers (Smith & Whitehouse 1978), working with both herbarium material and cultivation experiments, recognize four distinct taxa of the *Bryum bicolor* group occurring in Britain and Ireland: *Bryum bicolor, B. gemmiferum, B gemmilucens* and *Bryum dunense* A. J. E. Sm. ex Whitehouse. They use as key characters: axillary bulbils and leaf morphology. In addition they report a fifth endemic species in Britain belonging to *Bryum bicolor* group: *Bryum dixonii* Card. ex Nicholson. They point out that it differs from other known species of the *Bryum bicolor* complex because it does not produce regularly axillary bulbils on sterile shoots and the reddish base of the leaves.

As regards the Italian territory, only three species of *Bryum bicolor* complex were known: *Bryum bicolor*, *B. versicolor* and *B. dunense* (Cortini Pedrotti 1992). In the course of bryofloristic and bryovegetational researches carried out on the cork-oak woods in central-southern Sicily, a small acrocarpous moss was discovered among *Bryum dunense* populations near Niscemi in December 1994. This moss certainly belonged to *Bryum bicolor* complex, because of the occurrence of bulbils in the leaf axils and the nerve at the base less than 60μm; but it could not be referred to any of the Italian known species.

Further gatherings in January 1995 and February 1996, checking the species variability too, and the examination of herbarium specimens (FI, RO, SIENA, herbarium Hébrard) revealed that plant collected in Niscemi territory belonged to a new species for the Italian bryoflora: *Bryum gemmilucens* Wilcz. & Dem.

At the beginning we had some doubtful points because the Sicilian material did not agree exactly with the descriptions and illustrations of *Bryum gemmilucens* in the works consulted (Smith 1978, Smith & Whitehouse 1978, Demaret 1993); even if the collected specimens corresponded more to the description of *Bryum gemmilucens* of Demaret 1993 in Flore Générale de Belgique. Also we hesited because the Sicilian specimens differed from Britain specimens (Smith in lit.). Then we compared the Sicilian material with French material (from herbarium Hébrard) and we did not find any marked morphological difference between them. Therefore for the time being it seems better to take on, in agreement with Smith, that the British specimens are conspecific with Belgian, French, Italian specimens.

Voucher specimens are kept in the herbaria of Botanical Departments of Catania (CAT) and Palermo (PAL).

Key to Italian species of the *Bryum bicolor* complex

1 - Bulbils 1-2 in leaves axils with leaf primordia 1/2 or 2/3 total bulbil body **2**
- Bulbils c.5 in leaves axils with leaf primordia rudimentary and restricted to apex of bulbil body ..... *Bryum gemmilucens*

2 - Leaves nerve percurrent or excurrent not exceeding 200 µm ..... *Bryum bicolor*
- Leaves nerve longly excurrent, exceeding 200 µm in upper leaves **3**

3 - Leaves with margin revolute from base to apex ..... *Bryum versicolor*
- Leaves with margin revolute below ..... *Bryum dunense*

The Italian species of *Bryum bicolor* complex are briefly presented below. In particular the features of bulbils and leaves are described, since these are believed essential to distinguish the species. The sporophyte is not described because alike in all species .

As regards the geographical distribution we are referring mainly to the works of Düll (1985, 1992) and Demaret (1993), whereas for Italy to Cortini Pedrotti's work (1992) and personal data coming from gatherings or material revision of some Italian herbaria (FI, RO, SIENA).

***Bryum bicolor* Dicks. (syn. *B. atropurpureum* B. S. et G., *B. arenarium* Jur.)**

Dioecious, plants green-yellowish, red to brown below, to 1cm. Leaves ovate to ovate-lanceolate, concave, to 1.5 mm, apex obtuse or acute to acuminate; margin recurved below, intire. Nerve, green-brownish, percurrent to shortly excurrent. Sterile shoots with greenish axillary bulbils, 1-2 per axil, 150-500 x 170-230 µm, primordia to half total length of bulbil, hardly leaf-like, triangular without a nerve, bulbil base rounded. Rhizoidal gemmae at times present.

Ecology. - Waste ground, grassland, roadsides, common in urban environment on old walls, in flower-beds etc.

Geographical area. - Almost cosmopolite.

Italy. - Widespread excepting Val d'Aosta. Almost the whole herbarium material examined sub. *Bryum atropurpureum* corresponds well to *Bryum bicolor* Dicks. except for some specimens which we are treating below.

***Bryum dunense* A. J. E. Sm. ex Whitehouse**

Dioecious, plants green-yellow, to 1.5 cm. Leaves ovate to ovate lanceolate , more or less concave, 0.7-1.6 mm, apex acute; margin recurved below, intire or obscurely denticulate above. Nerve yellowish-green, longly excurrent, in upper leaves to 500 µm. Bulbils solitary in leaf axils, yellowish-green, 400-650 x 220-350 µm, primordia 1/2 or 2/3 bulbil total body, leaf-like with nerve. Rhizoidal gemmae produced only in culture.

Ecology. - Sandy soil, near the coasts mainly.

Geographical area. - In Europe: Austria, Great Britain, Ireland, Corse, Germany, Greece, Spain, Portugal, Sweden, Iceland, Belgium, France. Also in Turkey, Canary Islands, Balearic Islands, Malta.

Italy. - Sicily (Privitera & Lo Giudice 1988a, b) and Campania (Esposito & al. 1993). Certainly wideaspread but overlooked. The revision of herbarium specimens attributed to *Bryum atropurpureum* allowed to notice that they are to be referred to *Bryum dunense.* Therefore, we should add to the above-mentioned territories: Emilia Romagna, prov. Modena, "Colli presso Sassuolo", 5 Apr 1884, *A. Fiori* (RO); *B. dunense* is mixed with *B. bicolor.* Also a new station from Campania: Napoli, Posillipo alla Caiola, 20 Apr 1869, *Giordano* (RO). All specimens with sporophyte.

***Bryum versicolor* A. Braun**

Dioecious. Plants, green-yellowish, brown below, to 1 cm. Leaves ovate to ovate-lanceolate to 1.6 mm, apex long acuminate, margin revolute, intire. Nerve, yellow, yellow-brown at the base, excurrent 200-500 µm. Bulbils usually solitary in leaf axils, obovoid to ellipsoid, yellow-green, 400-680 x 150-250 µm, with leaf primordia acuminate 1/2 or 2/3 total bulbils length, with nerve hardly. Rhizoidal gemmae unknown.

Ecology. - Damp ground.

Geographical area. - Almost the whole Europe.

Italy. - Piemonte, Lombardia, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Emilia Romagna, Toscana, Lazio, Campania, Sardegna. From herbarium revision: *Bryum versicolor* mixed with *Bryum bicolor* (sub. *B. atropurpureum*) - Lazio, prov. Roma, Frascati, Villa di Belentara, 2 Mar 1873 (RO). All specimens with sporophyte.

***Bryum gemmilucens* Wilcz. & Dem.**

Dioecious. Plants green above,orange-red below, 0.3-1 cm. Leaves, 0.5-1 x 0.3-0.5 mm, ovate to ovate-lanceolate, more or less concave, apex acute, margin plane, entire or obscurely denticulate in upper leaves. Nerve 50-60 µm at the base, evanescent, percurrent

or shortly excurrent; cells in mid-leaf 35-60 x 8-16 µm, rhomboid-hexagonal, basal cells 30-50 x 13-20 µm, rectangular, marginal cells narrower, but no forming border. Axillary bulbils yellowish or yellow-orange, glossy, c. 5 per axil, pyriform or obovoid, 150-250 x 100-150 µm, with leaf primordia indistinct or restricted to apex of bulbil. Sporophyte unknown.

Geographical area. - Europe: Great Britain, Denmark, Belgium, Luxemburg, France, Germany, Netherlands, Portugal, Corse, Hungary. Also in California and Canary Islands.

Italy. - Sicily, "condrada Arcia" (240 m) and Piano Stravolata (230 m) near Niscemi (Caltanissetta province).

Taxonomic remarks. - The Sicilian specimens (Fig. 1) differ for some features: leaves to 0.7 x 0.35 mm, nerve of upper leaves percurrent, while nerve of lower leaves percurrent or excurrent to 150 µm, margin plane, cells in mid-leaf 30-45 x 8-10 µm. Moreover the axillary bulbils, yellow or yellow-brownish, glossy, are max 150-160 x 90-100 µm with leaf primordia 1/6-1/7 total length bulbil, never indistinct.

Besides both in natural conditions and agar culture we have not been able to notice rhizoidal gemmae.

Environmental conditions and ecology of *Bryum gemmilucens*

Bryum gemmilucens is a terricolous moss occurring mostly on clayey soil or sandstone. In Sicily it has been collected, at low altitude, in contrada Arcia and Piano Stravolata on non calcareous sediment (reaction with HCL 1/2 negative, pH values ranging from 6.8 to 7.4). From the geological point of view the outcrops are here composed of Pliocene deposits including sandstone (87.6%), besides clay (8.4%) and silt (4%).

As there is no meteorological station in condrada Arcia and Piano Stravolata we refer to the data of the station in Caltagirone (513 m a.s.l.), the closest (20 km c.) to collecting localities. The mean annual precipitation is 540 mm with maxima in autumn (248 mm) and winter (182 mm). Concerning the temperature the mean annual values are + 16.1°C with maxima (M) of the warmest month + 31.0°C and minima (m) of the coldest month + 4.9°C. After Rivas Martinez's classification (1981) the territory belongs to the bioclimatic thermomediterranean belt with dry climate.

Although the drought period lasts many months of years, this should be compensated by a rapid development of *Bryum gemmilucens* in December-January, when the soil humidity is considerable. This rapid development of species occurring dry sunny biotope was pointed out also in other territories of Mediterranean area (Ros & Guerra 1987, Sérgio & al. 1993).

The environmental fanerogamic vegetation is characterized mainly by *Quercus suber* L., *Calycotome villosa* (Poiret) Link., *Teucrium fruticans* L., *Cistus* sp. pl., in addition the herbaceous species *Stipa capensis* Thunb., *Arisarum vulgare* Targ.-Tozz., *Asphodelus microcarpus* Viv., *Salvia verbenaca* L., *Iris sisyrinchium* L., *Poa bulbosa* L.

Associated bryophytes include taxa that are frequent in communities of *Barbuletea unguiculatae* von Hübschmann 1967 like *Fossombronia caespitiformis* De Not. ex Rabenh., *Fossombronia wondraczekii* (Corda) Dum., *Pottia davalliana* (Sm.) C.E.O. Jens., *P. starckeana* (Hedw.) Müll. Hal., *Weissia controversa* Hedw., *Bryum dunense* A. J.

E Sm. ex Whitehouse, *Corsinia coriandrina* (Spreng.) Lindb., *Pseudocrossidium hornschuchianum* (Schultz) R. H. Zander, *Barbula unguiculata* Hedw., besides *Acaulon fontiquerianum* Casas & Sérgio, recorded recently to Italy (Lo Giudice 1995), and *Acaulon muticum* (Hedw.) Müll. Hal. var. *mediterraneum* (Limpr.) Sérgio.

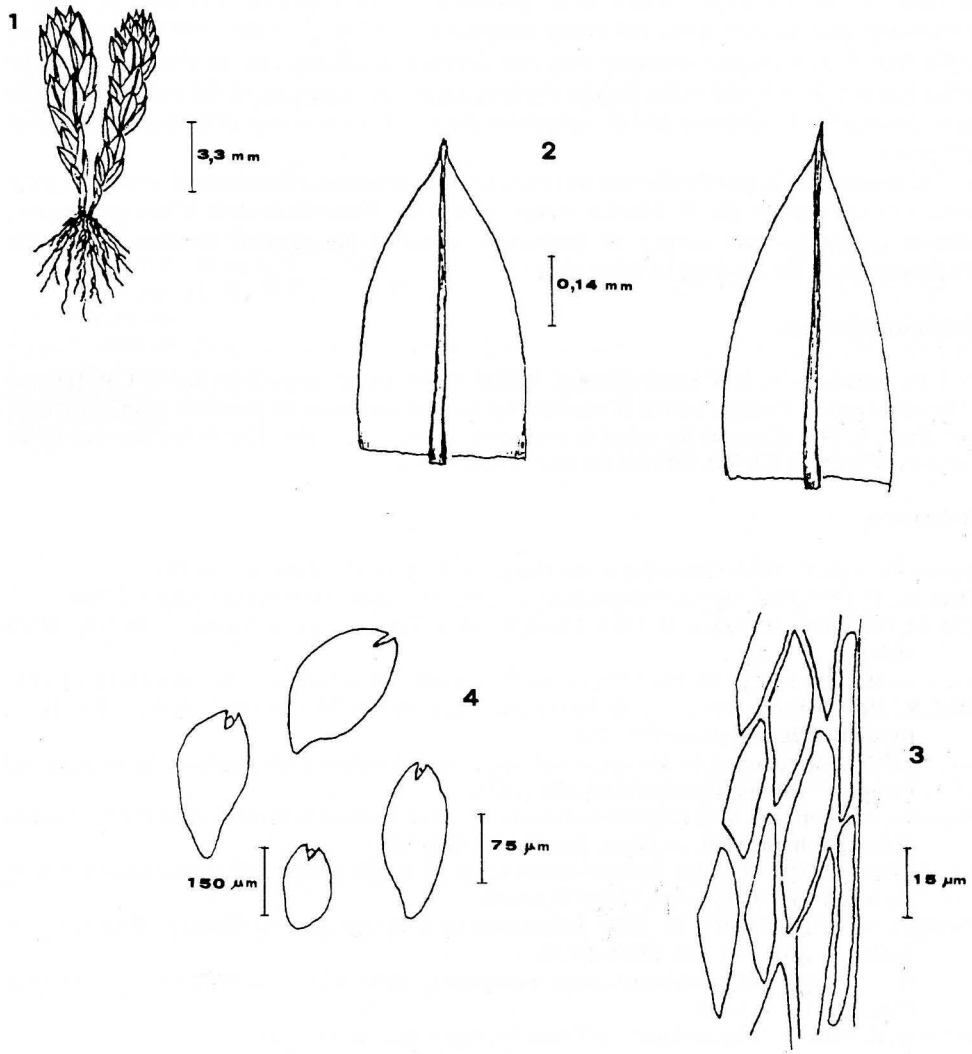

Fig. 1. *Bryum gemmilucens* Wilcz. & Dem. (from Sicilian specimens). **1**, general habit; **2**, leaves; **3**, mid-leaf cells; **4**, axillary bulbils.

Conclusion

The study carried out made it possible to state some taxonomic characters of *Bryum gemmilucens* concerning mainly the morphology of leaves and bulbils, taking into account that the Sicilian specimens do not correspond precisely with the descriptions and

illustrations of the Floras habitually used. In addition a key distinguishing better the Italian species of *Bryum bicolor* complex including *B. gemmilucens* is presented.

Moreover this research allowed to point out some noteworthy phytogeographical aspects. The discovery of *B. gemmilucens* in Sicily extends the species distribution area to extreme southern Europe. Mixed to *B. gemmilucens* two species very rare in Sicily - previously only known from Peloritani mountains (Dia & al. 1985, 1987) - have been collected: *Fossombronia wondraczekii* and *Acaulon muticum* var. *mediterraneum*. The latter has not been found in the Italian territory since the beginning of the century. Besides new stations for *B. dunense* and *B. versicolor* coming from revision of herbarium material are given.

Therefore, this research allowed to stress some taxonomic, chorological and ecological aspect of the taxa of the *B. bicolor* complex in Italy. Nevertheless, it is not exhaustive; further gatherings and survey of herbarium material are needed to state better the distribution and the ecology of these taxa.

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