

**Remarkable new records to the bryophyte flora of Yemen
(al-Mahra and Socotra Island)
Additions to the Bryophyte Flora of the Arabian
Peninsula and Socotra 6**

Harald KÜRSCHNER^{a*} & Ryszard OCHYRA^b

^a *Institut für Biologie Systematische Botanik und Pflanzengeographie,
Freie Universität Berlin, D-14195 Berlin, Germany*

^b *Laboratory of Bryology, Institute of Botany,
Polish Academy of Sciences, ul. Lubicz 46,
PL-31-512 Kraków, Poland*

(Received 3 August 2003, accepted 28 October 2003)

Abstract – Remarkable major range extensions for one species of hepatic and five species of moss are provided. *Brachymenium leptophyllum* (Müll. Hal.) A. Jaeger is a new addition to the moss flora of mainland Yemen on the Arabian Peninsula and *Plagiochila fusifera* Taylor, *Fissidens flaccidus* Mitt., *Macrocoma tenuis* (Hook. & Grev.) D. H. Vitt subsp. *tenuis*, *Felipponea assimilis* (Müll. Hal.) O'Shea and *Scorpiurium circinatum* (Brid.) M. Fleisch. & Loeske are recorded for the first time from Socotra Island which administratively belongs to Governorate Hadramout of Yemen. Except for the last, all species are briefly described and illustrated from Yemeni material and the global geographical distribution of all species is reviewed and mapped.

Bryophyta / Yemen / Socotra / phytogeography / distribution maps / taxonomy

INTRODUCTION

Based on a recent bryophyte collection made in the spring of 2003 by the first author from the hitherto undercollected Socotra Island in the Indian Ocean, which administratively belongs to Governorate Hadramout of Yemen, five new species are added to the bryophyte flora of the island (cf. Kürschner, 2000). They are common in the high montane range of the western Haghier Mountains (Skent area, 1400-1550 m) which is densely covered by an evergreen Afromontane woodland (e.g., *Eucllea divinorum*, *Pittosporum viridiflorum*, *Sideroxylon discolor*), interspersed with numerous granitic rock outcrops, boulders, and shelters, where fog and mist are typical. These discoveries indicate that the bryophyte flora of Socotra is still in need of more detailed investigation. So far, 71 bryophyte species

* Correspondence and reprints

have been recorded on Socotra Island comprising 1 hornwort, 30 hepatics and 40 mosses (Kürschner, 2000, 2003b).

In addition, one epiphytic moss, *Brachymenium leptophyllum*, hitherto restricted to subtropical and tropical Africa, is reported from mainland Yemen. It is a common element of the endemic *Anogeissus dhofarica* monsoon woodland, ranging from the Hawf Mountains at the Omani border to Jabal Fartak in Governorate al-Mahra in the west. On the mainland of Yemen the bryophyte flora is richer than on Socotra Island and hitherto 117 species have been recorded, including 1 hornwort, 34 liverworts and 82 mosses (Kürschner, 2000, 2003a).

LIST OF TAXA

Hepaticophytina

Plagiochilaceae

Plagiochila fusifera Taylor (Fig. 1)

Plants 1-2 cm long, to 4.5 mm broad, little branched; antical bases of leaves decurrent in a small tapering wing, usually leaving the stem well exposed; leaves succubous, imbricate, complanate, \pm triangular, widest near the base, 1.5-2.0 mm long, 0.9-1.4 mm wide; marginal teeth short, triangular, often about as long as broad, ending in 1-2 cells which are always short; leaf cells isodiametric, $15\text{-}20 \times 18\text{-}24 \mu\text{m}$, trigones distinct, triangular; perianth and sporophyte not seen in Socotran material.

Specimen examined – YEMEN. GOVERNORATE HADRAMOUT. *Socotra Island*: Haghier Mts., Skent, Arra'bin area, lat. $12^{\circ}34'20.7''\text{N}$, long. $54^{\circ}01'03''\text{E}$, alt. 1470 m, on wet granite rocks, 12 Mar. 2003, *Kürschner 03-88* (B).

A xerotropical palaeo-African species, widespread in Cameroun, Central African Republic, the Democratic Republic of Congo (Zaire), Ethiopia, Gabon, Ghana, Guinea, Ivory Coast, Kenya, Malawi, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Tanzania, Togo, and Uganda (Jones, 1962; Wigginton & Grolle, 1996; Fig. 1.1). Previously reported also from the Arabian Peninsula [Yemen: Jabal Milham, Jabal Thallamlan/J. Raymah, and Mahwit (Long, 1987; Kürschner, 2000)]. According to Jones (1962) it is the most abundant *Plagiochila* species of the southern Guinea zone of Nigeria and similar climates in East Africa and seems to be characteristic in areas with a sufficiently high rainfall but a pronounced dry season.

Bryophytina

Fissidentaceae

Fissidens flaccidus Mitt. (Fig. 2)

Plants small, yellowish to translucent green, up to 15 mm tall; leaves distant, in 12-16 pairs; upper leaves to 2.5 mm long, narrowly bordered of 1-2 rows of very narrow cells; costa vanishing below the leaf tip; lamina cells large, irregularly hexagonal, thin-walled, $30\text{-}40 \mu\text{m}$.

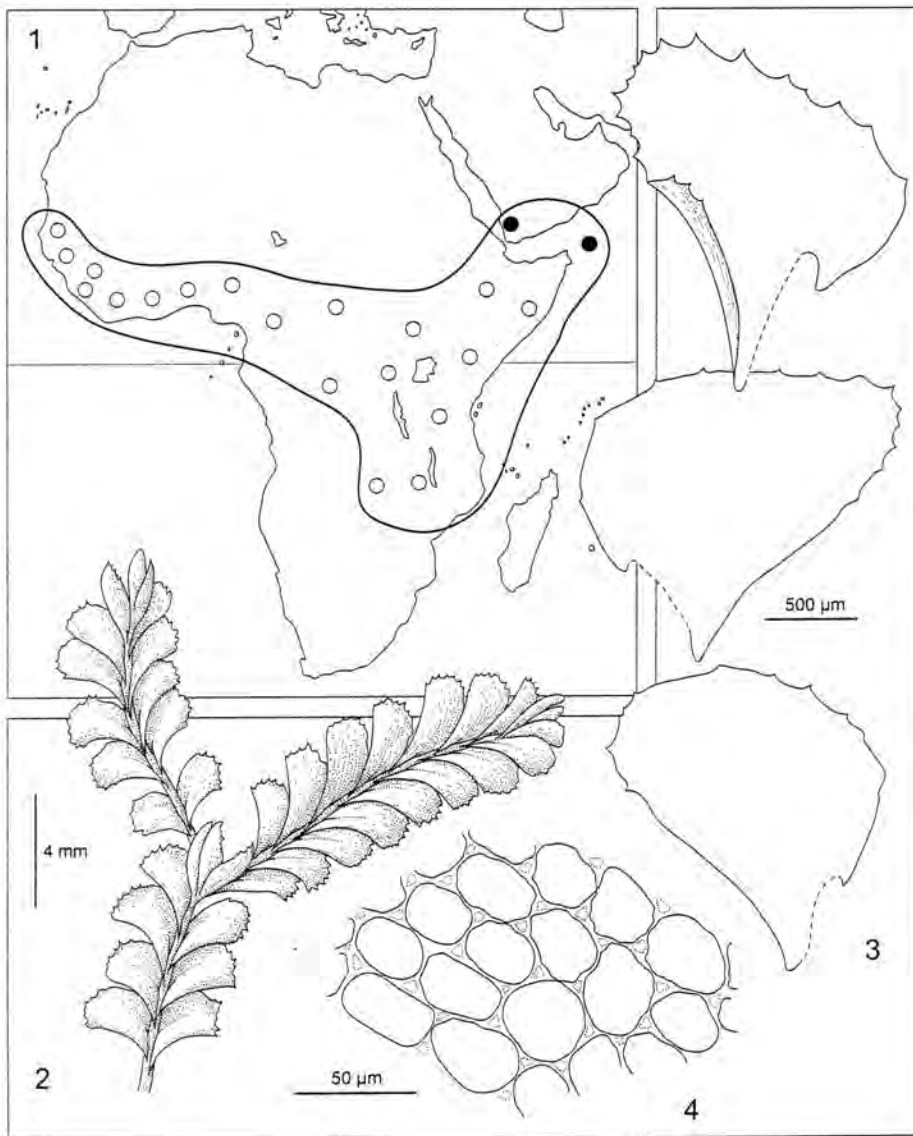


Fig. 1. *Plagiochila fusifera* Taylor. – 1. Distribution (open circles: country records only, cf. Jones, 1962 and Wigginton & Grolle, 1996). 2. Habit (dorsal view). 3. Leaves. 4. Leaf cells (all from Kürschner 03-88, B).

Specimen examined – YEMEN. **GOVERNORATE HADRAMOUT. Socotra Island:** Wadi Ayhaft south of Muri, lat. 12°35'52"N, long. 53°59'03"E, alt. 120 m, on soil in rock crevices, 22 Mar. 2002, Kürschner 02-142 (B).

A widespread pantropical species reported throughout much of tropical America (Delgadillo *et al.*, 1995), for example from Mexico (as *F. megacistis*

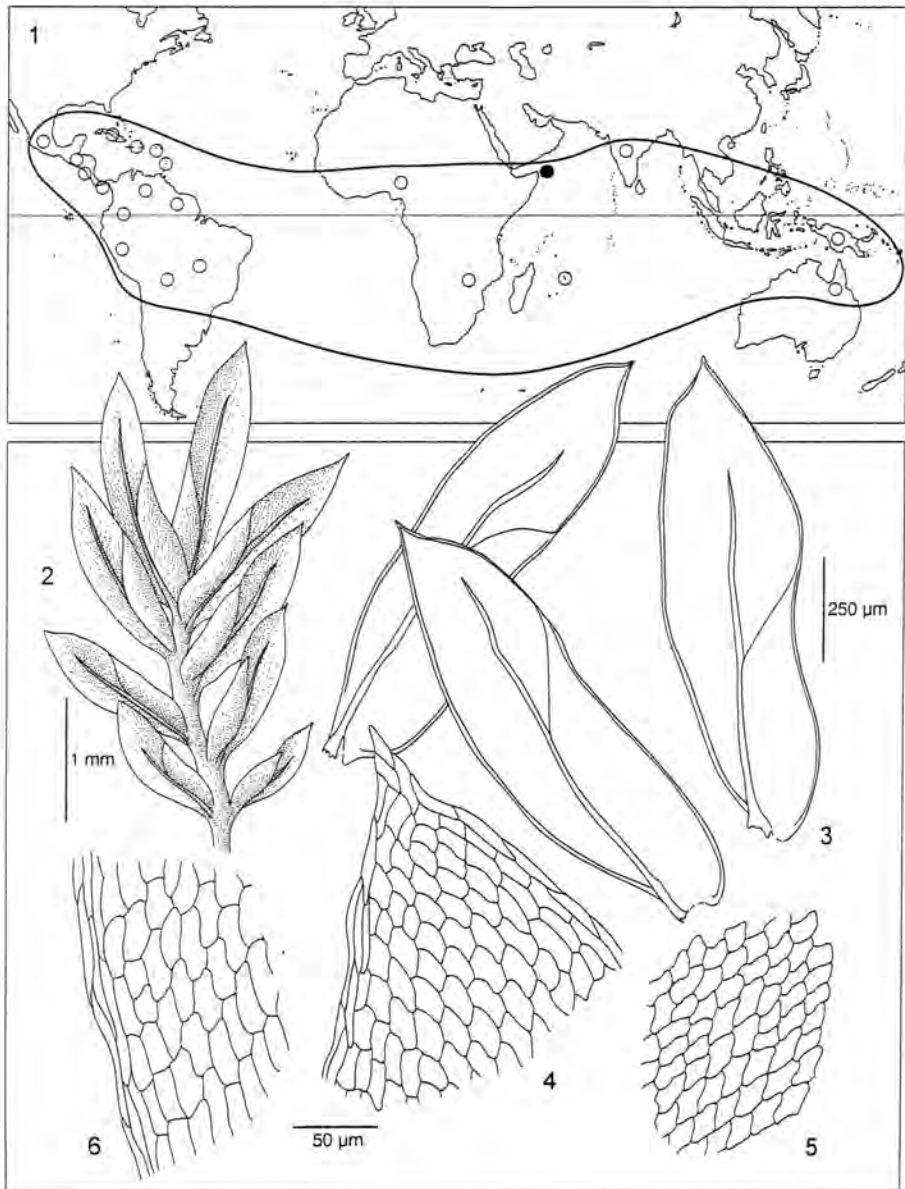


Fig. 2. *Fissidens flaccidus* Mitt. – 1. Distribution (open circles: country records only, cf. O’Shea, 1995). 2. Habit. 3. Leaves. 4. Leaf apex. 5. Mid-leaf cells. 6. Basal leaf cells (all from Kürschner 03-142, B).

Pursell, *F. mollis* Mitt.), Central America [Costa Rica, El Salvador, Guatemala, Panama (as *F. mollis*), the West Indies [Cuba, the Dominican Republic, Haiti, Puerto Rico (as *F. mollis*)], the Lesser Antilles [e.g., Guadeloupe (as *F. palmatus* Besch.)], and South America [Brazil (as *F. schwackeanus* Broth.), Colombia,

Paraguay, Peru, Suriname, Venezuela (as *F. mollis*), Africa [Mascarenes/Rodriguez, Nigeria, Zimbabwe (O'Shea, 1995)], Indo-Malaya from India to New Guinea (as *F. atroviridis* Besch., *F. splachnobryoides* Broth.; cf. Eddy, 1988), and Australia (Queensland, as *F. maceratus* Mitt.) (for the puzzling synonymy cf. Pursell, 1997). Previously reported from the Arabian Peninsula from Oman [Dhofar, Jabal Qara near Salalah, (Bruggemann-Nannenga, 1987)].

Bryaceae

Brachymenium leptophyllum (Müll. Hal.) A. Jaeger (Fig. 3)

Plants corticolous, in dense mats, very variable in size, habit, shapes of leaves and capsules; leaves very soft, strongly twisted when dry, oblong-lanceolate to obovate, bordered by 1-2(-3) rows of elongate cells, the margin nearly entire; costa long excurrent; lamina cells thin-walled, lax, hexagonal to short-rectangular, 9-11 × 36-45 µm; autoicous; capsule inclined to pendulous or nearly erect, the neck variable in length; operculum with apiculus or none; spores 40-45 µm in diameter, densely papillose.

Specimens examined – YEMEN. GOVERNORATE AL-MAHRA. *Hawf Mts.*: Uteq area near al-Ayn, lat. 16°38.9'N, long. 52°57.6'E, alt. 780 m, epiphytic on *Anogeissus dhofarica*, 29 Sept. 2001, *Kürschner 01-1280* (B, KRAM; det. R. Ochrya); same locality, epiphytic on *Commiphora gileadensis*, 30 Sept. 2001, *Kürschner 01-1303* (B); same locality, alt. 950 m, epiphytic on *Anogeissus dhofarica*, 29 Sept. 2001, *Kürschner 01-1301* (B); Cha'rud area near Damqawt, lat. 16°33.5'N, long. 52°46.2'E, alt. 720 m, epiphytic on *Acacia etbaica* subsp. *uncinata*, 2 Oct. 2001, *Kürschner 01-1326* (B); same locality, lat. 16°34'01.8"N, long. 52°46'17.4"E, alt. 750 m, epiphytic on *Anogeissus dhofarica*, 22 Aug. 2002, *Kilian YP 2940a* (B). *Jabal Fartak*: Jabal Karmum, lat. 15°50'N, long. 51°59'E, alt. 970 m, epiphytic on *Anogeissus dhofarica*, 6 Oct. 2001, *Kürschner 01-1389* (B). *Ras Fartak*: north-east of Khadifud, lat. 15°39'N, long. 52°12'E, alt. 780 m, epiphytic on *Anogeissus dhofarica*, 10 Oct. 2001, *Kürschner 01-1414* (B).

A xerotropical palaeo-African species, widely distributed in tropical and subtropical Africa [Central African Republic, Cameroun, the Democratic Republic of Congo (Zaire), Ethiopia, Gabon, Guinea, Ivory Coast, Kenya, Madagascar, Malawi, Mascarene Isl., Nigeria, Rwanda, Senegal, S. Tomé Isl., Sierra Leone, South Africa (Natal, Transvaal), Tanzania, Togo, Uganda, Zambia, Zimbabwe (Ochi, 1972; O'Shea, 1995); Fig. 3.1].

Macromitriaceae

Macrocoma tenuis (Hook. & Grev.) D. H. Vitt subsp. *tenuis* (Fig. 4)

Plants slender, brownish-green to yellowish-red, in radiculose dense mats; primary stems creeping, irregularly branched with numerous erect-ascending branches; leaves erect to erect-appressed, spreading at tips when dry, 1.0-1.5 mm long, keeled, ovate-lanceolate to lanceolate, unistratose, frequently with bistratose patches above; margins entire or minutely crenulate, recurved below; costa ending below apex; upper and median leaf cells 6-10 µm, oval to rounded-quadrate, thick-walled, smooth to mamilliose; basal cells rounded to elliptic, strongly bulging to bulging-papillose, inner basal cells near costa elongate, incrassate, to 20 µm long.

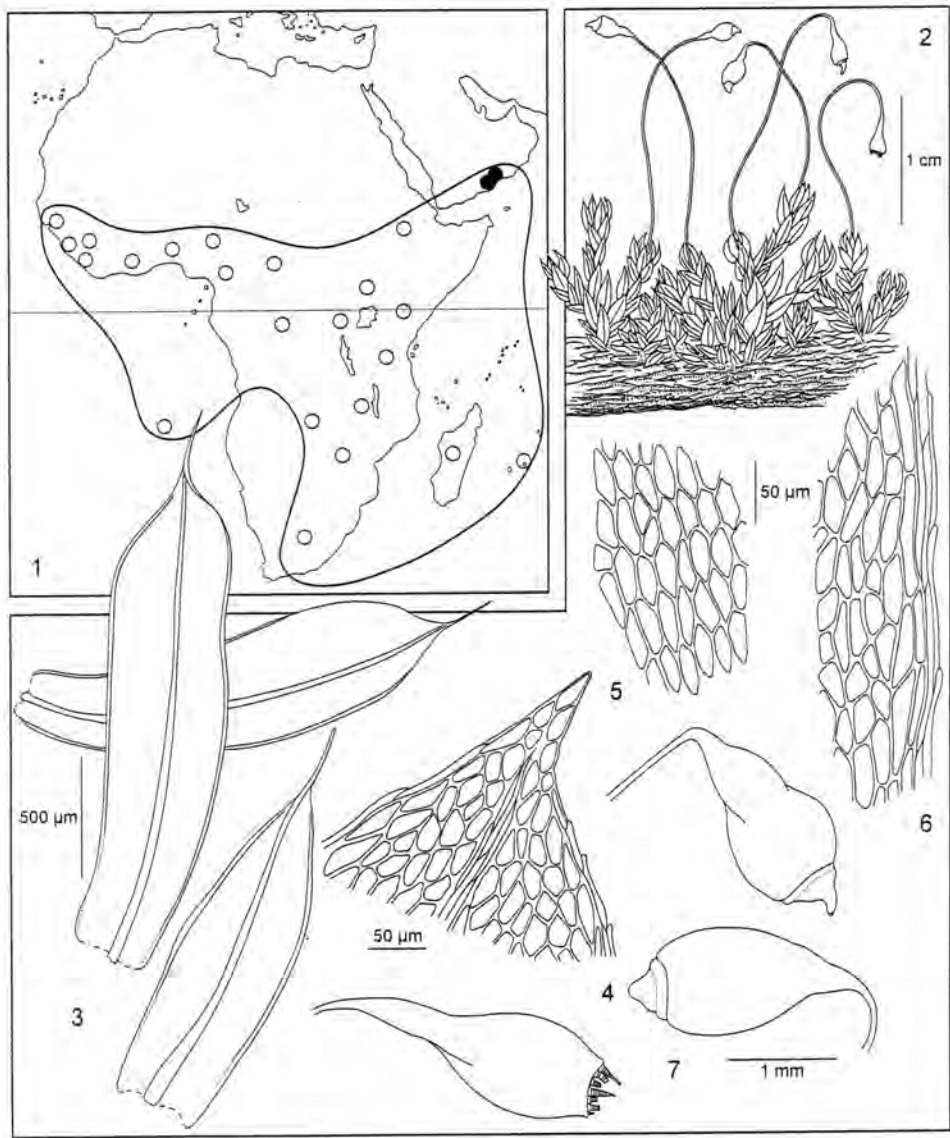


Fig. 3. *Brachymenium leptophyllum* (Müll. Hal.) A. Jaeger. – **1.** Distribution (open circles: country records only, cf. O'Shea, 1995). **2.** Habit. **3.** Leaves. **4.** Leaf tip. **5.** Mid-leaf cells. **6.** Basal leaf cells. **7.** Capsule (all from Kürschner 01-1280, B).

Specimen examined – YEMEN. GOVERNORATE HADRAMOUT. *Socotra Island*: Haghier Mts., Skent, Arra'bin – Wadi Antanqatan area, lat. 12°34'20.7"N, long. 54°01'03"E, alt. 1470 m, on granite rock, 12 Mar. 2003, Kürschner 03-85 (B, KRAM).

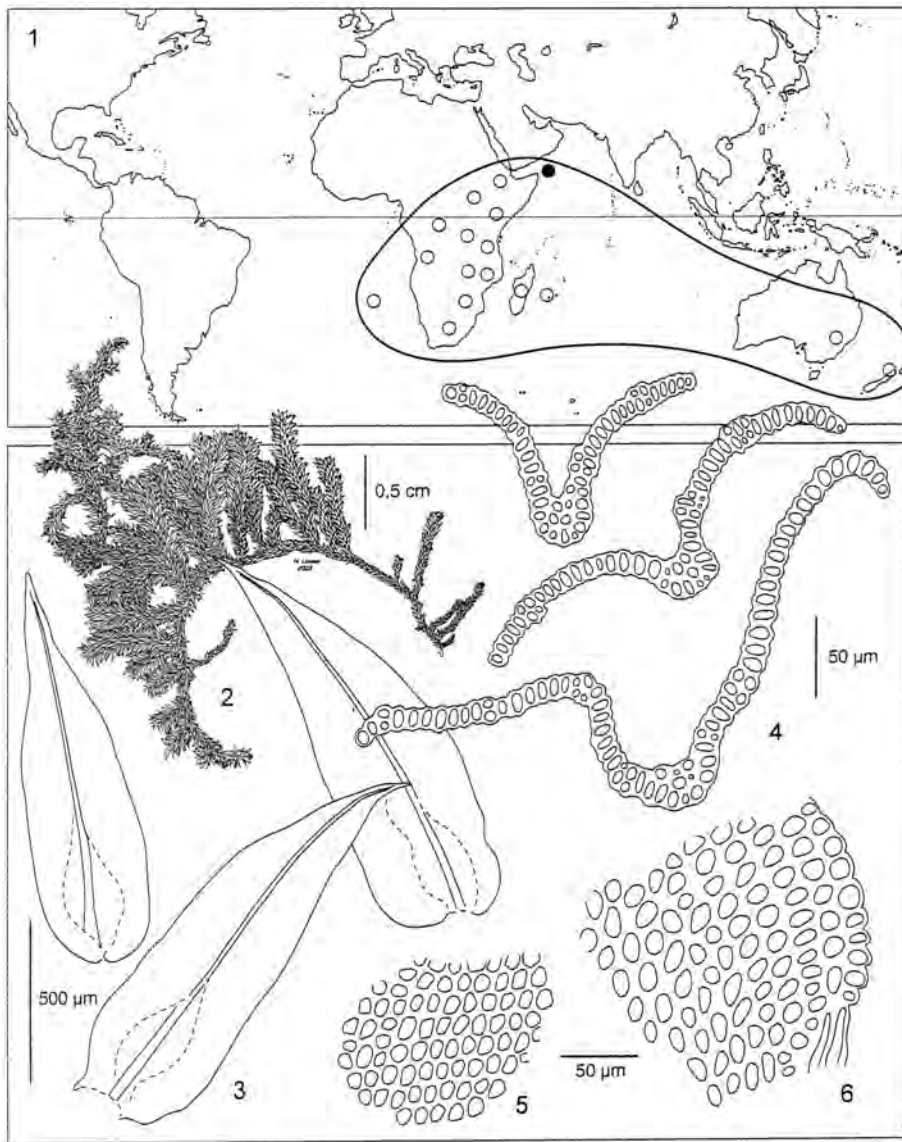


Fig. 4. *Macromitrium tenuis* (Hook. & Grev.) D. H. Vitt subsp. *tenuis*. – **1**. Distribution (open circles: country records only, cf. O'Shea, 1995). **2**. Habit. **3**. Leaves. **4**. Cross-section of leaf. **5**. Mid-leaf cells. **6**. Basal leaf cells (all from Kürschner 03-85, B).

This taxon belongs to the polymorphous *Macrocoma tenuis*–*M. sullivan-tii* complex which shows considerable variation throughout its pantropical geographical range (Vitt, 1980a, b). Taxonomically, it is considered as a single species with two subspecies: the type subspecies which is palaeotropical in distribution

and confined mainly to the Southern Hemisphere (Africa, SE Australia and New Zealand) and subsp. *sullivantii* (Müll. Hal.) D. H. Vitt which is pantropical in distribution but in the Old World distributed only in the Northern Hemisphere. In Africa, *M. tenuis* subsp. *tenuis* is common in Afrotropical forest from the Cape through the Drakensberg and eastern Transvaal to the East African volcanic region in Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zimbabwe, just crossing the equator and extending to southern Ethiopia. Outside this major south-north distribution axis, it occasionally occurs in central western Angola and the south of the Democratic Republic of Congo (Zaire) as well as on Madagascar, Réunion, and St. Helena (Magill & Vitt, 1981; O'Shea, 1995).

The discovery of this taxon on Socotra is interesting for a number of reasons. Because this island lies in the Northern Hemisphere one might expect here subsp. *sullivantii* rather than subsp. *tenuis*. However, the Socotran population is characterized by small, short, narrow leaves with blunt incurved apices and uniform leaf areolation between costa and margins and these are typical features of African populations of *M. tenuis* subsp. *tenuis*.

It is worth noting that until recently the generic name *Macrocoma* was erroneously considered to be neuter, but Eckel (2000) has convincingly proved that its gender is feminine. Accordingly, the correct ending of the specific epithet is '-is', not '-e'.

Leucodontaceae

Felipponea assimilis (Müll. Hal.) O'Shea (Fig. 5)

Plants medium-sized, rather slender, with creeping primary stems to 4 cm long, which are sparsely and irregularly branched; branches erect, julaceous and somewhat curved, to 8 mm long on drying; both central strand in transverse section as well as pseudoparaphyllia lacking; leaves densely set, ecostate, never plicate, closely appressed when dry and widely spreading when wet, broadly ovate to elliptical, 1.3-1.8 mm long, 0.9-1.0 mm wide, abruptly short-acuminate to acute, rounded and narrowed at the insertion, margins plane, entire; laminal cells smooth, thick-walled, markedly diversified into a pronounced group of elongate cells with moderately porose walls in the centre of the base, 50-120 µm long, 4-6 µm wide, extending to about 1/3-1/2 way up the leaf; median and upper cells rhombic, elliptic to shortly fusiform, 10-25 µm long, 3-6 µm wide, almost imperceptibly passing into a group of transversely elliptic to rounded-quadrate alar cells.

The Socotran plants of *Felipponea assimilis* are entirely sterile but the correspondence of its gametophyte characters with other African specimens is perfect (Fig. 5).

Specimen examined –YEMEN. GOVERNORATE HADRAMOUT. *Socotra Island*: Haghier Mts., upper Wadi Ayhaft (Ziroyq area), lat. 12°34'45.6"N, long. 54°00'32"E, alt. 1060 m, on granite rock, 13 Mar. 2003, *Kürschner 03-113* (B, KRAM).

Felipponea Broth. is a small genus of pleurocarpous mosses closely allied to *Leucodon* Schwägr. from which it differs in having smooth, non-plicate leaves, weakly differentiated alar and upper laminal cells and horizontally spreading peristome teeth on wetting (Akiyama, 1988). It may be confused with *Braunia secunda* (Hook.) Bruch & Schimp. (Hedwigiaceae) which, however, has weakly plicate leaves with generally hyaline and papillose leaf tips. The genus consists of two

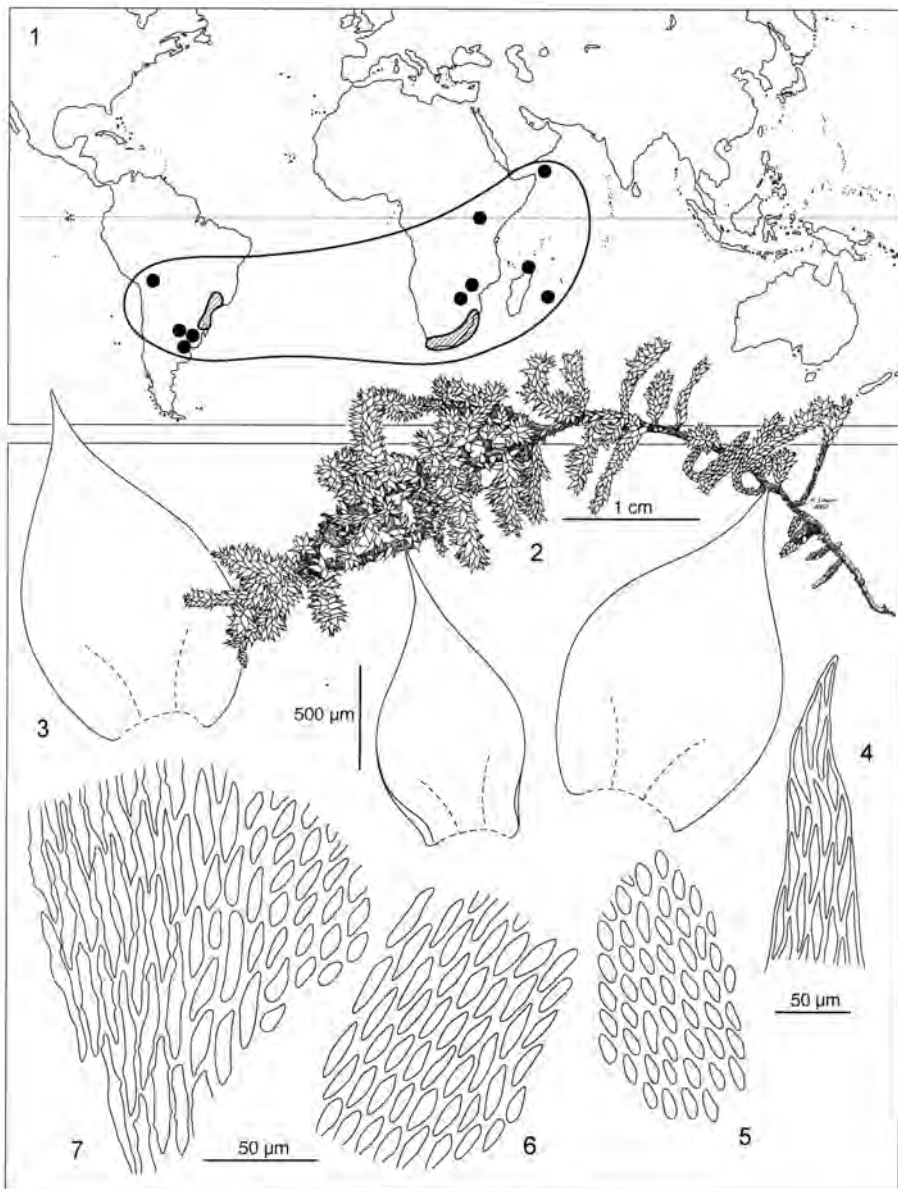


Fig. 5. *Felipponea assimilis* (Müll. Hal.) O'Shea. – 1. Global distribution. 2. Habit. 3. Leaves. 4. Leaf tip. 5. Upper leaf cells. 6. Mid-leaf cells. 7. Basal leaf cells (all from *Kürschner 03-113, B*).

species, namely the Far-Eastern *F. esquirolii* (Thér.) Akiyama which is known from China and Japan and the Afro-American *F. assimilis*. A third species, *F. hollermeyeri* Thér. from Chile, is poorly known and, judging from the description and illustrations (Thériot, 1935), it belongs elsewhere.

Felipponea assimilis has had quite a chequered taxonomic, nomenclatural and phytogeographical history, for very long time having been known only from South America under the name *F. montevidensis* (Müll. Hal.) Broth. Apart from Uruguay, from where it was originally described as *Cladomnium montevidense* Müll. Hal. (Müller, 1897), the species is widely distributed in the coastal regions of south-eastern Brazil, ranging from Rio de Janeiro to Rio Grande do Sul (Sehnem, 1970; Yano, 1981, 1989), and recurring at a highly disjunct and isolated station in Cordillera Oriental in Bolivia (type of *Leucodon squarrosus* Herzog). It has subsequently been recorded from South Africa (Cape region, Natal, Orange Free State, Swaziland, Transvaal; Akiyama, 1988; O'Shea, 1995) and very recently O'Shea (2001) clarified taxonomic and nomenclatural problems associated with this species. He found that the oldest available name for it was *Neckera assimilis* Müll. Hal. described from South Africa (Müller, 1850) and the transfer of this species to *Felipponea* necessitated a new combination. Moreover, he markedly extended the range of the species in Africa to Zimbabwe (type of *Braunia peristomata* Dixon), the Democratic Republic of Congo (Zaire), Kenya, Malawi, Uganda, Rwanda, and Zambia on mainland Africa, as well as to Madagascar and Réunion in the Mascarenes (type of *Leucodon capensis* Schimp. ex Renault). The discovery of *F. assimilis* at the disjunct station on Socotra represents a major range extension of the species in East Africa (Fig. 5.1) and this distribution pattern is to a certain extent similar to that of *Macrocoma tenuis* subsp. *tenuis* (Fig. 4.1).

Brachytheciaceae

Scorpiurium circinatum (Brid.) M. Fleisch. & Loeske (Fig. 6)

Specimen examined – YEMEN. GOVERNORATE HADRAMOUT. *Socotra Island*: Haghier Mts., Skent, Arra'bin area, lat. 12°34'22.7"N, long. 54°01'2.7"E, alt. 1470 m, on wet granite rock, 12 Mar. 2003, *Kürschner 03-90* (B, KRAM).

Scorpiurium circinatum is a Mediterranean-Atlantic species (Fig. 6) which is frequent in the Mediterranean countries from the Iberian Peninsula (Casas *et al.*, 1989) in the west to Turkey (Henderson & Prentice, 1969), the Crimea and the Caucasus (Ignatov & Afonina, 1992) and Lebanon, Jordan and Israel (Frey & Kürschner, 1991) in the east, as well as in North Africa from the Morocco to Libya (Ros *et al.*, 1999) and Macaronesia (Eggers, 1982), and extending northwards to the British Isles (Preston, 1994) and Belgium (De Zuttere & Schumacker, 1984). Some isolated localities are known from the Cape Verde Islands (Frahm *et al.*, 1996), the Arabian Peninsula (Kürschner, 2000) and in the Republic of Djibouti on mainland Africa (Kürschner & Onraedt, 1990) and the present Socotran station nicely extends the geographical range in this region. Müller (2002) recorded *S. circinatum* from the highly disjunct site on Réunion in the southern Indian Ocean and because of its placement well outside the continuous range of the species he interpreted it as a possible recent introduction.

Acknowledgements. The field excursion was supported by the German Federal Ministry of Education and Research (bmb+f) within the scope of the BIOLOG program, BIOTA East (H. Kürschner). We are grateful to Dr M. El-Masjhary, Environmental Protection Authority (EPA, Head Office Sana'a), the EPA branch Socotra, and S. M. A. Al-Gareiri (Dir. Gen., Dept. of Agriculture, Socotra) for research permission on Socotra. Special thanks go to Dr M. A. Hubaishan (AREA Mukalla), Dr N. Kilian (BGBM Berlin) and P. Hein (Berlin), to H. Lünser (Berlin) for drawing the figures as well as to Arthur Copping, Roydon, Diss, UK, for checking the English.

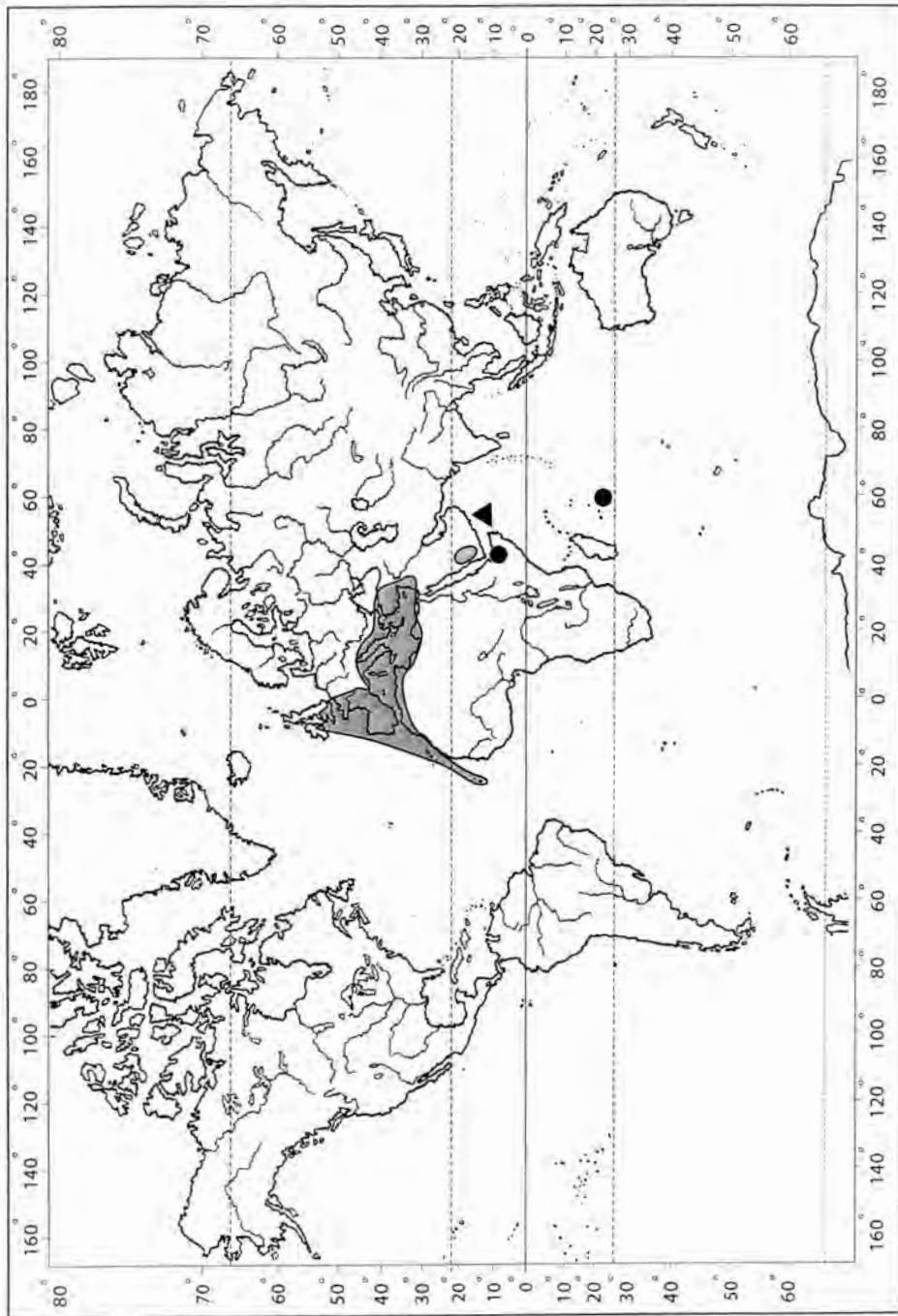


Fig. 6. Global distribution of *Scorpiurium circinatum* (Brid.) M. Fleisch. & Loeske. The Socotran locality is marked by the triangle.

REFERENCES

- AKIYAMA H., 1988 — Rearrangement of two species of *Leucodon* (Leucodontaceae, Musci) with a note on *Felipponea*. *Journal of Japanese Botany* 63: 265-272.
- BRUGGEMANN-NANNENGA M.A., 1987 — An annotated list of *Fissidens* species from the Yemen Arab Republic and Sultanate of Oman, with *F. laxetexturatus* nov. spec. *Studies in Arabian bryophytes 7. Nova Hedwigia* 45: 113-117.
- CASAS C., BRUGUÉS M., CROS R.M. & SÉRGIO C., 1989 — Cartografia de briòfits. Península Ibérica i les Illes Belears, Canàries, Açores i Madeira. Fascicule II: 51-100. Barcelona, Institut d'Estudis Catalans, Universitat Autònoma de Barcelona. 158 p. + 50 maps.
- DELGADILLO C.M., BELLO B & CÁRDENAS S.A., 1995 — LATMOSS: A catalogue of Neotropical mosses. *Monographs of Systematic Botany of the Missouri Botanical Garden* 56: 1-191.
- DE ZUTTERE Ph. & SCHUMACKER R., 1984 — Bryophytes nouvelles, méconnues, rares, menacées ou disparues de Belgique. *Service de la Conservation de la Nature Travaux* 13: 1-160 + 40 maps.
- ECKEL P.M., 2000 — The gender of *Macromitrium* Grout is feminine, not neuter. *Journal of Bryology* 22: 72-73.
- EDDY A., 1988 — *A handbook of Malesian mosses. Volume 1. Sphagnales to Dicranales*. London, British Museum (Natural History). iii + 204 p.
- EGGERS J., 1982 — Artenliste der Moose Makaronesiens. *Cryptogamie, Bryologie-Lichénologie* 3: 283-335.
- FRAHM J.-P., LINDLAR A., SOLLMAN Ph. & FISCHER E., 1996 — Bryophytes from the Cape Verde Islands. *Tropical Bryology* 12: 123-153.
- FREY W. & KÜRSCHNER H., 1991 — *Conspectus Bryophytorum Orientalium et Arabicorum*. An annotated catalogue of bryophytes in southwest Asia. *Bryophytorum Bibliotheca* 39: 1-181.
- HENDERSON D.M. & PRENTICE H.T., 1969 — Contribution to the bryophyte flora of Turkey: VIII. *Notes from the Royal Botanic Garden Edinburgh* 29: 235-262.
- IGNATOV M.S. & AFONINA O.M. (eds.), 1992 — Check-list of mosses of the former USSR. *Arctoa* 1: 1-85.
- JONES E.W., 1962 — African Hepatics XV. *Plagiochila* in Tropical Africa. *Transactions of the British Bryological Society* 4: 254-325.
- KÜRSCHNER H., 2000 — Bryophyte flora of the Arabian Peninsula and Socotra. *Bryophytorum Bibliotheca* 55: 1-131.
- KÜRSCHNER, H., 2003a — Further new bryophytes to Socotra and the Yemen mainland, including *Papillaria crocea* (Hampe) A. Jaeger (Metoriaceae, Bryopsida), a palaeotropical Asian species. Additions to the Bryophyte flora of the Arabian Peninsula and Socotra 3. *Nova Hedwigia* 76: 257-267.
- KÜRSCHNER, H., 2003b — Nineteen new records to the bryophyte flora of Socotra Island. Additions to the Bryophyte Flora of the Arabian Peninsula and Socotra 5. *Willdenowia* 33: 447-461.
- KÜRSCHNER H. & ONRAEDT M., 1990 — Quelques bryophytes de la République de Djibouti (Territoire français des Afars et des Issas). *Nova Hedwigia* 50: 181-189.
- LONG D.G., 1987 — Hepaticae and Anthocerotae of the Arabian Peninsula.. *Studies in Arabian bryophytes 5. Nova Hedwigia* 45: 175-195.
- MAGILL R.E. & VITT D.H., 1981 — The phytogeography and ecology of *Macrocoma* (Orthotrichaceae, Musci) in Africa. *Bothalia* 13: 463-464.
- MÜLLER C., 1850-1851 — *Synopsis muscorum frondosorum omnium hucusque cognitorum. Pars secunda. Musci vegetationis pleurocarpicae*. Berolini, sumptibus Alb. Foerster. 772 p.
- MÜLLER C., 1897 — *Prodromus bryologiae argentinicae atque regionum vicinarum. III. Hedwigia* 36: 84-144.
- MÜLLER F., 2002 — Additions to the bryophyte floras of Réunion and Mauritius (East African islands). *Tropical Bryology* 21: 47-49.

- OCHI H., 1972 — A revision of African Bryoideae, Musci (First part). *The Journal of the Faculty of Education Tottori University Natural Science* 23: 1-126.
- O'SHEA B., 1995 — Checklist of the mosses of sub-Saharan Africa. *Tropical Bryology* 10: 91-198.
- O'SHEA B., 2001 — *Felipponea* (Leucodontaceae, Musci), a new genus for Africa, to include "*Leucodon maritimus*" and *L. assimilis*. *Tropical Bryology* 20: 43-49.
- PRESTON C.D., 1994 — *Scorpiurium circinatum* (Brid.) Fleisch. & Loeske. In: M.O. Hill, C.D. Preston & A.J.E. Smith (eds.), *Atlas of the bryophytes of Britain and Ireland. Volume 3. Mosses (Diplolepideae)*. Colchester, Harley Books, p. 310.
- PURSELL R.A., 1997 — Taxonomic notes on Neotropical *Fissidens*. II. An addendum. *The Bryologist* 100: 193-197.
- ROS R.M., CANO M.J. & GUERRA J., 1999 — Bryophyte checklist of Northern Africa. *Journal of Bryology* 21: 207-244.
- SEHNEM A., 1970 — Musgos sul-brasileiros II. *Pesquisas, Botanica* 28: 1-117.
- THÉRIOT L., 1935 — Contribution à la flore bryologique du Chili (12^e article). *Revista Chilena de Historia Natural* 39: 16-21.
- VITT D.H., 1980a — The genus *Macrocoma* I. Typification of names and taxonomy of the species. *The Bryologist* 83: 405-436.
- VITT D.H., 1980b — The genus *Macrocoma* II. Geographical variation in the *Macrocoma tenue-M. sullivantii* species complex. *The Bryologist* 83: 405-436.
- WIGGINTON M.J. & GROLLE R., 1996 — Catalogue of the Hepaticae and Anthocerotae of Sub-Saharan Africa. *Bryophytorum Bibliotheca* 50: 1-267.
- YANO O., 1981 — A checklist of Brazilian mosses. *Journal of the Hattori Botanical Laboratory* 50: 279-456.
- YANO O., 1989 — An additional checklist of Brazilian bryophytes. *Journal of the Hattori Botanical Laboratory* 66: 371-434.