

The genus *Aloina* (Pottiaceae, Musci) in the Mediterranean region and neighbouring areas

by

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With 14 figures

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Abstract: A revision of the genus *Aloina* in the Mediterranean region and neighbouring areas reveals 7 species: *Aloina aloides*, *A. ambigua*, *A. bifrons*, *A. brevirostris*, *A. humilis*, *A. obliquifolia*, and *A. rigida*. An identification key is provided. *Aloina rigida* var. *mucronulata* and *A. rigida* var. *obliquifolia* are synonymized and elevated to the rank of species as *A. obliquifolia*. Lectotypes for *A. brevirostris*, *A. rigida* and *A. ambigua*, and epitypes for *A. rigida* and *A. ambigua* are proposed.

Resumen: Se ha realizado la revisión del género *Aloina* en la región Mediterránea y áreas limítrofes. Se han reconocido 7 especies: *Aloina aloides*, *A. ambigua*, *A. bifrons*, *A. brevirostris*, *A. humilis*, *A. obliquifolia* y *A. rigida*. Se incluye una clave para las especies. *A. rigida* var. *mucronulata* y *A. rigida* var. *obliquifolia* se sinonimizan y se elevan al nivel de especie bajo el binomio *A. obliquifolia*. Se proponen lectótipos para *A. brevirostris*, *A. ambigua* y *A. rigida*, así como epítipos para *A. ambigua* y *A. rigida*.

Key words: Bryophyta, Musci, Pottiaceae, *Aloina*, Mediterranean region, Taxonomy.

Introduction

A revision of the genus *Aloina* in the Mediterranean area is presented with particular attention paid to gametophytic characters.

The genus *Aloina* (Pottiaceae) is morphologically characterized by the incurved margins of its leaves and chlorophyllose filaments on the adaxial face, which give it a carnose appearance and easily distinguish it from closely related genera of the same family. The results and conclusions expressed in this paper are based on the analysis of representative specimens from the Mediterranean area and type material.

The only worldwide survey of the genus was made by Delgadillo (1975). He considered 12 taxa, of which only six are present in the Mediterranean area: *Aloina aloides* (as *Aloina aloides* var. *aloides*), *A. ambigua* (as *A. aloides* var. *ambigua*), *A.*

bifrons, *A. brevirostris*, *A. obliquifolia* (as *A. rigida* var. *mucronulata*) and *A. rigida*. In addition, Gallego et al. (1998) described *A. humilis* from the Canary Islands.

Materials and methods

Samples deposited in the following herbaria were revised: ARAN (Vitoria), B (Berlin), BCC (Barcelona), BM (London), BR (Brussels), BRNU (Brno), BUF (Buffalo), C (Copenhagen), CANM (Ottawa), E (Edinburgh), FCO (Oviedo), FH (Cambridge), FI (Florence), G (Genova), GZU (Graz), H (Helsinki), HBG (Hamburg), IBA (Pravia), JE (Jena), K (Kew), LISU (Lisbon), LU (Lugo), M (Munich), MA (Madrid), MACB (Madrid), MADS (Funchal), MADJ (Funchal), MGC (Málaga), MUB (Murcia), NY (New York), O (Oslo), PAL (Palermo), PC (Paris), RO (Rome), S (Stockholm), SALA (Salamanca), TFC (La Laguna), VIT (Vitoria), W (Vienna), Blockeel herbarium (Dore), Dirkse herbarium (Wageningen), Düll herbarium (Bad Müstereifel), Frey herbarium (Berlin) and Privitera herbarium (Catania).

The leaf surfaces, peristomes and spores were studied by scanning electron microscope (SEM), for which the material was fixed in 3% glutaraldehyde with 0.1 cacodylate buffer at 4°C. The samples were washed in cacodylate and saccharose buffer and dehydrated in a rising gradient of acetone (30, 50, 70, 90 and 100%), critical-point dried and gold-sputtered with a 200-300 Å thick-layer before being photographed with a Jeol JSM 6100 microscope, using 10-25 kv acceleration.

For species distribution, we have followed Delgadillo (1975), Hill et al. (1992) and O'Shea (1995).

Relevant diagnostic taxonomic characters

Although the morphological-anatomical aspects characterizing the genus *Aloina* were previously discussed by Delgadillo (1973a, b and 1975), in this paper we evaluate the most important diagnostic taxonomic characters of the gametophyte and sporophyte, including variations found in the study area.

Gametophyte. Apex of the leaves. The apex may be mucronate (*A. aloides*), rounded (*A. ambigua*, *A. brevirostris*), sometimes with excurrent costa (*A. obliquifolia*), obtuse (*A. humilis*, *A. rigida*) or cucullate (*A. bifrons*).

Leaf margins. The leaf margins are entire and strongly incurved from the base of the leaf to the apex. A membranous border in the basal marginal region can be distinguished in some species (e.g., *Aloina brevirostris*, *A. obliquifolia* and *A. rigida*). This consists of 2-3(-4) rows of hyaline, thin-walled cells which vary in shape from quadrate to rectangular. Their size varies from 20-100 µm in length and 7-25 µm in width. All other basal cells have thick reddish-yellow walls. It is particularly important in differentiating *A. rigida* from *A. ambigua* since it is the most important diagnostic feature separating them. However, even with this character it is sometimes difficult to differentiate both species since *A. ambigua* can also have hyaline basal marginal cells similar to those of the membranous border of *A. rigida*, although never with thin walls. Furthermore, the border in *A. ambigua* does not appear fragile as in *A. rigida*.

Costa. Leaves with weakly differentiated (1-2 abaxial stereid layers) to strongly differentiated (3-6 abaxial stereid layers) costa, which may be excurrent at the apex although not forming a hair-point (e.g., *Aloina obliquifolia*). When a hairpoint is present it is derived from laminal cells (*A. bifrons*). The width of the costa as measured at midleaf, varies from (100)250-400(-550) µm.

Sporophyte. Annulus. It is formed of 1-3 layers of large rectangular cells which fall when the capsule is mature. Until recently it was considered to be of taxonomic value whether the annulus fell or remained attached to the mouth of the capsule (Delgadillo 1975, Smith 1978). However, since this can only be clearly observed in young recently dehisced capsules and they soon fall in all species, this character is no longer regarded as relevant.

Peristome. The peristome consists of 16 teeth bifid to the base into 32 yellowish to reddish brown filiform segments, and a basal membrane when present of 2-5 rows of papillose cells (e.g., *Aloina ambigua*, *A. bifrons*, *A. brevirostris*, *A. humilis* and *A. rigida*). The teeth can be in pairs or single, spiralling when dry or remaining open and curved towards the interior of the capsule mouth. The length of the teeth is only important taxonomically to differentiate *A. humilis*, in which they are shorter, from the other species. The taxonomic value of the peristome lies in the presence or absence of a basal membrane. This feature has been used to separate *A. aloides* and *A. obliquifolia*, which do not have a basal membrane, from the rest of the species.

Spores. They are spherical, granulate, 8-33 µm in diameter. Smith (1978) considers the spore size an important taxonomical character to differentiate *Aloina aloides* var. *aloides* from *A. aloides* var. *ambigua*. Nevertheless, we have concluded that the spore size is very similar in both taxa and therefore does not serve to differentiate them.

Descriptions

Aloina (Müll. Hal.) Kindb.

Bih. Kongl. Svenska Vetensk.-Akad. Handl. 6(19): 22, 1882, nom. cons.

Basionym: *Barbula sect. Aloina* Müll. Hal., Syn. I: 596. 1849.

Type: *Aloina aloides* (Schultz) Kindb.

Plants 1.7-10.5 mm high, growing in gregarious or dense turfs. Stems erect, asexual reproduction with basal innovations; in cross-section thin-walled cells forming a cortex; central strand absent or present. Rhizoids reddish-brown, branched and smooth. Leaves 1.2-5.5 mm carnosae, mostly lingulate, ovate or ligulate from an expanded basal part, incurved or imbricate when dry and erect-patent when moist, apex mucronate, rounded, cucullate or not, piliferous or not; margins entire, dentate or crenulate, strongly incurved from the base to the apex, base sheathing, non-decurrent. Hyaline hair-point smooth formed by lamina cells, up to 1.5 mm long when it is present. Costa ending at or some cells below the apex, sometimes excurrent, in cross-section plano-convex, with 13(-15) guide cells in 1-2(-3) layers and 1-4(-8) abaxial stereid layers. Photosynthetic filaments uniseriate, branched or not, inserted on the guide cells and covering all the adaxial surface of the lamina, formed by 2-4(-6) quadrate or subglobose, thin-walled cells, the terminal cells conical with an apical thickening usually smooth, sometimes papillose. Upper and median laminal cells rectangular, quadrate, rounded, rounded-hexagonal or obovate, smooth, thick-walled with rounded corners and of variable size; basal cells quadrate or rectangular, 25-

112 µm long and 12-22 µm wide; basal marginal cells quadrate or rectangular, 20-100 µm long and 6-25 µm wide, hyaline, thin-walled when a membranous border is differentiated, or thick-walled. Dioicous, synoicous, rhizoautoicous or cladautoicous. Perigonium with obovate leaves smaller than perichaetial leaves, with weakly developed costa. Seta erect, 4-23 mm long, reddish-brown, twisted to the right above, to left below; capsule erect, sometimes inclined, cylindrical, ovoid, ovoid-cylindrical or cyathiform, 0.6-5.8 mm long and 0.4-1.3 mm wide, reddish-brown; exothelial cells irregularly quadrate, thick-walled at the mouth of the capsule; annulus broken-off when mature, with 1-3 rows of rectangular and well-differentiated cells; peristome of 16 teeth bifid to the base into 32, yellowish to reddish-brown, spirally twisted, incurved to the capsule or nearly straight and papillose; basal membrane with 2-5 rows of papillose cells projecting above mouth of capsule, sometimes undifferentiated or absent; operculum mostly erect, conical or rostrate, 0.8-4 mm long; calyptra long-conical and with subulate beak, covering 2/3 of the capsule length, 3-6 mm long, yellowish. Spores sphaerical, granulate, 8-33 µm in diameter.

Key of the species

1. Leaf apex with a hyaline, smooth hair-point, up to 1.5 mm long 6. *A. bifrons*
- 1*. Leaf apex without hyaline hair-point 2
2. Leaf apex mucronate; basal membrane of the peristome with 1-2 rows of papillose cells 3
- 2*. Leaf apex cucullate or not, rounded; basal membrane of the peristome with 3-5 rows of papillose cells 4
3. Leaves with mucro formed by excurrent costa, ovate to ovate-lanceolate 5. *A. obliquifolia*
- 3*. Leaves with mucro formed by 2-3 hyaline cells from the lamina, ligulate 1. *A. aloides*
4. Basal marginal cells of the leaves forming a differentiated membranous border consisting of 2-3(-4) rows of quadrate to rectangular, hyaline, thin-walled cells 5
- 4*. Basal marginal cells of the leaves not forming a differentiated membranous border 6
5. Leaves with costa formed by a 3-6 (-8) stereid layers 2. *A. rigida*
- 5*. Leaves with costa formed by 1-2 stereid layers 4. *A. brevirostris*
6. Plants 1.7-3.2 mm high; leaves with weakly differentiated costa, formed by 1-2 abaxial stereid layers. Capsule ovoid to cyathiform; peristome teeth short, nearly straight 7. *A. humilis*
- 6*. Plants 2.6-7 mm high; leaves with strongly differentiated costa, formed by 3-6 abaxial stereid layers. Capsule cylindrical; peristome teeth twisted spirally 3. *A. ambigua*

1. ***Aloina aloides* (Schultz) Kindb.**, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 7: 136. 1883
Fig. 1a-g; Fig. 2a-f

Type: France, in Vogesis Inferioribus ad rupes siliceas colegerunt doctiss. Autumno. Mougeot & Nestler 717. (Lectotype: BM!).

Basionym: *Trichostomum aloides* L. F. Koch ex Schultz, Nov. Act. Leop. Car. 11: 197. 1823.

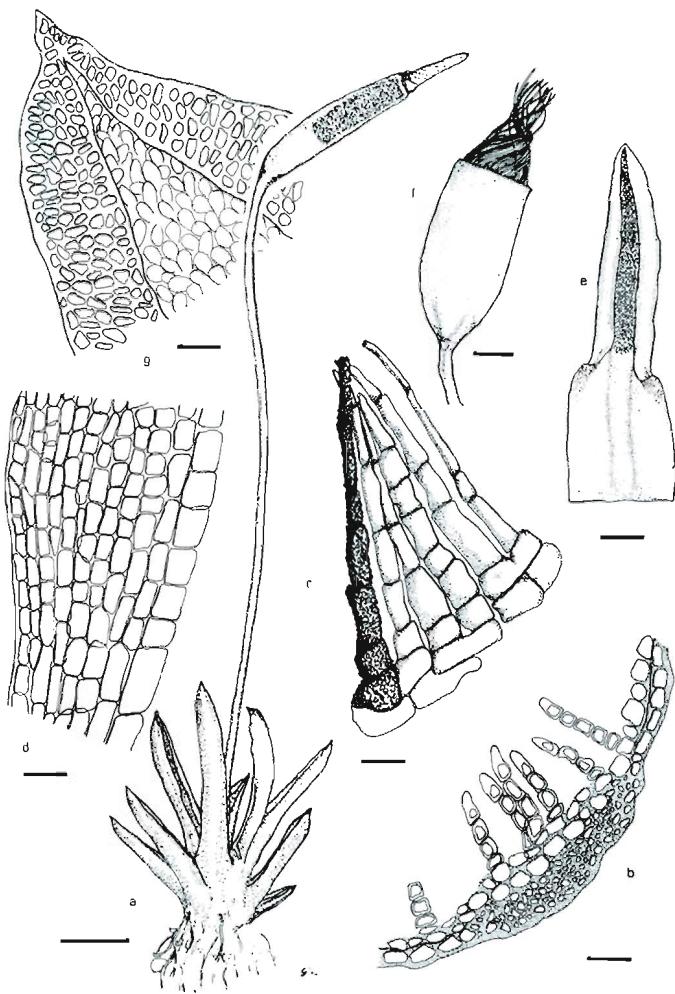


Fig. 1a-g. *Aloina aloides*. a, habit; b, cross-section of leaf; c, peristome teeth; d, basal marginal cells of leaf; e, leaf; f, capsule and peristome teeth; g, leaf apex. Bars = a, 1.2 mm; b, c, d, g, 40 µm; e, f, 400 µm. (From VIT 3184).

Plants 2.5-10.5 mm high; leaves ligulate to linear-ligulate, 1.6-6 mm long and 0.3-1 mm wide; apex acute, obtuse-apiculate, mucronate, cucullate or not; cross-section with 1-3 rows of guide cells and 3-4(-8) dorsal stereid layers; basal marginal cells not forming a membranous border. Dioicous; basal membrane of peristome with 1(-2) rows of cells not projecting above mouth of capsule. Spores 14-25 µm in diameter.

Distribution: Europe, Macaronesia, N Africa and W Asia.

Selected material studied: ALGERIA: Alger-Vablei, Des easons, Appert, 14.4.1896 (B 48567). AUSTRIA, Viena, Mur á Gain près Isla, Lamy, 8.4.1866 (BM 97448). BELGIUM: Comblain, La

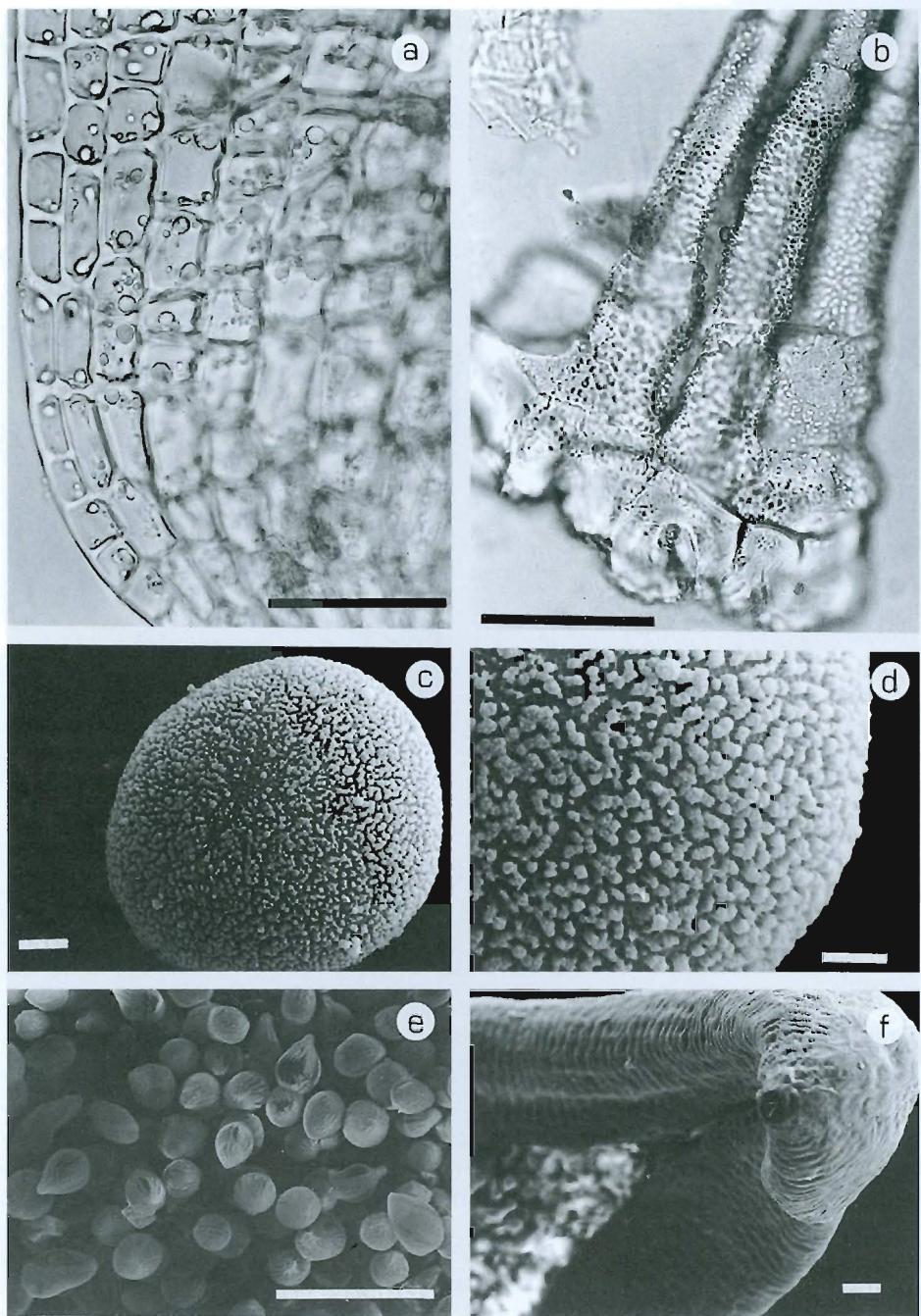


Fig. 2a-f. *Aloina aloides*. a, basal marginal leaf cells; b, detail of peristome showing the under-developed basal membrane; c, spore; d, detail of spore ornamentation showing a granulate ornamentation; e, terminal cells of filaments; f, leaf apex. Bars = a, b, 55 µm; c, 2 µm; d, 1 µm; e, 10 µm; f, 100 µm. (From FI 3765-9).

Tour, Vallée de L'Ourthe, Cornet, 4.1928 (BM 97456f). CYPRUS: Vroisha Valley, 350 m, Townsend, 4.3.1957 (BM 974430). CROATIA: Istrien, 300 m, n.c., 13.2.1930 (B 48560). FRANCE: Igars Cale, Nimes, Boulay, 1.1973 (BR 175911-50). GERMANY: Bavaria, Palatinat, Schultz, 4.12.1860 (LISU G-4439). GREECE: Creta, Prov. Rethimnom, 1 km nörd. Prasies, 330 m, Fleisnischen, 30.3.1972 (Herb. Düll 3628). ITALY: Liguria, oberhalb Solva bei Alassio, Jendralski, 23.4.1958 (BM 97431). LEBANON: Jezzin, Davis, 14.3.1943 (E 5426). MOROCCO: Abdoun, hacia el cabo Trois Fourches, 30SWE0110, 100 m, Ros, Cano, Garilleti, Lara & Gallego, 9.3.1997 (MUB 6596). NETHERLANDS: Beilen, Sgr. Gor., Flaassknecht, 27.2.1965 (JE 38). PORTUGAL: Estremadura, Espichel, entre Azioa e Cabo Espichel, MC85, 150 m, Sérgio, 29.2.1984 (LISU 5046). Madeira, Ponta de Sao Lourenco, CB4224, n.c., (MADJ 7167). SPAIN: Alava, río Bayas, WN0837, 510 m, P. Heras, 6.1.1984 (VIT 3184). Almería, salinas del Cabo de Gata, García-Zamora, Ros & Guerra, 14.11.1987 (MUB 2277). SWITZERLAND: Lanton Alp. Mar. Valleyres, Vaud, Barbey, 29.12.1876 (G). TUNISIA: Golf von Hammamet, 10 km NNE Hammamet, Poelt, 17.4.1982 (GZU 41-82). TURKEY: West-Anatolien, Prov. Izmir, 50 m, n.c., 29.9.1968 (B 91048).

2. *Aloina rigida* (Hedw.) Limpr., Laubm. Deutschl. 1: 637. 1888

Fig. 3a-f; Fig. 4a-f

Type: *Barbula rigida* Hedw. Descr. I. p. 65 ex p.; t. 25, f. 16 (1787). (Lectotype). *Barbula rigida* Hg. Herbier Hedwig-Schwaegrichen 208412. (Epitype: G!).

Basionym: *Barbula rigida* Hedw., Spec. Musc. 11 5. 1801.

Barbula ambigua Bruch & Schimp., Bryol. Eur. 2: 76. 139. 1842 nom. illeg.

Tortula ericaefolia Lindb., Musci Scand. 20. 1879, syn. nov. Type: Norvegia, inter Hundlorfs et Brandvold in Gudbrandsdal, Linblom, Maji 1857. (Holotype: H!).

Aloina ericaefolia (Lindb.) Kindb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 7: (9): 13. 1883.

Plants 2.4-8.2 mm high; leaves lingulate, lingulate-lanceolate or ligulate, 1.8-5 mm long and 0.5-1.8 mm wide; apex rounded, obtuse, cucullate; costa in cross-section with 1-3 rows of guide cells and 3-6(-8) dorsal stereid layers; basal marginal cells long-rectangular, sometimes quadrate, hyaline, thin-walled, 20-100 µm long and 7-25 µm wide forming a well-differentiated membranous border. Dioicous. Basal membrane of peristome with 3-4 rows of cells projecting above mouth of capsule. Spores 11-15 µm in diameter.

Distribution: Widespread in the Northern Hemisphere, boreal-montane but apparently not reaching the Arctic. In the tropics it is found in Ecuador, Bolivia and Peru and extends from Djibouti to Kenya in the African continent. In this paper it is cited for the first time from Egypt.

Observations: It was not possible to study the var. *obtusa* (Jur.) Limpr. since we were unable to locate the type material. Previously *Aloina ericaefolia* Kindb. was considered a synonym of *A. ambigua* (Limpricht 1895, Delgadillo 1975 and Nyholm 1989). After studying the type material of *A. ericaefolia* it was concluded that it corresponds to the concept species of *A. rigida*. The same probably applies to *A. ericaefolia* var. *microphylla* Latzel (Jesel Gimppana "Fripan": ben Hapen luka, 10 m, Latzel, 5.1.1909, Herbarium Latzel, Flora Dalmatica, 398912 BRNO), although we have been unable to ascertain whether the material studied was the type material.

Selected material studied: ALGERIA: Oran, Umgebung von Oran, Trabut, 2.1894 (M 90-95184). AUSTRIA: Kärnten, Karawanken, Loibltal, Glowacki, 6.8.1910 (GZU H 173). CHINA: along highway near km 204 west of Kumuni on Buma road, 1850-1890 m, Redfearn, 24.7.1984 (CANM 309762). CROATIA: Istrien, V. Aurisina (Nabresina), b. Triest, 150 m, n.c., 16.2.1930 (B 48597). EGYPT: Alexandria, Kinghi-Mariouz, Maire, 1910 (BM 97455). FRANCE: Ardèche, Janjae, n.c.,

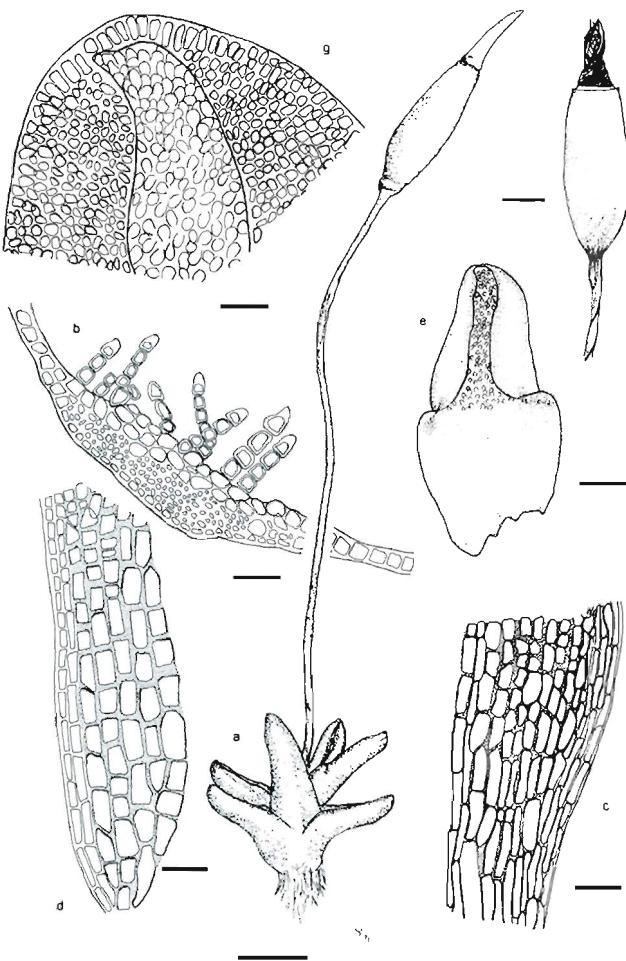


Fig. 3a-g. *Aloina rigida*. a, habit; b, cross-section of leaf; c, d, membranous border of the basal marginal region of leaf; e, leaf; f, capsule; g, leaf apex. Bars = a, 1.2 mm; b, c, d, g, 40 µm; e, f, 400 µm. (From BR 177058-33).

2.1892 (G 260). GERMANY: Bavaria, Unterfranken, 230 m, Vill, 3.1904 (M 90-95/80+81). GREECE: Peloponnesia, Argolida, site of the Argive Heraion, near Mikines, n.c., 3.1988 (Herb. Blockeel 17-296). IRELAND: Dublin, Moore, 1868 (BM 97452b). ITALY: Cerdeña, prope Cagliari, Martio, Müller (E 121/95). JORDAN: Irbid, Ajlun, Anjara, 5 km W, 1100 m, Frey & Kürschner, 19.3.1983 (Herb. Frey 406). LEBANON: Beirut, Syria, Brochen (PC). LIBYA: Bengasi: Aua'Zarda, Zanon, 2.1916 (FI 3765-13). MOROCCO: Berkane, gargantas del Zegzel, 30SWD5855, 370 m, Ros, Cano, Garilleti, Lara & Gallego, 10.3.1997 (MUB 6597). OMAN: Jebel Akhdar, bei Wakhan, 2050 m, Frey & Kürschner, 18.2.1983 (Herb. Frey I-4108). POLAND: Cracovia, pagus Przegorzały prope Cracoviam, Szafram, 21.10.1952 (C 129/95, 27-7). PORTUGAL: Azores, S. Miguel, Mosteiros, PG09, Sérgio (LISU 2657). RUSSIA: Rep. de Gomyj Alfaj, Antän, Teneimkoe osepo, 51° 45' N-870 35' E, 440 m, n.c., 3.6.1989 (MACB 36852). SAUDI ARABIA: Asir, Al Qa'raa, Asir National Park S Abha, 2100 m, Frey & Kürschner, 17.8.1982 (Herb. Frey I-3776). SLOVENIA: Slowenien, Tolmein, Glowacki, 16.4.1908 (GZU H 173). SPAIN: Alava, Oyon, El Cerezo, WN4805, P. Heras, 5.3.1983 (VIT 248183). Alicante, Calpe, salinas El Saladar, 0 m, Cano, Ros & Gallego, 15.3.1993

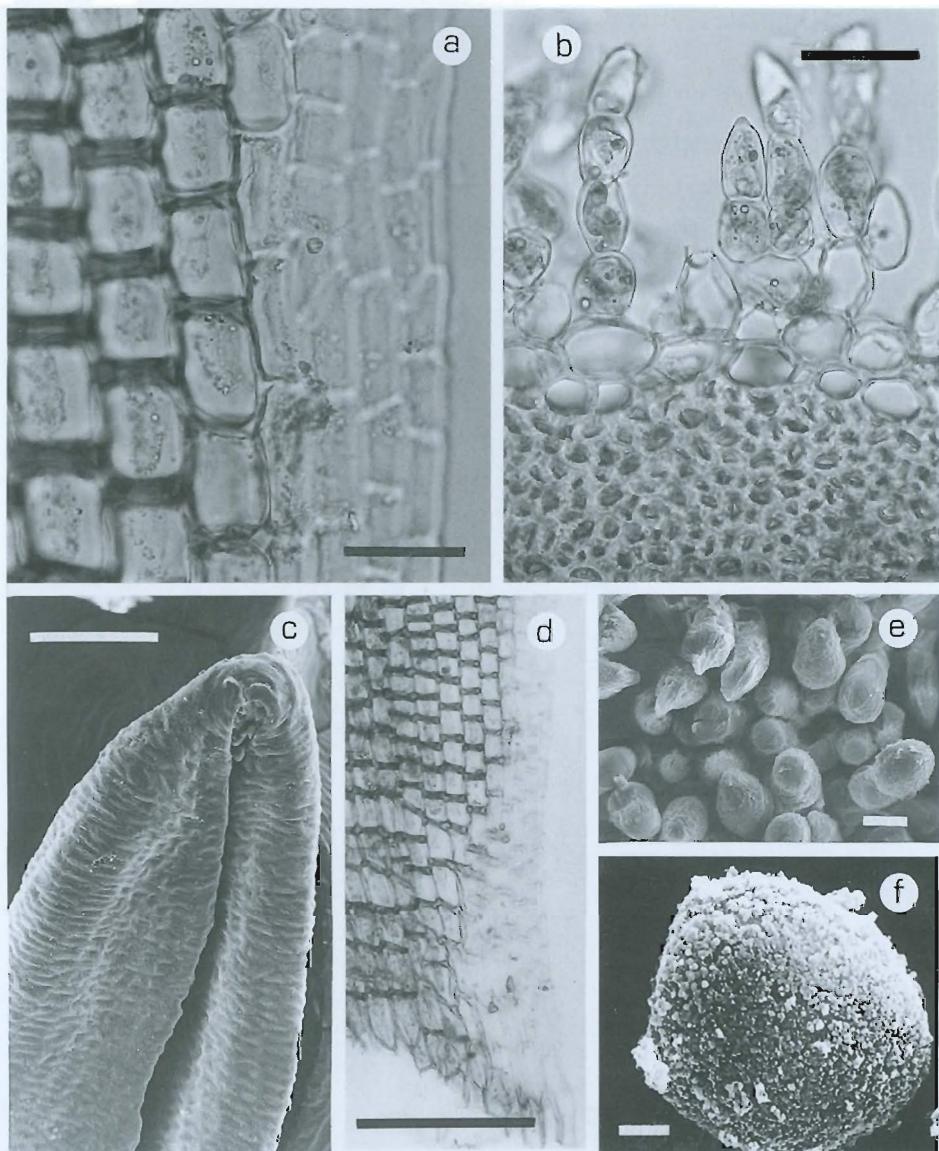


Fig. 4a-f. *Aloina rigida*. a, d, membranous border of the basal marginal region of leaf; b, cross-section of leaf; c, leaf apex; e, terminal cells of filaments; f, spore. Bars = a, b, 28 µm; c, 100 µm; d, 200 µm; e, 10 µm f, 2 µm. (From BR 177058-33).

(MUB 6381). Islas Canarias, Fuerteventura, El Pinar, Betancerría, 19.4.1989 (TFC). SWITZERLAND: nr. Sphügen, Gresons, Amann, 20.7.1924 (BM 97444). TUNISIA: Golf von Hammamet, 10 km NNE Hammamet, Wadi mit angrenzenden Hängen, Poelt, 17.4.1982 (GZU 41-82). TURKEY: Izmir, Smyrna, Unio Itineraria, Fleischer, 1827 (E). YEMEN: between Taizz and Jiblah, near of Naqūl as-Sayyani, 2400 m, Kürschner, 6.9.1993 (Herb. Frey 93-1169).

3. *Aloina ambigua* (Bruch & Schimp.) Limpr., Laubm. Deutschl. 1: 638. 1888
 Fig. 5a-g; Fig. 6a-e

Type: *Barbula rigida* Hedw. Descr. I. p. 65, t. 25, fig. 3 et 5 (1785). (Lectotype). Alicante, sierra de la Carrasqueta, puerto de la Carrasqueta (Jijona), YH1976, 1020 m, Cano, Guerra & Ros, 1.2.1993 (MUB 6375). (Epitype: MUB!).

Plants 2.5-7 mm high; leaves lingulate, lingulate-lanceolate, sometimes ligulate, 2.5 mm long and 0.7-1 mm wide; apex rounded, cucullate; costa in cross-section with 1-3 rows of guide cells and 3-6 dorsal stereid layers; basal marginal cells not forming a membranous border. Dioicous. Basal membrane of peristome with 3-4(5) rows of cells projecting above mouth of capsule. Spores 17.5-27.5 μm in diameter.

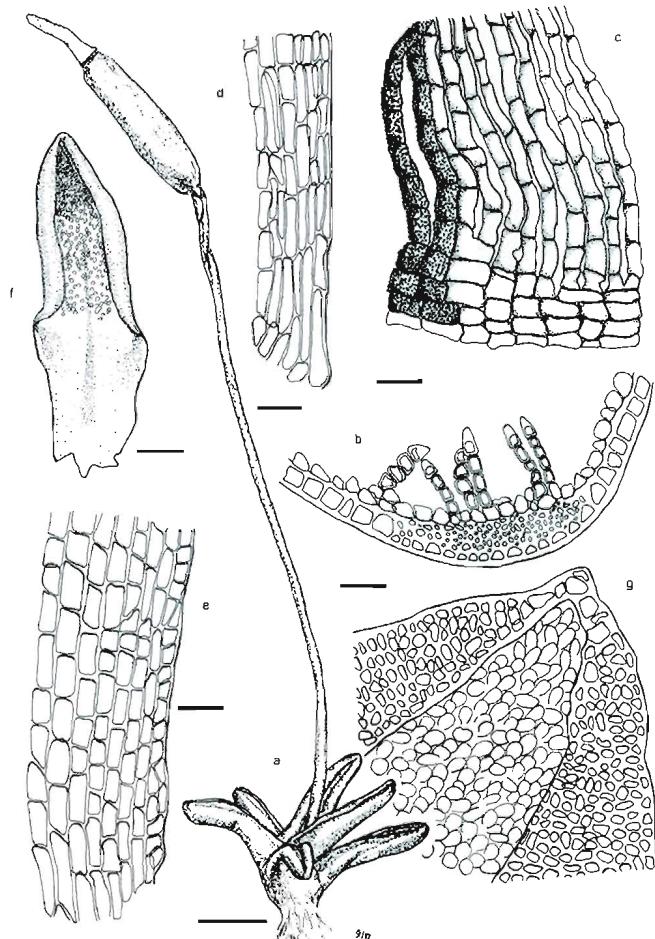


Fig. 5a-g. *Aloina ambigua*. a, habit; b, cross-section of leaf; c, basal membrane of peristome; d, e, basal marginal leaf cells; f, leaf; g, leaf apex. Bars = a, 1.2 mm; b, c, d, e, g, 40 μm ; f, 400 μm . (From VIT 74/90).

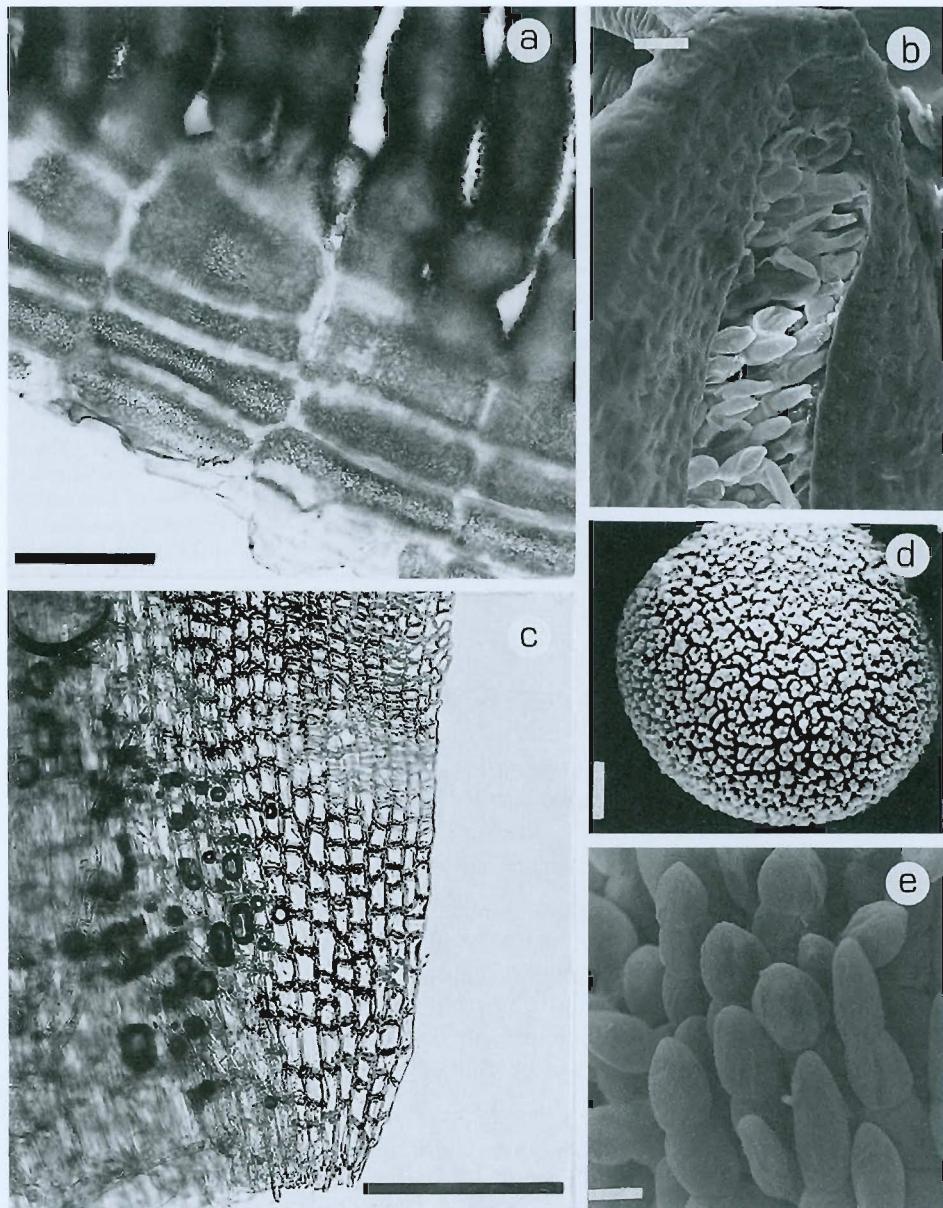


Fig. 6a-e. *Aloina ambigua*. a, basal membrane of peristome; b, leaf apex; c, basal marginal leaf cells; d, spore; e, terminal cells of filaments. Bars = a, 28 μm ; b, 20 μm ; c, 200 μm ; d, 2 μm ; e, 10 μm . (From VIT 74/90).

Distribution: Europe, N Africa, W Asia, Macaronesia, Australia, North and Central America.

Selected material studied: ALGERIA: Kabylie de Collo de Constantine, estuarie de L'Oued Guebli-Collo, Feldman, 17.6.1944 (PC 2726). AUSTRIA: Viena, Mur à Gain près Isla, Lamy, 8.4.1866 (BM 97448). EGYPT: south of Alexandria, Liberation province, along the desert road 41 km, n.c., 16.12.1961 (K 1612/95/1). FRANCE: Mireval, garrigue de la Gardiole, Hérault, 7.4.1963 (BR 177059-34). GERMANY: Nordrhein-Westfalen, Stolberg bei Aachen, MTB5204A, 200 m, n.c., 31.3.1991 (IBA 3467). GREECE: Arch korinthos, Strimer, 6.5.1984 (O). IRELAND: Dublin, Moore, 1868 (BM 97452b). ISRAEL: Golan Heights, near Syrian border, Coll. Morris Blank, Ireland, 1985 (CANM). ITALY: Génova, Staglieno, Mauern der Via Montaldo, Sharbaro, 2.1924 (BP, 175917-56). JORDAN: Irbid, El-Ghor, Tabkat fahel Jordan, -2 m, Frey & Kürschner, 19.3.1983 (Herb. Frey 410). LEBANON: Beirut, les Jables, Libaur, n.c., 17.1.1932 (PC 3). LIBYA: Tripoli, viam P. Taubert, Barbey (G 11). MOROCCO: Oulad Moussa, cerca de Ben-Tieb, 3OSVD7683, 300 m, Ros, Cano, Garilleti, Lara & Gallego 11.3.1997 (MUB 6598). PORTUGAL, Algarve, hillside near Barranco de Apra, E of Loule, 380 m, Long, 25.3.1989 (E 15842). Madeira, Ponta de Sao Lourenço, CB3923, n.c. (MADJ 7115). SPAIN: Alicante, Relleu, río Amadoiro, carretera Relleu-Torremanzanas, km 1, YH3375, 500 m, Cano, 12.12.1993 (MUB 6378). Islas Canarias, La Palma, 1 km EN of Fuencaleiente, 700 m, Long, 7.12.1978 (E 7498). SWITZERLAND: Ginebra, Bernet, 4-1869 (BM 97453a). TUNISIA: Túnez, Kasbah, Pitard, 11.1907 (G). TURKEY: Smyrna, Anatolian, Prov. Izmir, n. Kusadasi, 2 m, n.c., 13.6.1965 (Herb. Düll 2616). YEMEN: Yemen, Hadramout, Jol Plateau, Kor Saiban escarpment SE of Wadi Dawan, 1900 m, Kürschner, 29.8.1993 (Herb. Frey 93-1054-55).

4. *Aloina brevirostris* (Hook. & Grev.) Kindb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 7: 137.1883 Fig. 7a-f; Fig. 8a-g

Type: Not designated in original description, but rather based on several specimens, for which reason a lectotype is designated. Sweden, same as H-1674. Herb. Hort. Kew., Swartz, II-d (Lectotype: BM!).

Basionym: *Tortula brevirostris* Hook. & Grev., in Edinburgh J. Sci. 38: 289. 12. 1824.

Plants 4-6 mm high; leaves lingulate, ligulate or oblong-ovate, 2.5-3.5 mm long and 0.5-1 mm wide; apex rounded, cucullate; margins entire; base slightly sheathing; costa in cross-section with 1-2 rows of guide cells and 1(-2) dorsal stereid layers. Basal marginal cells rectangular, hyaline, thin-walled, 20-42 µm long and 10-20 µm wide forming a differentiated membranous border. Synoicous. Basal membrane of peristome with 3-4 rows of cells projecting above mouth of capsule. Spores 15-25 µm in diameter.

Distribution: Circumpolar. A mainly boreal and arctic species. Also it has been recorded in Zimbabwe. N, NE and Central Europe. Recently observed in the Iberian Peninsula, Canary Islands and Greece (Gallego & Cano 1998). In this paper it is cited for the first time from Algeria and Tunisia.

Observations: This species shows great variety in capsule, seta, leaf and operculum size although this last structure is the shortest within the genus. In the specimens studied from the Mediterranean basin the operculum is longer than in the Centroeuropean samples. Characteristically it has suborbicular leaves and differs from *A. rigida* principally by the absence of a clearly distinguishable costa.

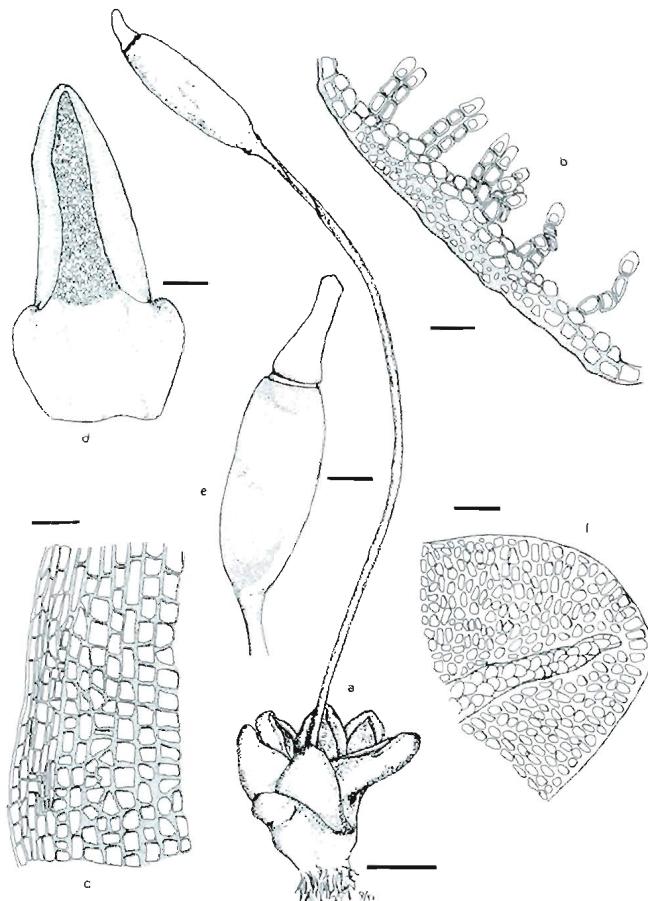


Fig. 7a-f. *Aloina brevirostris*. a, habit; b, cross-section of leaf; c, membranous border of the basal marginal region of leaf; d, leaf; e, capsule; f, leaf apex. Bars = a, 1.2 mm; b, c, f, 40 µm; d, e, 400 µm. (From E 121/95).

Selected material studied: ALGERIA: Orán, Balanser, n.c., 1852 (BM). AUSTRIA: Tyrol, Lienz in deilivibus ad flumen Dravum, Zander, 1887 (BM 97446). GERMANY: Prov. Hannover, Lüneburger Kalkgruben, Timm, 30.10.1910 (M 90-95/16). GREECE: Cyclades Archipelago, Santorini islands, Thira, 36°22'N 25°27'E, 500 m. Mt. Profitis Llias, Sipman & Raus, 16.5.1990 (B 271370). JORDAN: Kerak, etwa 25 km Fenan, 760 m. Baierle, 4.1986 (Herb. Frey I-4704). NORWAY: Christiania, Zetterstedt & Wickbom, 1819 (E 121/95). POLAND: Stettin, Finkenwalde, Winkelmann, 14.10.1899 (M 90-95/13). SPAIN: Argedas, cerca de Los Molares, XM2173, 270 m. Heras, 17.3.1985 (VIT 331/85). Islas Canarias, Tenerife, Puerto de San Marcos, 30 m, Long. 14.1997 (E 5730). Lanzarote, Hascha Grande, 350 m, Malme, 1.1.1978 (O 688). SWEDEN: Scania Hanmschvg, Hasslow, 11.10.1922 (O 90-95/190-19). TUNISIA: Túnez, 117 km EN Gafsa, faid bei Sidi Bouzid, Stipacek, n.c., 21.4.1982 (GZU 1-82). TURKEY: Alatau, Brotherus, 13.8.1896 (BM 97443).

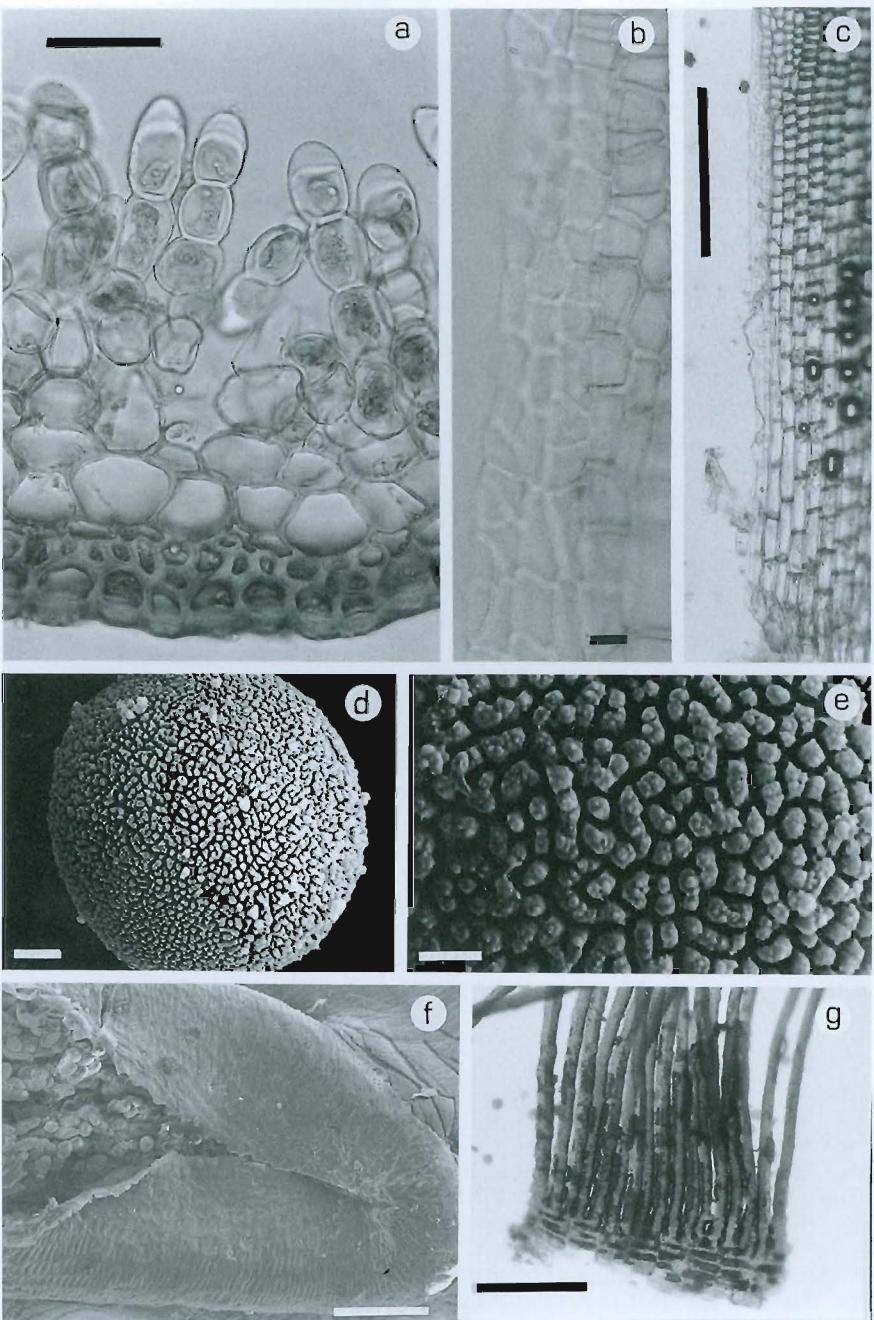


Fig. 8a-g. *Aloina brevirostris*. a, cross-section of leaf; b, c, membranous border of basal marginal region of leaf; d, spore; e, detail of spore; f, leaf apex; g, basal membrane of peristome. Bars = a, 28 μm ; b, 20 μm ; c, 200 μm ; d, 2 μm ; e, 1 μm ; f, 100 μm ; g, 165 μm . (From E 121/95).

5. *Aloina obliquifolia* (Müll. Hal.) Broth., Nat. Pfl. 1(3): 428. 1902.

Type: China interior, provincia Schen-si sept., in monte Tui-Kio-san, Giraldi, 20.10.1896. (Holotype: H!).

Basionym: *Barbula obliquifolia* Müll. Hal., Nuov. Giorn. Bot. Ital. n. ser. 5: 178. 1898.

Aloina rigida var. *obliquifolia* (Müll. Hal.) Delgad., The Bryologist 78: 264-265. 1975.

Barbula rigida var. *mucronulata* Bruch & Schimp., Bryol. Eur. 2: 75. 1842. syn. nov.

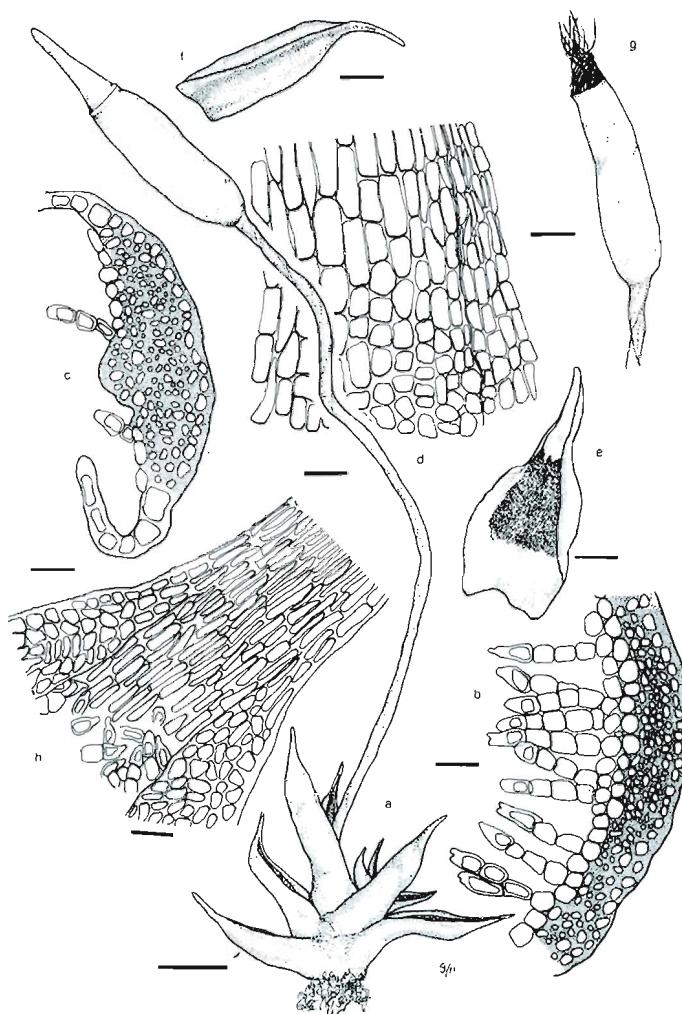


Fig. 9a-h. *Aloina obliquifolia*. a, habit; b, c, cross-sections of leaves; d, membranous border of the basal marginal region of leaf; e, f, leaves; g, capsule and peristome teeth; h, leaf apex. Bars = a, 1.2 mm; b, c, d, h, 40 µm; e, f, g, 400 µm. (From M 9095).

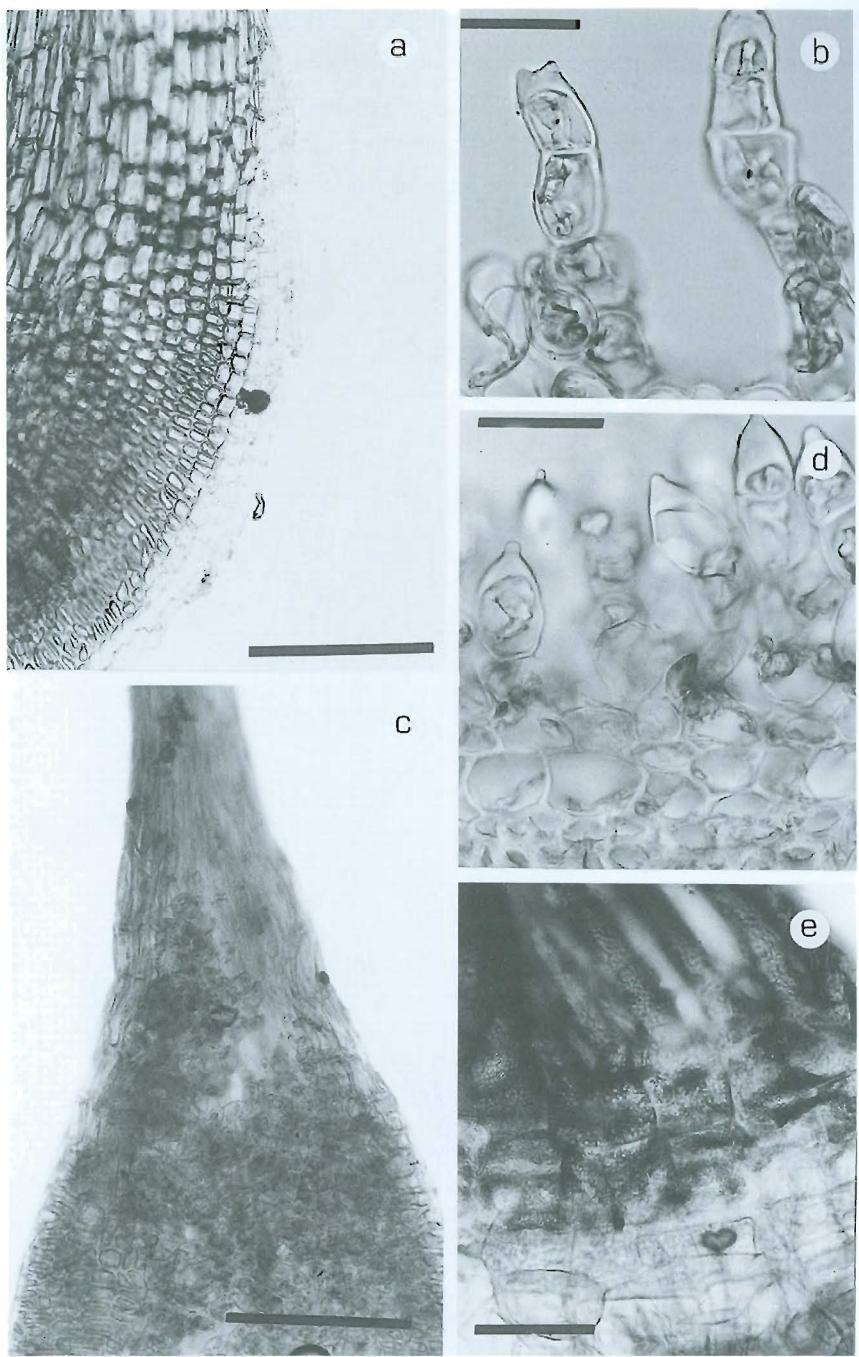


Fig. 10a-e. *Aloina obliquifolia*. a, membranous border of the basal marginal region of leaf; b, d, terminal cells of filaments; c, leaf apex; e, detail of peristome showing the under-developed basal membrane. Bars = a, c, 200 μm ; b, d, e, 28 μm . (From M 9095).

Plants 2.5-5 mm high; leaves ovate or ovate-lanceolate, 2.2-3 mm long and 0.2-0.8 mm wide; apex mucronate, cuspidate or subulate, sometimes acuminate; margins denticulate or crenulate near the apex; costa excurrent, in cross-section with 1-3 rows of guide cells and (2)3-4(-6) dorsal stereid layers, forming a protuberance near the apex due to increased number of stereid layers in that part, photosynthetic filaments 3-5 cells high, the terminal cell with 1(-3) papillae, sometimes smooth; basal marginal cells forming a well differentiated membranous border. Autoicous. Basal membrane of peristome with 1-2 rows of cells which do not project above mouth of capsule. Spores 10-15 μm in diameter.

Distribution: According to Delgadillo (1975) it extends from the south of France and northern Italy, to Lithuania in the east, Ireland in the west and Sweden in the north. Also it is present in China.

Selected material studied: AUSTRIA: Dumstein, n.c., 31.8.1943 (BM 97429b). Steiermark, bei Burgstall, W Großklein, 350 m, Poelt, 3.9.1990 (GZU 73-90). CZECH REPUBLIC: Böhmen, Librantice bei Königsgrätz a.E., im Dorf, 260 m, Vanek, 29.6.1934 (BM 974444). GERMANY: Bavaria, Unterfranken bei Gerolzhofen, 230 m, Vill, 3.1904 (M 90-95/80+81). ITALY: Südtirol, Vinschgau, Sonnenberg zw. Schlanders und Vezzan, 850 m, Köckinger, 28.10.1989 (GZU 129-89). POLAND: Oberschlesien, Beuthen, 250 m, Graw, 14.9.1935 (M 9095/70).

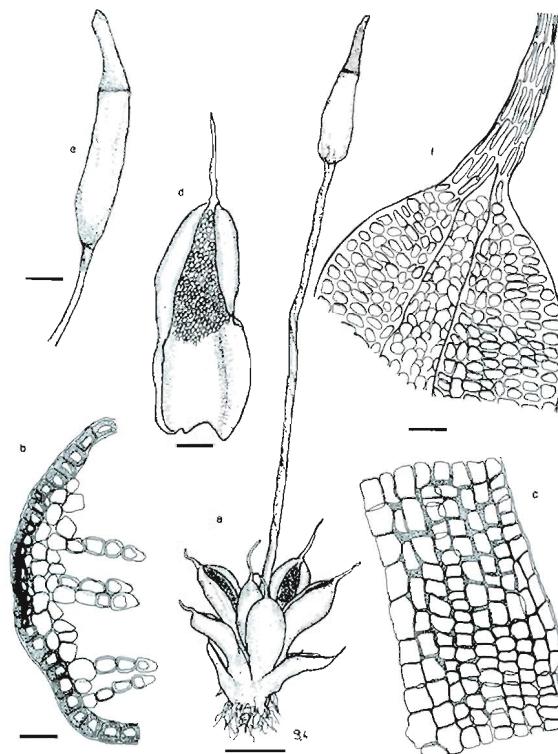


Fig. 11a-f. *Aloina bifrons*. a, habit; b, cross-section of leaf; c, basal marginal cells of leaf; d, leaf; e, capsule; f, leaf apex. Bars = a, 1.2 mm; b, c, f, 40 μm ; d, e, 400 μm . (From MUB 4549).

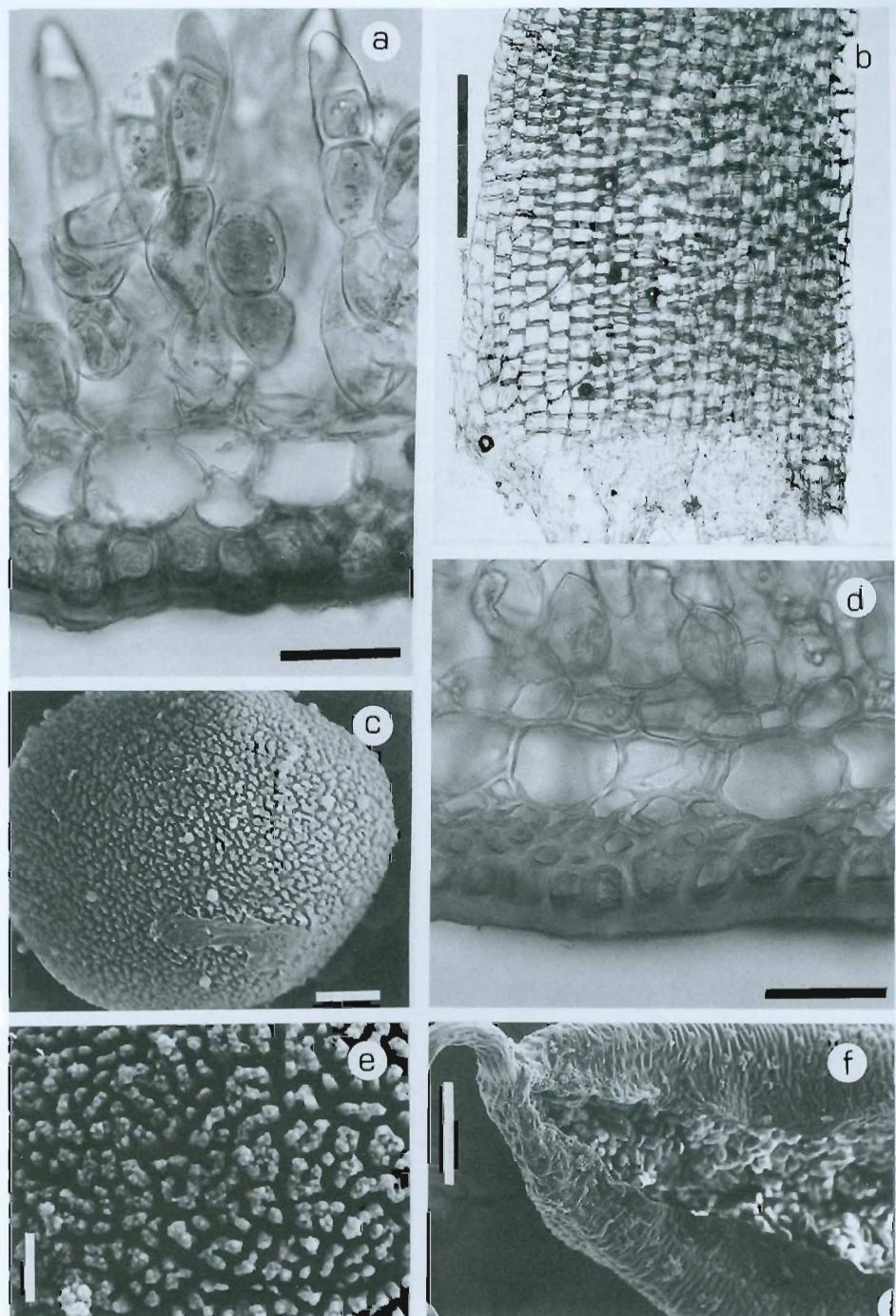


Fig. 12a-f. *Aloina bifrons*. a, d, cross-sections of leaf; b, basal marginal cells of leaf; c, spore; e, detail of the spore ornamentation; f, leaf apex. Bars = a, d, 28 μm ; b, 220 μm ; c, 2 μm ; e, 1 μm ; f, 100 μm . (From MUB 3504).

6. **Aloina bifrons** (De Not.) Delgad., Bryologist. 76: 273. 1973

Fig. 11a-f; Fig. 12a-f

Type: Cagliari, ad margines agrorum. Herb. E. Fiorini-Mazzanti, 22/90, De Notaris. (Possible holotype: RO!).

Basionym: *Tortula bifrons* De Not., Mem. Reale Accad. Sci. Torino 40: 305. 1838.

Plants 3-8 mm high; leaves lingulate or ovate-lanceolate, 1.2-3 mm long and 0.4-1.1 mm wide; apex cucullate; hyaline hair-point up to 1.5 mm long, smooth, formed from the lamina; costa in cross-section with 1-2 rows of guide cells and 1(2) dorsal stereid layers; basal marginal cells hyaline not forming a membranous border. Dioicous. Basal membrane of peristome with 2-5 rows of cells projecting above mouth of capsule. Spores 8-24 μm in diameter.

Distribution: S Europe, N Africa, SW Asia, North and Central America, Australia, New Zealand. In this paper it is cited for the first time from Morocco.

Observations: An easily distinguishable taxon within the genus, it alone has a long hyaline hair-point at the apex of leaves. Also characteristic is the usual absence of stereids in the lamina. If present, the stereids appear in one row, which is not usually uniform so that the costa is at best weakly distinguished.

Selected material studied: CANADA: Summerland, 49°40'N 119°35'W, Schofield & McIntosh, 23.4.1980 (CANM 283058). ITALY: Roma, 700 m (Herb. Privitera). Cerdeña, Notaris (BM 97429f). ISRAEL: Jerusalem, Talpiot, Reichert, 20.I.1931 (PC). JORDAN: Kerak, Khirbet en-Nahas, N Fenan, 320 m, Frey & Kürschner, 10.3.1986 (Herb. Frey I-4431). LEBANON: the ruins of Baalbek, n.c., 24.4.1967 (K 1612/95/8). MOROCCO: carretera entre Ketama y Asilah, cerca del cruce con la carretera a Tawnat, 30SUD5562, 1400 m, Ros, Cano, Garilleti, Lara & Gallego, 14.3.1997 (MUB 6599). SPAIN: Hellín, carretera de Las Minas a Agramón, XH1644, 450 m, Ros, Guerra & Martínez Sánchez, 19.4.1991 (MUB 4549). Granada, Cúllar, cortijo D. Andrés, Guerra & Ros, 4.3.1988 (MUB 3620). TUNISIA: N of the ruins of Thuburbo Majus, 9.5.1983 (K 1612/95/19). TURKEY: Prov. Urfa, sur de Urfa, 409 m, Mull, 11.10.1906 (E 193). U.S.A.: California, along Highway 99, 10 mi S of Bakersfield, Kem Co., L.F. Koch, 2.5.1954 (CANM 131979).

7. **Aloina humilis** M.T. Gallego, M.J. Cano & Ros, Nova Hedwigia 67: 119. 1998

Fig. 13a-f; Fig. 14a-f

Type: ESPAÑA, isla de Fuerteventura, NE de la ladera del monte Fenduca, Morro de los Olivos, 3 km NNE de Pájara, laderas rocosas secas con *Kleinia*, *Launaea*, *Allium* y *Euphorbia*, 585-3135, 400-500 m, G.M. Dirkse, 12.2.1992. (Holotype: MUB 6801!).

Plants 1.7-3.2 mm long; leaves ovate-lingulate, 0.9-2.2 mm long, 0.3-0.75 mm wide; apex rounded to obtuse, cucullate or not; costa in cross-section with 1-2 guide cells rows and 1(-2) stereid layers; basal marginal cells not forming a membranous border. Autoicous. Peristome teeth, short, nearly straight; basal membrane with 1-3 rows of cells projecting above mouth of capsule. Spores 20-22.5 μm in diameter.

Distribution: This taxon has till now only been found in Tenerife, El Hierro and Fuerteventura (Gallego & al. 1998).

Paratypes studied: SPAIN: Islas Canarias, El Hierro, al oeste de Valverde, Ermita Virgen de la Peña, Las Lajas, 205-3075, 600-740 m, Dirkse, 17.3.1991 (Herb. Dirkse 8429). Tenerife, 2.5 km al este de Arico Viejo, 355-3115, 200 m, Dirkse, 25.3.1991 (Herb. Dirkse 8510).

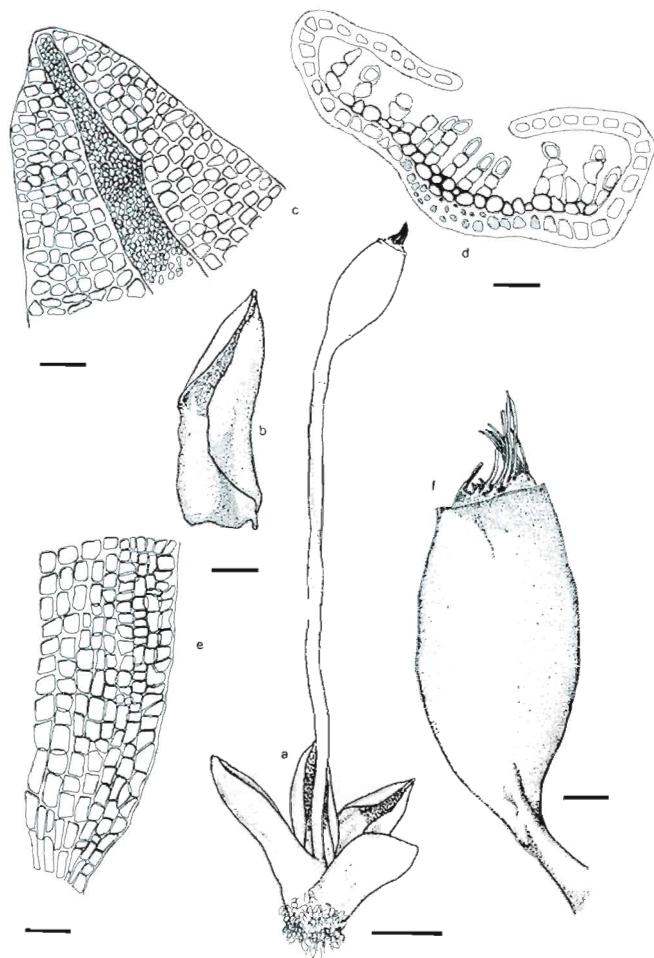


Fig. 13a-f. *Aloina humilis*. a, habit; b, leaf; c, leaf apex; d, cross-section of leaf; e, basal marginal cells of leaf; f, capsule and peristome teeth. Bars = a, 0.7 mm; b, 200 µm; c, d, e, 40 µm; f, 160 µm. (From Herb. Dirkse 8429).

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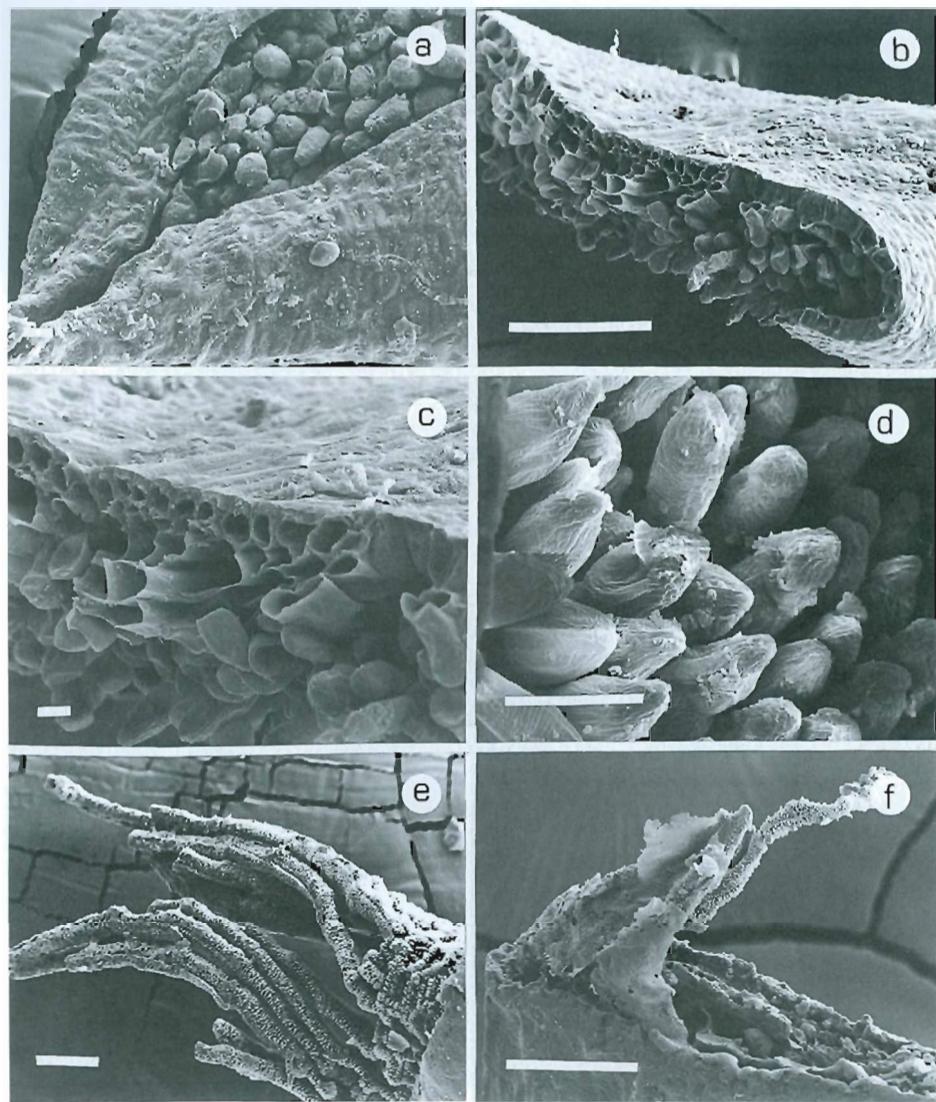


Fig. 14a-f. *Aloina humilis*. a, leaf apex; b, c, cross-sections of leaf; d, terminal cells of filaments; e, f, peristome teeth. Bars = a, c, d. 10 μ m; b, e, f 100 μ m. (From Herb. Dirkse 8429).

References

- DELGADILLO, M.C. (1973a): A new species, nomenclatural changes, and generic limits in *Aloina*, *Aloinella*, and *Crossidium* (Musci). - Bryologist 76: 271-277.
- DELGADILLO, M.C. (1973b): A quantitative study of *Aloina*, *Aloinella*, and *Crossidium* (Musci). - Bryologist 76: 301-305.

- DELGADILLO, M.C. (1975): Taxonomic revision of *Aloina*, *Aloinella* and *Crossidium* (Musci). - *Bryologist* **78**: 245-303.
- GALLEGÓ, M.T. & M.J. CANO (1998): *Aloina brevirostris* (Hook & Grev.) Kindb., new for Greece, the Iberian Peninsula and the Canary Islands. - *J. Bryol.* **20**: 245-246.
- GALLEGÓ, M.T., M.J. CANO, R.M. ROS, J. GUERRA & G.M. DIRKSE (1998): *Aloina humilis* sp. nov. (Bryopsida, Pottiaceae) from the Canary Islands. - *Nova Hedwigia* **67**: 119-124.
- HEDWIG, J. (1801): Species muscorum frondosorum descriptae. Leipzig.
- HILL, M.O., C.D. PRESTON & A.J.E. SMITH (1992): Atlas of the Bryophytes of Britain and Ireland. Vol. 2. Mosses (Except Diplolepidiae). - Harley Books. Colchester & Essex.
- LIMPRICHT, K.G. (1895): Die Laubmose Deutschlands, Österreichs und der Schweiz. Part 11. - Kummer. Leipzig.
- NYHOLM, E. (1989): Illustrated Moss Flora of Nordic Mosses, Fasc. II. Nord. Bryol. Soc. Copenhagen & Lund.
- O'SHEA, B. (1995): Checklist of the mosses of sub-Saharan Africa. - *Tropical Bryology* **10**: 91-198.
- SMITH, A.J.E. (1978): The Moss Flora of Britain & Ireland. - Cambridge University Press. Cambridge.

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