sommerfeltia

7

L. Malme

Distribution of bryophytes on Fuerteventura and Lanzarote, the Canary Islands.

1988

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Forty mosses and twenty-six hepatics are reported for the first time from Fuerteventura, and fifteen mosses and nine hepatics are reported for the first time from Lanzarote, among them *Gigaspermum mouretii* Corb. which is new to Macaronesia. All taxa recorded so far are listed and their distribution outlined. Distribution maps are given for some of the more common species. The zonation of bryophytes is considered, and a survey of their phytogeographical affinities is given. Some ecological factors are discussed, and it is suggested that the bryophyte flora of these two islands is primarily restricted by climatic factors.

Keywords: Bryophytes, Distribution, The Canary Islands, Fuerteventura, Lanzarote.

Leif Malme, Skrabben 1 C, N-0682 Oslo 6, Norway.

CONTENTS

INTRODUCTION

Pitard (1907) gave the first report of mosses from Lanzarote. He mentioned seven species, among them *Hypnum cupressiforme* and *Polytrichum juniperinum* which have not been recorded since. Størmer (1959) reported three mosses new to the island, and Sunding (1971) contributed with twelve species. From my two first weeks of field work on Lanzarote I added fifteen new species to the bryophyte flora of the island (Malme 1977). During (1981) further reported thirty-eight species new to Lanzarote.

From the second largest island of the archipelago, Fuerteventura, no species at all were known until 1969, when the occurrence of five species was reported by Sunding (1969). Later, Sunding (1971) added twenty-two more species to the poorly known bryophyte flora of this island. The bryoflora of the eastern Canary Islands was still relatively poorly known.

The aims of the present study are to present new distributional data for bryophytes on Fuerteventura and Lanzarote, to compile the distributional data so far available for the islands, and to give an outline of their bryogeography.

THE INVESTIGATION AREA

Fuerteventura and Lanzarote are the two most easterly Canary Islands, about 28^0 N latitude and 14^0 W longitude, and within 90 to 100 km off the northwestern coast of the African continent. Fuerteventura is the second largest of the Canary Islands with an area of 1663 km^2, Lanzarote the fourth largest with an area of 904 km^2 (Kunkel 1976).

In contrast to the western Canary Islands the mountains of Fuerteventura and Lanzarote are relatively low. The highest point on Fuerteventura is Pico de la Zarza (807 m), on Lanzarote the Peñas del Chache (671 m).

The southern and eastern parts of Fuerteventura mainly consist of Miocene basalts; the northern part and southern central districts consist of young basalts and tuffs probably no more than a few thousands years old (Schmincke 1976). The Betancuria-Pajara area mostly consists of mafic and ultramafic rocks. Lanzarote consists of two Miocene basaltic massifs, making up the northern and southern highlands. Vast areas (about 200 km^2), especially in the western and northeastern parts of the island, are covered by recent volcanic material, both lava and ashes.

Fuerteventura and Lanzarote have a semi-desert climate (Fernandopullé 1976). The annual mean precipitation for the period 1949-1976 is 147 mm on Fuerteventura and 135 mm on Lanzarote, but there is considerable variation between years. The rainfall is chiefly in winter.

These two low-lying islands are entirely below the cloud-forming zone, so there is no orographic control of precipitation. The prevailing wind direction is north to north-east, owing to the trade winds.

The Canary Islands have a mild climate. The oceanic influence alters the climate from what would be predicted from their latitude.

MATERIAL AND METHODS

MATERIAL AND FIELD WORK

The records given in the present paper are mainly based on collections made by the author, but care has been taken to include all reliable published records in the treatment of distributional relationships. I visited Lanzarote for two weeks in December 1976, two weeks in December 1977, two weeks in December 1978, three weeks in April 1981, and Fuerteventura for three weeks in April 1979. Collections are deposited in O. Twenty-two collections from Fuerteventura and Lanzarote made by Per Sunding were kindly placed at my disposal. Altitudes are recorded by use of an aneroid barometer.

DIVISIONS INTO VERTICAL ZONES

A division of the bryoflora of the Canary Islands according to vegetation regions has been undertaken by Størmer (1959) and for individual islands by Bines (1964) for Hierro, Düll (1980) for La Palma, and Koppe and Düll (1982) for northern Tenerife. These authors mainly use the zonation of the higher vegetation as a basis. With an upper limit of 700-800 m Fuerteventura and Lanzarote wholly fall within the succulent zone (the lowermost region). Thus this kind of division is not suitable as basis for outlining the zonation of the bryophytes on these two islands. Instead I have merely studied distributions relative to altitudinal intervals 0-100 m, 100-200 m, 200-400 m, 400-600 m, and 600-807 m.

TERMINOLOGY OF PHYTOGEOGRAPHICAL ELEMENTS

In order to outline the phytogeographical relationships of the bryoflora of the two islands I have grouped the species into five distribution types (elements) according to overall distribution: (1) Mediterranean species, (2) Mediterranean-Atlantic species, (3) Macaronesian species, (4) Circumboreal species, and (5) Cosmopolitan species.

NOMENCLATURE

The nomenclature of hepatics follows Grolle (1983), of mosses mostly Corley et al. (1981). Taxa of rank below species are mostly in accordance with Index Muscorum (van der Wijk et al. 1959-1969).

RESULTS AND DISCUSSION

Together with the sixty-six new species recorded in this paper the bryophyte flora of Fuerteventura now totals ninety-one, sixty-five mosses and twenty-six hepatics. Twenty-four species are reported as new to Lanzarote and, together with species earlier reported, make a total of ninety-eight, seventy-three mosses and twenty-five hepatics.

PATTERNS OF VERTICAL DISTRIBUTION

The number of species in each altitudinal interval on each island is shown in Tab. 1. In the maritime zone (0-100 m) I have found only five species on Lanzarote: *Fissidens viridulus* var. *bambergeri*, *Gymnostomum calcareum*, *Tortella flavovirens*, *Tortula atrovirens* and *T. muralis*. The first two species were found only at one locality (Barranco de la Pila near Puerto del Carmen). I found no species at all in this zone on Fuerteventura.

Between 100 and 200 m 12 more species were found on Lanzarote, among them one hepatic, *Fossombronia caespitiformis*. The commonest ones are *Aloina ambigua*, *Crossidium crassinerve*, *C. squamiferum*, *Didymodon rigidulus* and *D. vinealis*. On Fuerteventura the same 12 species were found in this zone.

In the 200-400 m zone the number of species increased considerably on both islands. Important mosses are *Bryum canariense*, *Funaria* spp., *Grimmia trichophylla* (Lanzarote), *Pleurochaete squarrosa* (Lanzarote), *Scorpiurium circinatum*, *Trichostomum brachydontium*, and hepatics like *Frullania dilatata* (Lanzarote), *Riccia lamellosa*, *Targionia hypophylla* and *T. lorbeeriana*.

Between 400 and 600 m the number of species is also higher on Lanzarote than on Fuerteventura. Important additional species are *Bartramia stricta*, *Grimmia laevigata*, *Homalothecium sericeum*, *Leptodon smithii*, *Scleropodium touretii*, and hepatics like *Frullania polysticta*, *F. tamarisci*, *F. teneriffae*, *Porella canariensis* and *Radula lindenbergiana*.

Above 600 m, the number of species is considerably higher on Fuerteventura than on Lanzarote, but Lanzarote has a comparatively small area above 600 m. New species in this zone are *Eurhynchium meridionale*, *Grimmia laevigata* (Fuerteventura), *Leucodon canariensis*, *Tortula inermis*, and the hepatics *Cololejeunea minutissima* (Fuerteventura), *Metzgeria furcata* and *Plagiochasma rupestre*.

On Fuerteventura a number of species are found only above 750 m, including *Allorgea berthelotiana*, *Encalypta vulgaris*, *Epipterygium tozeri*, *Eucladium verticillatum*, *Neckera complanata*, *Fossombronia angulosa*, *Frullania teneriffae*, *Cephaloziella baumgartneri*, *Marchesinia mackaii* and *Plagiochila killarniensis*.

Table 2 shows the lower limit for some bryophyte species,

Table 1. Species richness of altitudinal zones on Fuerteventura and Lanzarote.

Island	Fuerteventura					Lanzarote				
Altitude (m)	0 -100	101 -200	201 -400	401 -600	>600	0 -100	101 -200	201 -400	401 -600	>600
No. of moss species	0	12	34	49	60	5	16	44	62	41
% of total	0	18	51	73	90	7	21	59	83	55
No. of liver- and hornwort species	0	0	7	11	24	0	1	10	19	18
% of total	0	0	27	42	92	0	4	40	76	72

and the altitude above which the species are usually more common. For most species both of these limits are situated at higher altitudes on Fuerteventura than on Lanzarote. According to Fernandopullé (1976) the annual amount of precipitation is higher on Fuerteventura than on Lanzarote, but the general impression during field work, together with the displacement of lower limits of bryophyte species to higher altitudes, suggests that Fuerteventura is drier. The table also gives some indications of the drought-resistance of the bryophyte species encountered.

The bryophyte flora shows a marked N-S zonation. Several species have lower limits that are considerably lower towards the north, e.g., *Scleropodium touretii*, which is found only in the northern part of Lanzarote. This may be related to the prevailing northerly winds, and consequently higher precipitation and air humidity there.

On Lanzarote there is also a clear E-W zonation. For instance, *Tortella flavovirens* has a lower limit of about 150 m in the eastern part, but descends to 80 m in the west. The lower limits for epiphytic bryophytes show the same tendency. In the case of Fuerteventura my material is not sufficient to show distinct trends.

The investigation also indicates that N-facing localities are preferred by most of the bryophytes found, followed by W, NNW and NNE. Only *Crossidium squamiferum* and *Gymnostomum calcareum* are more widespread over the different aspects, and to some extent also *Aloina ambigua*, *Bryum radiculosum*, *Crossidium crassinerve* and *Tortula atrovirens*. The preference for N-facing localities shown by most of the species is probably due to lower insolation and evaporation in such places. A lesser degree of weathering may also contribute to the same effect (cf. Hempel 1981).

Table 2. Altitudinal limits of some bryophytes on Fuerteventura and Lanzarote (a - lowest record known, b - lower limit of common occurrence).

Island	Fuerteventura		Lanzarote	
Lower limit	a	b	a	b
Liverworts				
Cololejeunea minutissima	580	-	700	-
Fossombronia caespitiformis	160	400	270	500
Frullania dilatata	310	450	500	600
Porella canariensis	520	550	570	700
Radula lindenbergiana	420	450	550	600
Riccia lamellosa	200	400	290	500
Targionia hypophylla	250	400	250	400
Mosses				
Aloina ambigua	130	250	180	350
Bryum radiculosum	160	350	180	370
Crossidium squamiferum	150	300	290	350
Didymodon rigidulus	150	350	180	350
Didymodon vinealis	150	300	180	350
Grimmia trichophylla	340	450	280	500
Gymnostomum calcareum	20	300	180	350
Homalothecium sericeum v. mand.	410	500	510	600
Pleurochaete squarrosa	380	450	410	550
Scleropodium touretii	400	500	540	600
Scorpiurium circinatum	230	350	220	500
Tortella flavovirens	20	200	150	300
Tortella nitida	360	450	240	600
Tortula atrovirens	80	250	170	400
Tortula muralis	20	300	180	350
Trichostomum brachydontium	330	450	310	600

PHYTOGEOGRAPHICAL AFFINITIES

With the exception of *Gigaspermum mouretii* all species are also known from some or all of the other Canary Islands. The more hygrophytic species common on the western islands are all very scanty on Fuerteventura and Lanzarote. This of course is due to climatic factors.

Fuerteventura and Lanzarote are the two Canary Islands nearest to North Africa. A comparison of the species list of Jelenc (1955) with my own reveals that 84 % of the bryophyte flora of Fuerteventura and Lanzarote is also known from North Africa.

Tab. 3 shows that phytogeographical elements present in the moss flora of Fuerteventura and Lanzarote are, ranked in order

Table 3. Phytogeographical spectrum of the bryophyte flora of Fuerteventura and Lanzarote.

Element	Mediterranean	Mediterranean-Atlantic	Macaronesian	Circumboreal	Cosmopolitan
No of moss species	29	32	4	12	7
% of total	35	38	5	14	8
No of liver- and hornwort species	11	20	2	2	0
% of total	32	57	6	6	0

of decreasing importance, the Mediterranean-Atlantic, the Mediterranean, the Circumboreal, with the Macaronesian and Cosmopolitan as subordinates. Only four Macaronesian endemics are found: *Allorgea berthelotiana*, *Homalothecium sericeum* var. *mandonii*, *Leucodon canariensis* and *Neckera intermedia*.

With regard to the liverworts, the Mediterranean-Atlantic element dominates completely (Tab. 3). On Fuerteventura and Lanzarote such species are distributed in areas with the highest air humidity. Next in importance comes the Mediterranean element. Only two Macaronesian endemics have been recorded: *Frullania microphylla* var. *deciduifolia* and *F. polysticta*.

SOME ECOLOGICAL RELATIONSHIPS

The bryophyte flora of Fuerteventura and Lanzarote contains few species, for example, compared with Tenerife, but it is not so poor in species as previously assumed. On Fuerteventura the area richest in species is the steep N-facing cliff of Pico de la Zarza, on Lanzarote the area around Peñas del Chache and northwards to Los Helechos. In the most favourable habitats in these areas we can find dense mats of bryophytes. In view of the low precipitation on these two islands this is surprising. The explanation may be sought in the relatively high air humidity caused by the maritime position. Typically the N-facing areas have the richest bryophyte flora. This may be related to the dominant wind direction and hence to precipitation and insolation (cf. Hempel 1980).

On Lanzarote, in particular, the richest bryophyte flora is encountered in the craters of the old volcanoes. There these plants are better sheltered against the desiccating effects of the strong winds as the moisture-laden clouds are often

delayed. The result is a higher air humidity, and hence more favourable ecological conditions for bryophytes.

The topography may also be of importance for the quantity of bryophytes and the composition of the bryophyte flora. The steep N-facing sites are more humid than corresponding areas with a gently rolling surface. On steep slopes the moisture is "lashing" against the cliffs. On Pico de la Zarza I have observed water dripping from stones in strong winds, but only a few metres away, on the leeward side, the soil was still very dry.

Pico de la Atalaya is only 83 m lower than Pico de la Zarza, but the bryophyte flora is much poorer both quantitatively and with respect to number of species. On Pico de la Atalaya the topography is more gently rolling, so there is no orographically conditioned increase of humidity.

Edaphic factors may also restrict the bryophyte flora. Typical of some of the new volcanoes is the loose, black cinder along the flanks. At steeply sloping sites this material is unstable and gives little opportunity for colonization by bryophytes. Areas with new lava on Lanzarote are not without bryophytes, as suggested by During (1981), but few species have been able to colonize these areas so far. The most common of these pioneers is *Tortella flavovirens*. However, areas with old, more or less lime-rich rocks have the richest bryophyte flora. Hard crystalline rocks are not a good basis for the establishment of bryophytes in an area with such a low precipitation as Fuerteventura and Lanzarote.

The bryophyte flora on these two islands is primarily restricted by climatic factors. Particularly in the low-lying areas most species are often damaged by drought. The plants are also short and depauperate, often with only a few green leaves. I interpret this as stress due to strong insolation, high evaporation and low air humidity. Many species are sterile. In dry areas the bryophyte flora consists mainly of sterile plants (cf. El- Saadawi & Badawi 1977).

In dry areas *Pottiaceae* occupy a prominent place in the bryophyte flora. Frey and Kürschner (1983) have shown *Pottiaceae* to constitute 50 % of the known moss flora of Transjordan. Fuerteventura and Lanzarote come close to this number with 46.4 %. Next come *Bryaceae* with 10.7 %, and *Funariaceae* with 8.3 %. The pleurocarpous families make up a total of 15.5 %.

Further investigations may lead to an increase in the number of species. Particularly promising are the steep N-facing cliffs of Pico de la Zarza (Fuerteventura), but they are difficult of access.

DISTRIBUTION OF RECORDED TAXA

In the species list, the species new to a single island are marked with an asterisk by the name of that island. All taxa known so far are included in the list and their distribution outlined. Aspect is indicated for most of the cited localities, as, for instance, "Montaña Terza 370 m SSW". Maps are given for some of the more common species (contour interval 200 m). I have attempted to trace the first report of each species from the other Canary Islands.

HORNWORTS

Anthoceros mandonii Steph.

Lanzarote. Peñas del Chache according to During (1981).
The other Canary Islands. Recorded from Gomera, Gran Canaria, La Palma and Tenerife (Arnell 1961).

LIVERWORTS

Asterella africana (Mont.) Evans

* Fuerteventura. Pico de la Zarza on soil-covered bank 730 m N.
The other Canary Islands. Recorded from Gomera (Pitard & Corbière 1908), Gran Canaria, Hierro, La Palma and Tenerife (Schiffner 1902).

Cephaloziella baumgartneri Schiffn.

* Fuerteventura. Pico de la Zarza on soil 770 m NNW.
The other Canary Islands. Recorded from Gran Canaria (Arnell 1961) and Tenerife (Koppe & Düll 1982).

Cephaloziella rubella (Nees) Warnst.

* Fuerteventura. Pico de la Atalaya on soil 490 m W.
The other Canary Islands. Recorded from Tenerife (Koppe & Düll 1982).

Cephaloziella stellulifera (Tayl. ex Spruce) Schiffn.

* Fuerteventura. Pico de la Atalaya 660 m N, Valle de los Canarios Barranco 360 m NE.

* Lanzarote. Montaña Guatizea on soil in the crater 410 m N.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Hierro, La Palma and Tenerife (Arnell 1961).

Cololejeunea calcarea (Libert) Schiffn.

* Fuerteventura. Pico de la Zarza 740 m and 770 m N in small quantities on *Neckera intermedia* and *Porella canariensis*.

The other Canary Islands. Recorded from La Palma (Pitard & Corbière 1908) and Tenerife (Koppe & Düll 1982).

Cololejeunea minutissima (SM.) Schiffn.

* Fuerteventura. Pico de la Atalaya 700 m N as an epiphyte on *Bubonium sericeum* and *Zygodon baumgartneri*, Pico de la Zarza 780 m W on *Porella canariensis*.

* Lanzarote. Peñas del Chache 580 m N and 590 m NW on *Frullania polysticta*, 620 m and 630 m N on bark of fruit trees.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), La Palma (Düll 1980) and Tenerife (Müller 1951-1958).

Exormotheca pustulosa Mitt.

* Lanzarote. Maguez Barranco 380 m N on soil.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria, La Palma (Schiffner 1902) and Tenerife (Koppe & Düll 1982).

Fossombronia angulosa (Dicks.) Raddi

* Fuerteventura. Pico de la Zarza on soil-covered banks 770 m NNW.

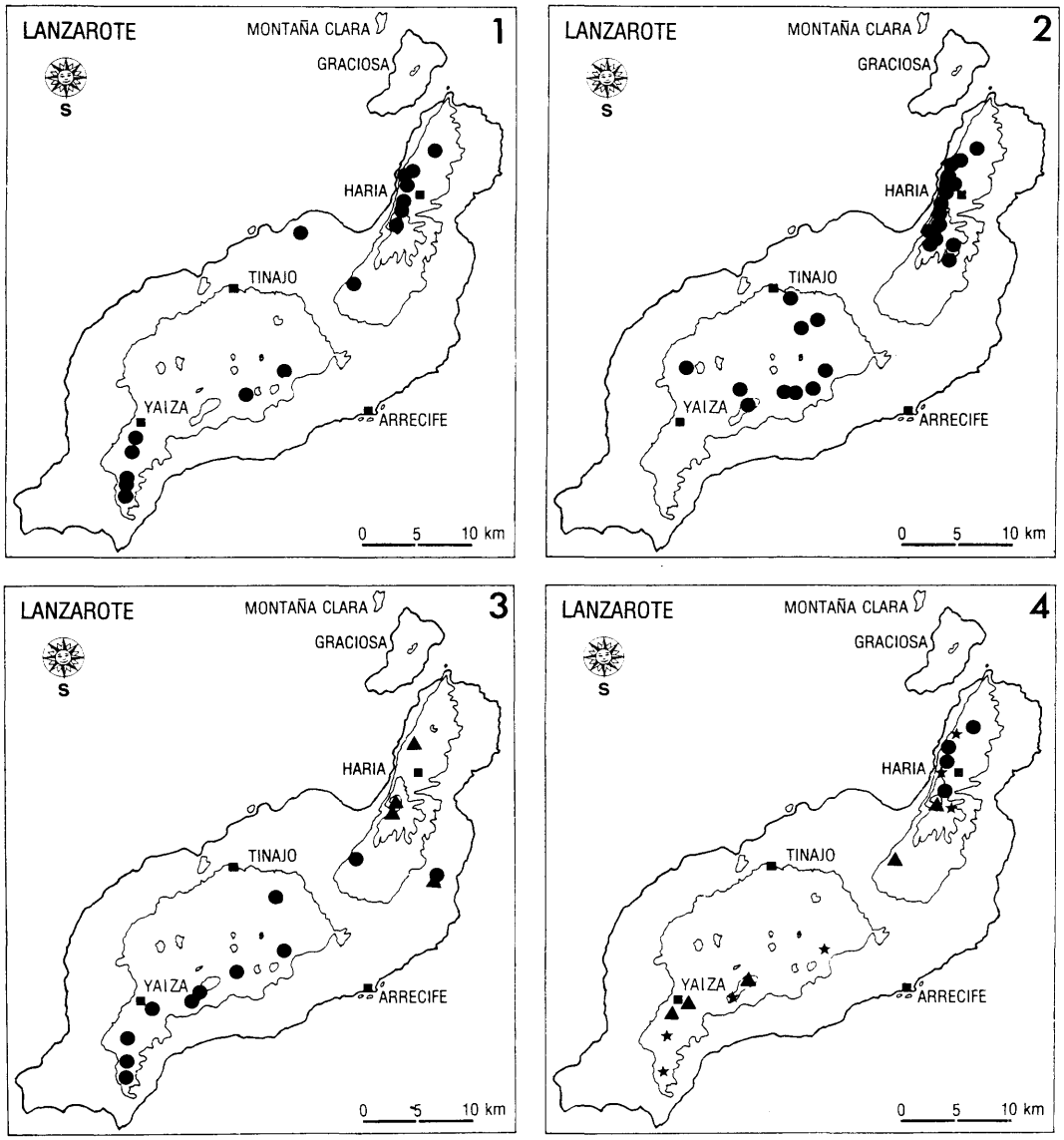
The other Canary Islands. Recorded from Gomera, Tenerife (Pitard & Corbière 1908), Gran Canaria, Hierro and La Palma (Schiffner 1902).

Fossombronia caespitiformis De Not. ex Rabenh.

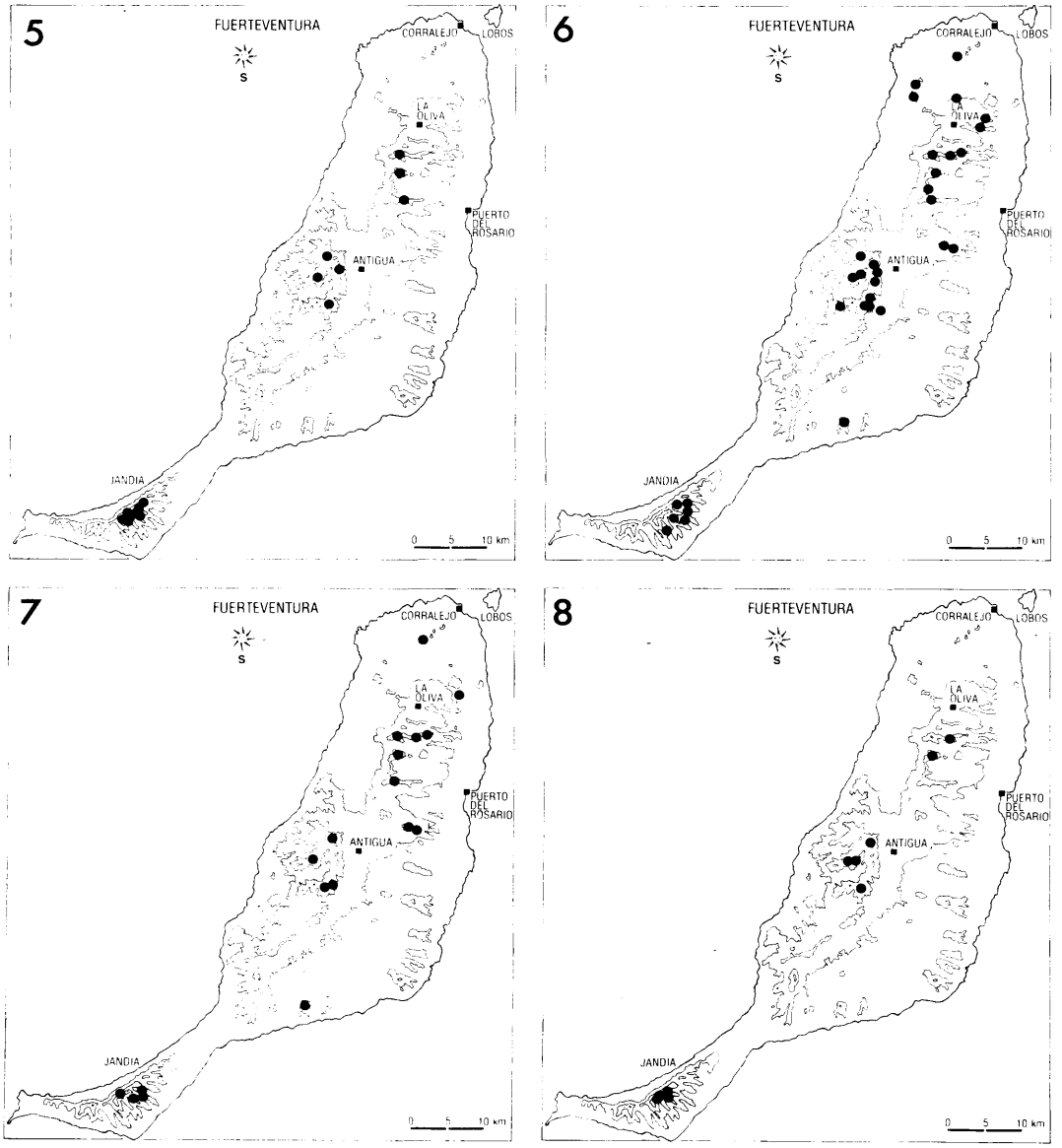
* Fuerteventura. Rather common above 450 m of the N-facing cliffs of Pico de la Zarza, Los Castillejitos 500 m NE, Montaña Escanfraga Barranco 290 m N.

Lanzarote (Fig. 1), common on naked earth above 400 m, only sporadic at lower altitudes.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Arnell 1961) and Tenerife (Pitard & Corbière 1908).



Figs 1-4. Lanzarote. Fig. 1. *Fossombronia caespitiformis*. Fig. 2. *Frullania dilatata*. Fig. 3. *Riccia lamellosa* (dots), *R. nigrella* (triangles), Fig. 4. *Targionia hypophylla* (triangles), *T. lorbeeriana* (asterisks), both species (dots).



Figs 5-8. Fuerteventura. Fig. 5. *Frullania dilatata*. Fig. 6. *Aloina ambigua*. Fig. 7. *Barbula unguiculata*. Fig. 8. *Bartramia stricta*.

Frullania dilatata (L.) Dum.

* Fuerteventura (Fig. 5). Common above 600 m.
Lanzarote (Fig. 2). Common above 450 m, scattered down to 300 m. The most common hepatic of both islands. It was found on rocks, on other bryophytes, lichens and on the bark of trees.
The other Canary Islands. Recorded from Gomera (Pitard & Corbière 1908), Gran Canaria, Hierro, La Palma and Tenerife (Schiffner 1902).

Frullania microphylla (Gott.) Pears. var. *deciduifolia* Grolle

* Fuerteventura. Fraile 570 m N, Valle de Vinamar 740 m and 770 m N, Montaña Muda 620 m N, Pico de la Zarza 500 m and 770 m N.

Lanzarote. Peñas del Chache 590 m N. This species seems to be rare on both islands.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), La Palma (Düll 1980) and Tenerife (Grolle 1970).

Frullania polysticta Lindenb.

* Fuerteventura. Fraile 570 m N, above Valle de Vinamar 740 m and 780 m N, Montaña Muda 620 m N, Pico de la Zarza several N-facing localities above 500 m.
* Lanzarote. Peñas del Chache 590 m W and 630 m N.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Pitard & Corbière 1908), Hierro, La Palma (Schiffner 1902) and Tenerife (Schiffner 1901).

Frullania tamarisci (L.) Dum.

* Fuerteventura. Pico de la Atalaya in a small cave 500 m N, Pico de la Zarza several localities between 700 m and the summit on rocks and soil-covered banks intermingled with other bryophytes.
* Lanzarote. Monte Corona 400 m, 520 m and 530 m N in the crater, Peñas del Chache 590 m SW in a small cave.
The other Canary Islands. Recorded from Gomera, Gran Canaria, Hierro, La Palma (Arnell 1961) and Tenerife (Montagne 1840).
Note. I have followed Grolle (1970) in the interpretation of this species. According to Düll et al. (1983), var. *nervosa* Mont. seems to be a good variety or subspecies of *F. tamarisci* rather than a synonym. All my specimens belong to this variety.

Frullania teneriffae (F. Web.) Nees

* Fuerteventura. Castillejo Alto 750 m N, Fraile 570 m N, both localities on rocks. Pico de la Zarza common on rocks and soil intermingled with other bryophytes on the steep N-facing cliffs between 750 m and the summit, 807 m, also as an epiphyte on *Bubonium sericeum*.

The other Canary Islands. Recorded from Gomera (Pitard & Corbière 1908), Gran Canaria (Montagne 1840), Hierro, La Palma (Schiffner 1902) and Tenerife (Schiffner 1901).

Gongylanthus ericetorum (Raddi) Nees

* Lanzarote. Los Helechos 500 m N in the crater. This species which is common on the western islands and also on Tenerife, seems to be very rare on Lanzarote.

The other Canary Islands. Recorded from Gomera, Hierro, La Palma, Tenerife (Pitard & Corbière 1908) and Gran Canaria (Schiffner 1902).

Lunularia cruciata (L.) Lindb.

Lanzarote. Montaña Guatizea 410 m N, Los Helechos 500 m N, both localities on soil in the crater. Valle del Malvaso several localities on damp soil between 480 and 510 m N.

The other Canary Islands. Recorded from Gomera, Hierro (Arnell 1961), Gran Canaria (Schiffner 1902), La Palma and Tenerife (Pitard & Corbière 1908).

Mannia androgyna (L.) Evans

* Fuerteventura. Montaña Escanfraga Barranco 250 m N, Pico de la Zarza 770 m N, Valle de Vinamar Barranco 430 m N.

* Lanzarote. Montaña Guatizea 400 m W, Los Helechos 500 m N, both localities on soil in the crater.

The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Arnell 1961), Gran Canaria (Montagne 1840) and Tenerife (Pitard & Corbière 1908).

Marchesinia mackaii (Hook.) S. Gray.

* Fuerteventura. Pico de la Zarza rare under overhanging rocks of the N-facing cliffs between 750 m and the summit.

The other Canary Islands. Recorded from La Palma (Düll 1980) and Tenerife (Koppe & Düll 1982).

Metzgeria furcata (L.) Dum.

* Lanzarote. Peñas del Chache 640 m N on soil-covered boulder

together with *Frullania dilatata* and *Leptodon smithii*.

The other Canary Islands. Recorded from Gran Canaria (Schiffner 1902), Hierro, La Palma and Tenerife (Pitard & Corbière 1908).

Plagiochasma rupestre (Forst.) Steph.

* Fuerteventura. Valle de Vinamar 730 m N.

Lanzarote. Peñas del Chache 530 m SW. Rare on both islands.

The other Canary Islands. Recorded from Gomera, Hierro, Tenerife (Pitard & Corbière 1908), Gran Canaria (Bryhn 1908) and La Palma (Schiffner 1902).

Plagiochila killarniensis Pears.

* Fuerteventura. Pico de la Zarza common on soil-covered banks and below overhanging rocks of N-facing cliffs above 730 m.

The other Canary Islands. Recorded from Tenerife (Paton 1977).

Porella canariensis (F. Web.) Bryhn.

* Fuerteventura. Pico de la Zarza, common below overhanging rocks and rock-ledges of the N-facing cliffs above 750 m, also as an epiphyte on *Bubonium sericeum*. Fraile 570 m N, Castillejo Alto 750 m N, above Valle de Vinamar 730 m N. The last three localities on boulders.

Lanzarote. Peñas del Chache common in shady crevices above 580 m, but also found about 520 m.

The other Canary Islands. Recorded from Gomera, Hierro (Pitard & Corbière 1908), Gran Canaria (Montagne 1840), La Palma (Schiffner 1902) and Tenerife (Schiffner 1901).

Radula lindenbergiana Gott. ex C. Hartm.

* Fuerteventura. Castillejo Alto 750 m N, Fraile 570 m N, Morro del Jorao 600 m N on *Bubonium sericeum*, Montaña Muda common above 600 m, Pico de la Atalaya 660 m N, Pico de la Zarza common above 750 m, scattered down to 540 m of the N-facing cliffs.

Lanzarote. Guardilama common above 550 m N in the crater, Los Risquetes 480 m N, La Cerca 420 m NNW, Los Helechos and Monte Corona common avove 500 m in the crater, Peñas del Chache common above 600 m.

The other Canary Islands. Recorded from Gomera (Arnell 1961), Gran Canaria, La Palma and Tenerife (Pitard & Corbière 1908).

Reboulia hemisphaerica (L.) Raddi

* Fuerteventura. Pico de la Zarza several localities on soil-covered ledges of the N-facing cliffs above 740 m, Valle de Vinamar 730 m N.

Lanzarote. Reported by Arnell (1961) from NE of Pinos de Galdar, and also quoted by During (1981). However, this is based on confusion of geographical names, Pinos de Galdar is on Gran Canaria. The specimen is preserved in Herbarium O, and is correctly labelled: Gran Canaria, NE of Pinos de Galdar.

The other Canary Islands. Recorded from Gomera, Hierro (Arnell 1961), Gran Canaria, La Palma (Schiffner 1902) and Tenerife (Pitard & Corbière 1908).

Riccia cavernosa Hoffm.

Lanzarote. Surroundings of Yaiza on picon according to During (1981).

The other Canary Islands. Recorded from Gran Canaria (Jovet-Ast 1965).

Riccia crystallina L. emend. Raddi.

* Fuerteventura. Gran Valle Barranco 350 m E and 390 m SW on earth with percolating water.

* Lanzarote. Montaña Chupaderos on black gravel in the crater 300 m N.

The other Canary Islands. Recorded from Gran Canaria (Arnell 1961) and Tenerife (Koppe & Düll 1982).

Riccia crozalsii Levier

Lanzarote. Famara cliffs above La Caleta, Barranco de la Pocela and near Masdache according to During (1981).

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria and Tenerife (Pitard & Corbière 1908).

Riccia gougetiana Durieu et Mont.

* Fuerteventuera. Pico de la Zarza on soil-covered banks of the N-facing cliffs 750 m.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Hierro and Tenerife (Arnell 1961).

Riccia lamellosa Raddi.

*Fuerteventura. Morro del Valle Corto 360 m N and Rosa del Taro 310 m N.

Lanzarote (Fig. 3). The most common *Ricciaceae* of

Lanzarote.
The other Canary Islands. Recorded from Gomera, Gran Canaria (Arnell 1961), La Palma (Düll 1980) and Tenerife (Bryhn 1908).

Riccia nigrella DC.

Lanzarote (Fig. 3). Rare above 500 m.
The other Canary Islands. Recorded from Gomera, Gran Canaria, Tenerife (Arnell 1961) and La Palma (Düll 1980).

Riccia sorocarpa Bisch.

* Fuerteventura. Pico de la Zarza several localities on soil-covered banks of the N-facing cliffs above 750 m.
Lanzarote. Montaña Guatizea 500 m N on soil in the crater.
The other Canary Islands. Recorded from Gran Canaria (Arnell 1961) and La Palma (Düll 1980).

Sphaerocarpus michelii Bellardi

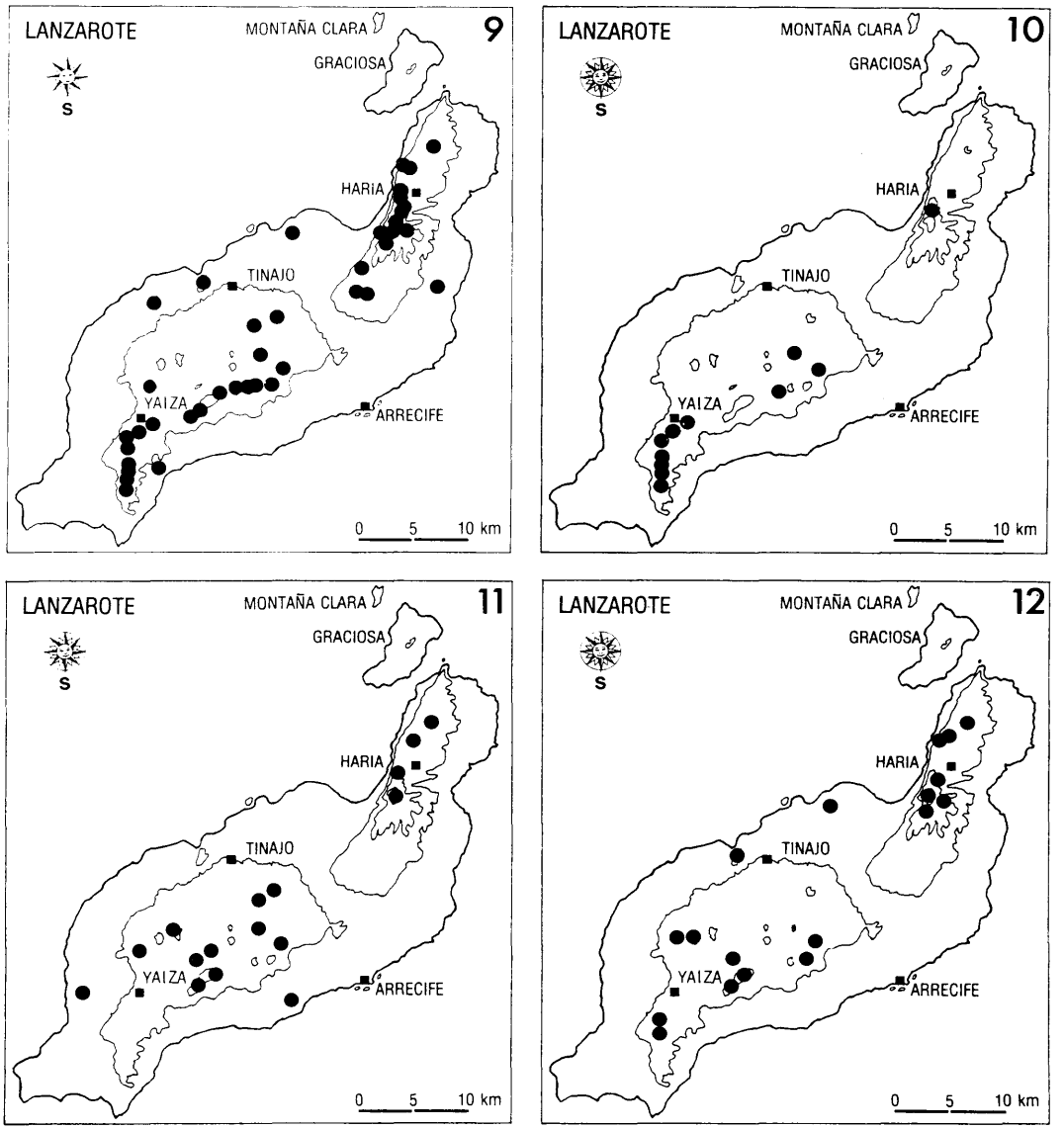
Lanzarote. SW of Haria 500-600 m according to During (1981).
The other Canary Islands. Recorded from Tenerife (Pitard & Corbière 1908).

Targionia hypophylla L.

* Fuerteventura. Aceitunal 520 m N, Betancuria Barranco 410 m N, Castillejo Alto 750 m N, Los Castillejitos 360 m NNE, Morro de Tabagosta 580 m, Morro de Teteguno 580 m and 600 m N, Pico de la Zarza several localities above 430 m N, above Valle de Vinamar 740 m N.
Lanzarote (Fig. 4). Scattered above 300 m, sporadic at lower altitudes.
The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Schiffner 1902), Gran Canaria (Montagne 1840) and Tenerife (Pitard & Corbière 1908).

Targonia lorbeeriana K. Müll.

* Fuerteventura. Betancuria Barranco 480 m N, Gran Montaña 600 m N, Los Castillejitos 500 m NE, Montaña Escanfraga 250 m N, Pico de la Atalaya 610 m N, Morro del Valle Corto 360 m N, Pico de la Zarza 770 m N.
Lanzarote (Fig. 4). Scattered above 300 m.
The other Canary Islands. Recorded from Gran Canaria (Arnell 1961), La Palma (Düll 1980) and Tenerife (Koppe & Düll 1982).



Figs 9-12. Lanzarote. Fig. 9. *Aloina ambigua*. Fig. 10. *Barbula unguiculata*. Fig. 11. *Bryum bicolor*. Fig. 12. *Bryum radiculosum*.

MOSSES

Aloina ambigua (B. & S.) Limpr.

Fuerteventura (Fig. 6), common above 350 m.
Lanzarote (Fig. 9), common above 250 m and scattered down to 20 m.
The other Canary Islands. Recorded from Gomera (Størmer 1959), Graciosa (Sunding 1971), Gran Canaria (Bryhn 1908), La Palma (Long et al. 1981) and Tenerife (Geheeb & Herzog 1910).

Aloina rigida (Hedw.) Limpr.

Fuerteventura. Morro del Cortijo 680 m, Rosa del Taro Barranco 360 m N, Valle de Esquinso Barranco 360 m N.
* Lanzarote. Atalaya de Femés 420 m NNE, Hascha Grande Barranco 300 m W, Pico de la Aceituna 440 m N. This species seems to be rare on both islands.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Long et al. 1981) and Tenerife (Pitard 1907).

Allorgea berthelotiana (Mont.) Ando

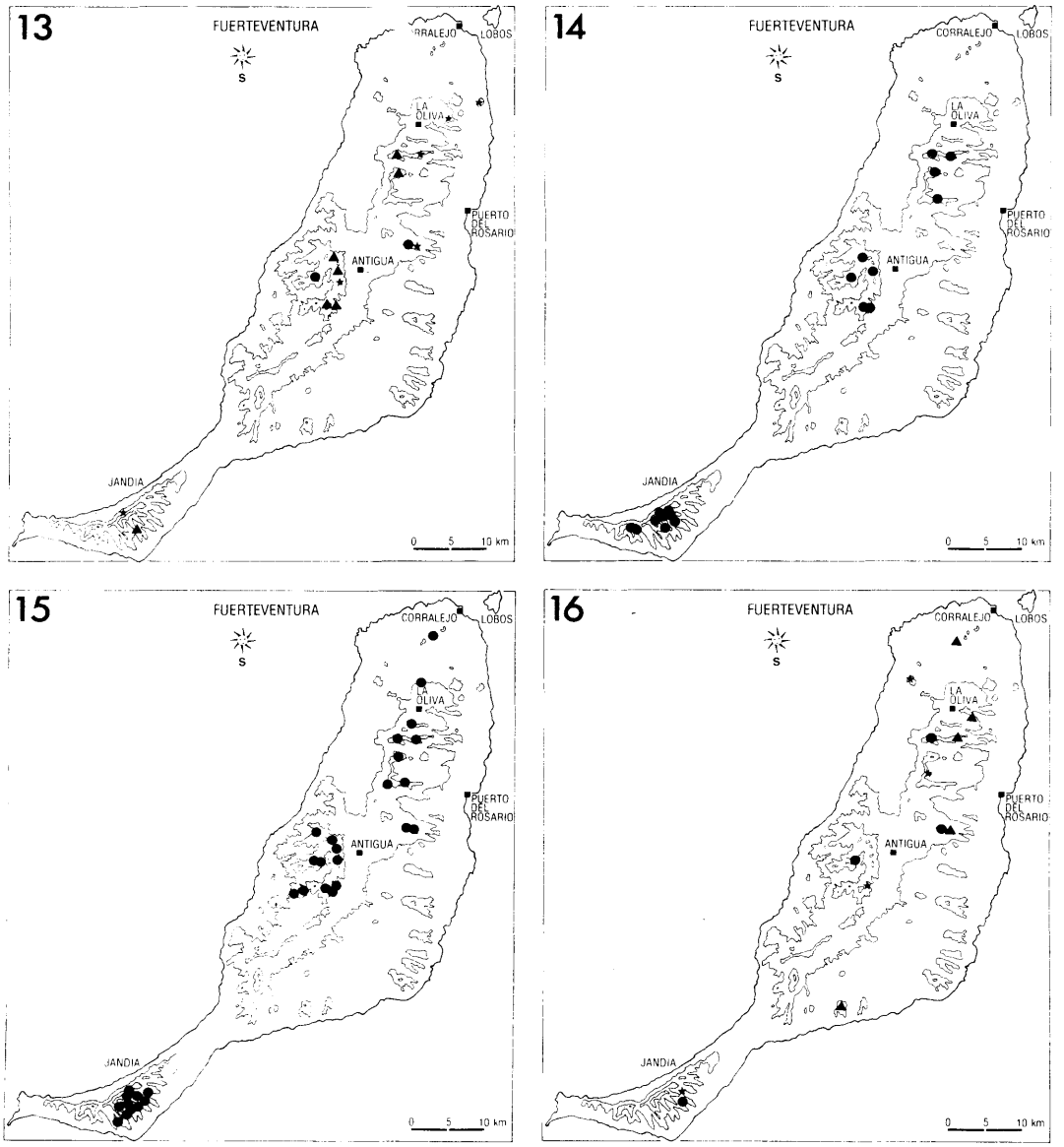
* Fuerteventura. Pico de la Zarza scattered below overhanging rocks and on soil-covered banks of N-facing cliffs above 740 m.
The other Canary Islands. Recorded from La Palma (Pitard 1907) and Tenerife (Montagne 1840).

Barbula convoluta Hedw.

Fuerteventura. Pico de la Zarza 750 m NNW.
* Lanzarote. Montaña de la Cinta 410 m N.
The other Canary Islands. Recorded from Gran Canaria (Armitage 1926), Hierro, La Palma (Størmer 1959) and Tenerife (Geheeb & Herzog 1910).

Barbula unguiculata Hedw.

* Fuerteventura (Fig. 7), common above 350 m, scattered down to 220 m.
Lanzarote (Fig. 10), scattered above 220 m.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986) and Gran Canaria (Bryhn 1908, cf. Persson 1939).



Figs 13-16. Fuerteventura. Fig. 13. *Bryum bicolor* (asterisks), *B. capillare* (triangles), both species (dots). Fig. 14. *Bryum canariense*. Fig. 15. *Bryum radiculosum*. Fig. 16. *Crossidium crassinerve* (triangles), *C. squamiferum* (asterisks), both species (dots).

Bartramia stricta Brid.

* Fuerteventura (Fig. 8), common above 550 m, only sporadic at lower altitudes.
Lanzarote. El Agujero 480 m N, Monte Corona common above 400 m, Los Helechos 500 m N, Valle del Malvaso common above 500 m.
The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Montagne 1840), Hierro (Pitard 1907), La Palma (Schiffner 1902) and Tenerife (Mitten 1870).

Bryum argenteum Hedw. var. *lanatum* (P. Beauv.) Hampe

Fuerteventura. Aceitunal 520 m SSW, Gran Montana 600 m, Pico de la Atalaya 670 m N, Pico de la Fortaleza 600 m
Lanzarote. Caldera del Corazoncillo 310 m N, Cerro Tegoyo 430 m, Los Helechos 490 m S, Montaña Terza 370 m SSW, Valle del Malvaso 460 m SSW.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Montagne 1840), La Palma (Schiffner 1902) and Tenerife (Bryhn 1908).

Bryum bicolor Dicks.

* Fuerteventura (Fig. 13), common above 350 m, a few localities down to 200 m.
Lanzarote (Fig. 12), common above 350 m, a few localities down to 200 m.
The other Canary Islands. Recorded from Gomera (Schiffner 1902), Gran Canaria, Hierro (Montagne 1840), La Palma and Tenerife (Pitard 1907).

Bryum canariense Brid.

* Fuerteventura (Fig. 14), common above 500 m, scattered down to 300 m.
Lanzarote. Montaña Fuego 280 m W, Los Helechos 440 m N, Peñas del Chache 580 m and 610 m N.
The other Canary Islands. Recorded from Gomera, Hierro (Pitard 1907), Gran Canaria (Montagne 1840), La Palma (Schiffner 1902) and Tenerife (Bridel 1826).

Bryum capillare Hedw.

* Fuerteventura (Fig. 13), scattered above 500 m, sporadic at lower altitudes.
Lanzarote. Guardilama 580 m N in the crater, Monte Corona 500 m N in the crater, Montaña Guatizea 460 m N, Valle del Malvaso 510 m, Valle del Rincon 500 m N.
The other Canary Islands. Recorded from Gomera (Schwab et

al. 1986), Gran Canaria (Montagne 1840), Hierro, La Palma (Pitard 1907) and Tenerife (Renauld & Cardot 1902).

Bryum dunense A. J. E. Sm. & Whiteh.

* Fuerteventura. Morro del Cortijo 530 m, Risco del Carnicero 610 m, 3 km W of Antigua 450 m.
* Lanzarote. Montaña Tamia 300 m N, Guardilama 520 m N.
The other Canary Islands. Recorded from Tenerife (Long et al. 1981).

Bryum gemmiferum Wilcz. & Demar.

Lanzarote. Yaiza and Tinajo according to Wilczek and Demaret (1976).

Bryum gemmilucens Wilcz. & Demar.

Lanzarote. Peñas del Chache according to During (1981).
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986).

Bryum radiculosum Brid.

Fuerteventura (Fig. 15), common above 350 m, a few localities down to 200 m.
Lanzarote (Fig. 12), common above 350 m, a few localities down to 200 m.
The other Canary Islands. Recorded from Graciosa (Sunding 1971), Gran Canaria, Tenerife (Bryhn 1908), Lobos (Sunding 1969) and La Palma (Størmer 1959).

Bryum ruderale Crundw. & Nyh.

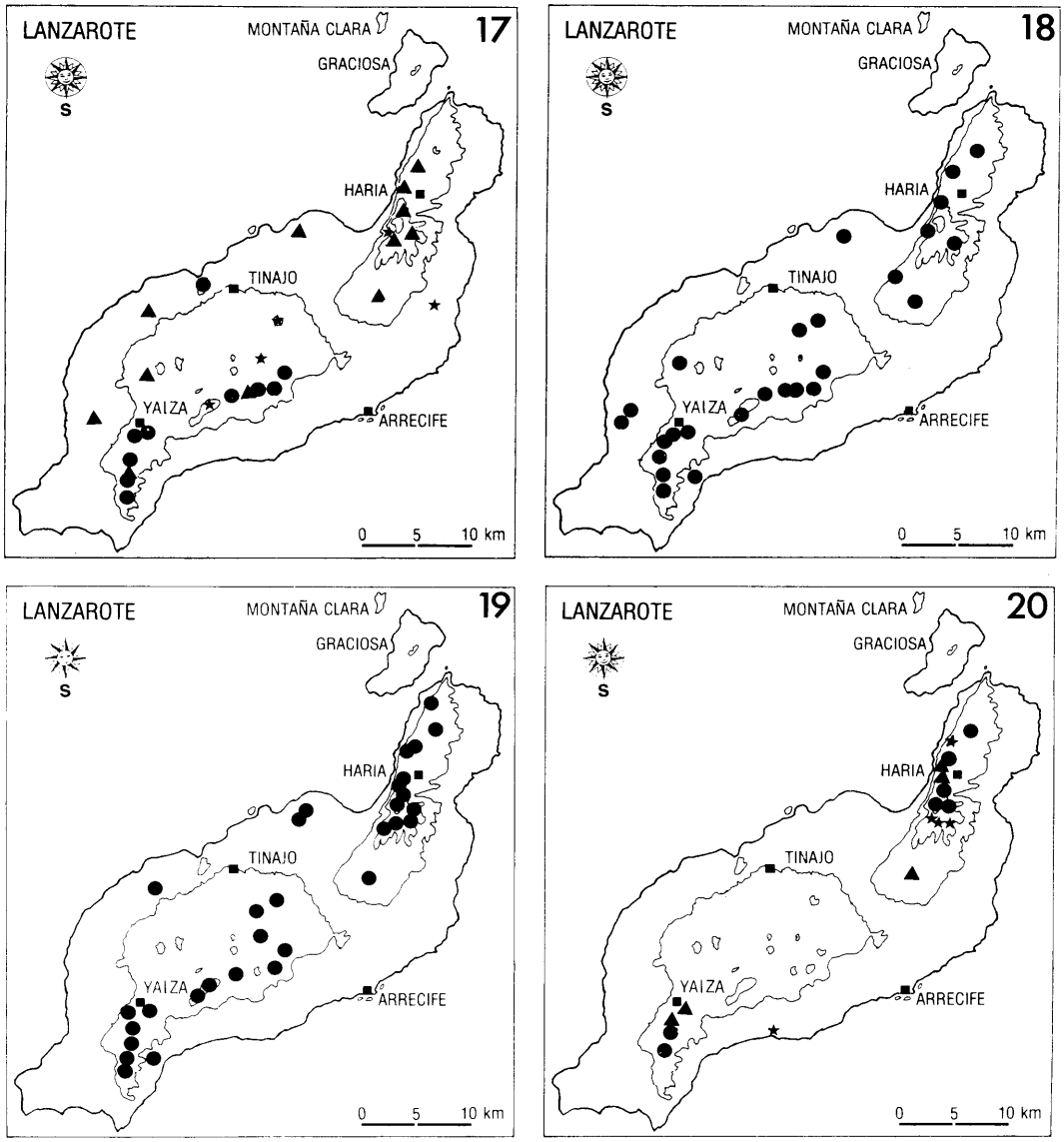
Lanzarote. Peñas del Chache according to During (1981).
The other Canary Islands. Recorded from La Palma and Tenerife (Long et al. 1981).

Bryum torquescens B. & S.

Lanzarote. Near Ye according to During (1981).
The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Bryhn 1908), La Palma and Tenerife (Pitard 1907).

Campylopus fragilis (Brid.) B., S. & G.

* Fuerteventura. Pico de la Zarza common on soilcovered ledges of the steep N-facing cliffs above 750 m.



Figs 17-20. Lanzarote. Fig. 17. *Crossidium crassinerve* (asterisks), *C. squamiferum* (triangles), both species (dots). Fig. 18. *Didymodon rigidulus*. Fig. 19. *Didymodon vinealis*. Fig. 20. *Fissidens viridulus* var. *bambergeri* (asterisks), *Funaria convexa* (triangles), both species (dots).

The other Canary Islands. Recorded from Gomera (Pitard 1907), Gran Canaria (Sunding 1966), Hierro (Bines 1965), La Palma (Schiffner 1902) and Tenerife (Bryhn 1908).

Cheilothela chloropus (Brid.) Lindb.

* Lanzarote. Monte Corona 500 m N on soil in the crater associated with *Tortella flavovirens*.

The other Canary Islands. Recorded from Gran Canaria (Long et al. 1981), Hierro (Størmer 1959), La Palma (Düll 1980) and Tenerife (Winter 1914).

Crossidium crassinerve (De Not.) Jur.

Fuerteventura (Fig. 16), scattered.

Lanzarote (Fig. 17), common above 300 m.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria, Tenerife (Geheeb & Herzog 1910) and La Palma (Long et al. 1981).

Crossidium squamiferum (Viv.) Jur.

* Fuerteventura (Fig. 16), rare.

Lanzarote (Fig. 17), common above 300 m.

The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Bryhn 1908), La Palma (Long et al. 1981) and Tenerife (Hooker 1818).

Dicranella howei Ren. & Card.

Lanzarote. Valle del Malvaso 500 m N associated with *Tortella flavovirens* and *Lunularia cruciata*.

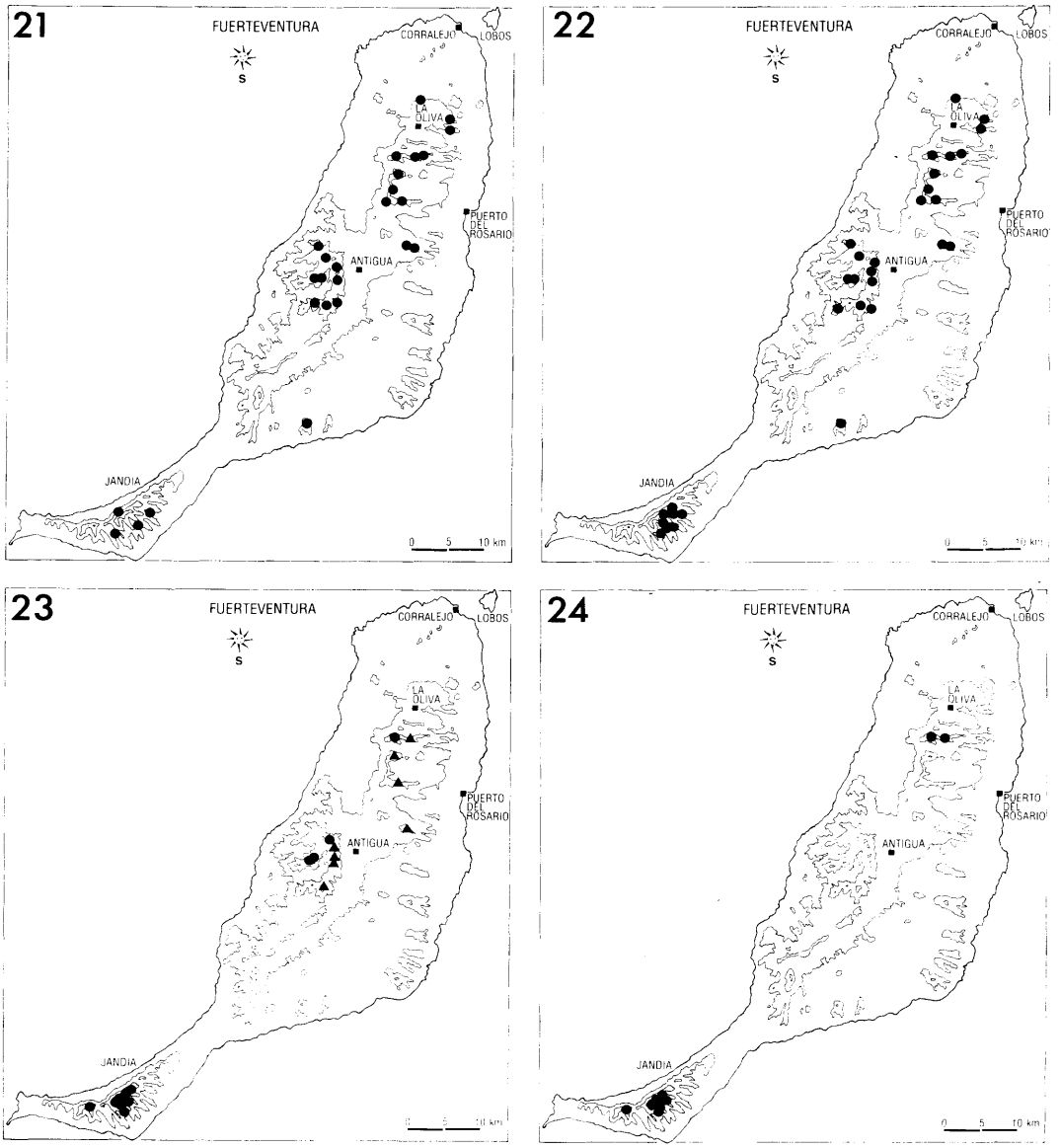
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Long et al. 1981), La Palma and Tenerife (Eggers 1982).

Didymodon insulanus (De Not.) M. Hill.

Fuerteventura. Aceitunal 620 m N, Aqua de Bueyes Barranco 370 m N, Los Castillejitos 500 m NE, Morro de la Cruz 600 m N, Morro de Teteguno 600 m N, Pico de la Atalaya 590 m N, Pico de Don David 510 m N, Rosa del Taro Barranco 290 m N, Valle de los Canarios Barranco 310 m N.

Lanzarote. Atalaya de Femés 440 m S, Caldera Trasera 160 m NW, Cerro Tegoyo 400 m, Hascha Grande 450 m N, Pico Redondo 470 m N.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Bryhn 1908), Hierro (Pitard 1907), La Palma (Schiffner 1902) and Tenerife (Renauld & Cardot 1902).



Figs 21-24. Fuerteventura. Fig. 21. *Didymodon rigidulus*. Fig. 22. *Didymodon vinealis*. Fig. 23. *Grimmia trichophylla* (triangles), *G. trichophylla* and *G. laevigata* (dots). Fig. 24. *Homalothecium sericeum* var. *mandonii*.

Didymodon luridus Hornsch. ex. Spreng.

Fuerteventura. Aceitunal 580 m N, Morro de Teteguno 580 m N, Pico de la Zarza 530 m and 780 m W.

* Lanzarote. Monte Guatizea 400 m W.

The other Canary Islands. Recorded from Gomera, La Palma (Størmer 1959), Gran Canaria (Sunding 1967 b) and Tenerife (Winther 1914).

Didymodon rigidulus Hedw.

Fuerteventura (Fig. 21), common above 350 m.

Lanzarote (Fig. 18), common above 300 m, scattered down to about 100 m on both islands.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Bryhn 1908), Hierro (Størmer 1959), La Palma (Long et al. 1981) and Tenerife (Winter 1914).

Note. During (1981) reports *Didymodon acutus* (Brid.) Saito from Lanzarote. In my opinion the occurrence of axillary gemmae and the bistratose leaf margins of the Lanzarote plants indicate that they belong to *D. rigidulus*. Zander (1981) treates *D. acutus* as *D. rigidulus* Hedw. var. *gracilis* (Hook. & Grev.) Zander.

Didymodon tophaceus (Brid.) Lisa

* Fuerteventura. Gran Valle Barranco 360 m and 390 m, Pico de la Zarza 150 m N. All localities on soil with percolating water.

* Lanzarote. Valle del Malvaso 460 m, Guanapay 480 m N, Montaña Diama 280 m W, vertical wall along road, with percolating water.

The other Canary Islands. Recorded from Gomera, Gran Canaria (Størmer 1959), La Palma (Düll 1980) and Tenerife (Bryhn 1908).

Didymodon vinealis (Brid.) Zander

Fuerteventura (Fig. 22), common above 350 m.

Lanzarote (Fig. 19), common above 350 m, scattered down to 50 m.

The other Canary Islands. Recorded from Gomera, La Palma (Størmer 1959), Graciosa (Sunding 1971), Gran Canaria (Schiffner 1902), Hierro and Tenerife (Pitard 1907).

Encalypta vulgaris Hedw.

* Fuerteventura. Pico de la Zarza 740 m and 780 m N associated with *Tortella flavovirens*.

The other Canary Islands. Recorded from Gran Canaria (Armitage 1926), La Palma (Düll 1980) and Tenerife (Winter 1914).

Entosthodon attenuatus (Dicks.) Bryhn

Lanzarote. Near Ye according to During (1981).
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Sunding 1966), Hierro (Schiffner 1902), La Palma (Størmer 1959), Lobos (Sunding 1969) and Tenerife (Bryhn 1908).

Entosthodon curvisetus (Schwaegr.) C. Mull.

* Fuerteventura. Agua de Bueyes Barranco 370 m N, Los Castillejitos 500 m NE, Valle de los Canarios 460 m N.
Lanzarote. Magues Barranco 380 m N, Los Helechos 490 m NE.
The other Canary Islands. Recorded from Gran Canaria and Tenerife (Eggers 1982).

Epipterygium tozeri (Grev.) Lindb.

* Fuerteventura. Pico de la Zarza 770 m NNW.
The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Bryhn 1908), Hierro, La Palma (Pitard 1907) and Tenerife (Renauld & Cardot 1902).

Eucladium verticillatum (Brid.) B., S. & G.

* Fuerteventura. Pico de la Zarza 770 m N.
The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Montagne 1840), Hierro (Long et al. 1981), La Palma (Schiffner 1902) and Tenerife (Geheeb & Herzog 1910).

Eurhynchium meridionale (B., S. & G.) De Not.

* Fuerteventura. Castillejo Alto 730 m N, Morro del Jorao 600 m N, Pico de la Zarza relatively common on soil-covered banks and below overhanging rocks of N-facing cliffs between 750 m and the summit.
* Lanzarote. Guardilama 580 m N, Los Helechos 530 m and 570 m N, Monte Corona 500 m N in the crater.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Schiffner 1902), Hierro (Størmer 1959), La Palma (Pitard 1907) and Tenerife (Schiffner 1901).

Fissidens algarvicus Solms

Lanzarote. El Agujero 480 m N, Monte Corona 400 m N, Peña de Juan Estévez 550 m N, Peñas del Chache several localities above 620 m.

The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Størmer 1959), Gran Canaria (Koppe & Düll 1986) and Tenerife (Pitard 1907).

Fissidens taxifolius Hedw. subsp. *pallidicaulis* (Mitt.) Amann

* Fuerteventura. Pico de la Zarza common on soil-covered ledges of the steep N-facing cliffs between 740 m and the summit, Valle de Vinamar Barranco 430 m N.

The other Canary Islands. Recorded from Gomera (Pitard 1907), Gran Canaria (Koppe & Düll 1986), Hierro (Størmer 1959), La Palma (Schiffner 1902) and Tenerife (Mitten 1870).

Fissidens viridulus (Sw.) Wahlenb. var. *bambergeri* (Schimp. ex Milde) Waldh. in Weim.

Fuerteventura. Los Castillejitos 500 m NE, Pico de la Zarza 430 m W, Rosa del Taro Barranco 290 m N, Risco del Carnicero 610 m, Valle de Vinamar Barranco 430 m N.

Lanzarote (Fig. 20). 82 % of the localities are found above 400 m. One locality (Barranco de la Pila near Puerto del Carmen) is situated at 20 m.

The other Canary Islands. Recorded from Gran Canaria, La Palma (Størmer 1959) and Tenerife (Bryhn 1908).

Note. I follow Smith (1978) in the interpretation of this species.

Funaria convexa Spruce

* Fuerteventura. Aceitunal 520 m N, Agua de Bueyes Barranco 370 m N, Betancuria Barranco 480 m N, Los Castillejitos 500 m NE, Montaña Muda 620 m N, Pico de la Zarza 430 m W, Rosa del Taro Barranco 310 m N, Valle de Esquinso Barranco 360 m N.

Lanzarote (Fig. 20), scattered above 400 m, only sporadic at lower altitudes.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria, Tenerife (Bryhn 1908), Hierro and La Palma (Størmer 1959).

Funaria hygrometrica Hedw.

Lanzarote. Peñas del Chache according to Pitard and Negri (1908).

The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Pitard 1907), Gran Canaria (Schiffner 1902) and Tenerife (Montagne 1840).

Funaria pulchella Philib.

Lanzarote. Monte Corona 500 m N in the crater. According to During (1981) also above Tabayesco 200-400 m and SW of Haria

500-600 m.

The other Canary Islands. Recorded from Gran Canaria (Koppe & Düll 1986), La Palma (Long et al. 1981) and Tenerife (Crundwell & Nyholm 1974).

Gigaspermum mouretii Corb.

* Lanzarote. Montaña Bermeja 440 m N on soil in the crater associated with *Scorpiurium circinatum* and *Tortella flavovirens*. This species is new to Macaronesia. The specimen is sterile, but it has the typically thick, white subterranean creeping stems, short budlike gametophore and imbricate, pale green nerveless leaves.

Note. *G. mouretii* was described by Corbière (1913) from a collection of Mouret from Rabat, Morocco. Later Jelenc (1955) reported it from Ain Cheggag. The species was long regarded as a Moroccan endemic, but later it was also reported from Spain (Allorge & Casas de Puig 1958) and Israel (Herrnstadt et al. 1980). The genus *Gigaspermum* is phytogeographically interesting. The other species of the genus are known from the Southern Hemisphere: South Africa, Madagascar, Australia, Tasmania and New Zealand.

Grimmia laevigata (Brid.) Brid.

* Fuerteventura Fig. 23.

Lanzarote. Monte Corona common above 500 m, Peñas del Chache common above 500 m, Los Helechos 400 m S, Eremita de las Nieves 540 m E.

The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Montagne 1840), La Palma (Pitard 1907) and Tenerife (Mitten 1870).

Grimmia pulvinata (Hedw.) Sm.

* Fuerteventura. Pico de la Atalaya 610 m N, Pico de la Zarza 750 m N.

Lanzarote. Peñas del Chache rather scattered above 500 m, Montaña Ganada 520 m N, Valle del Malvaso 500 m N.

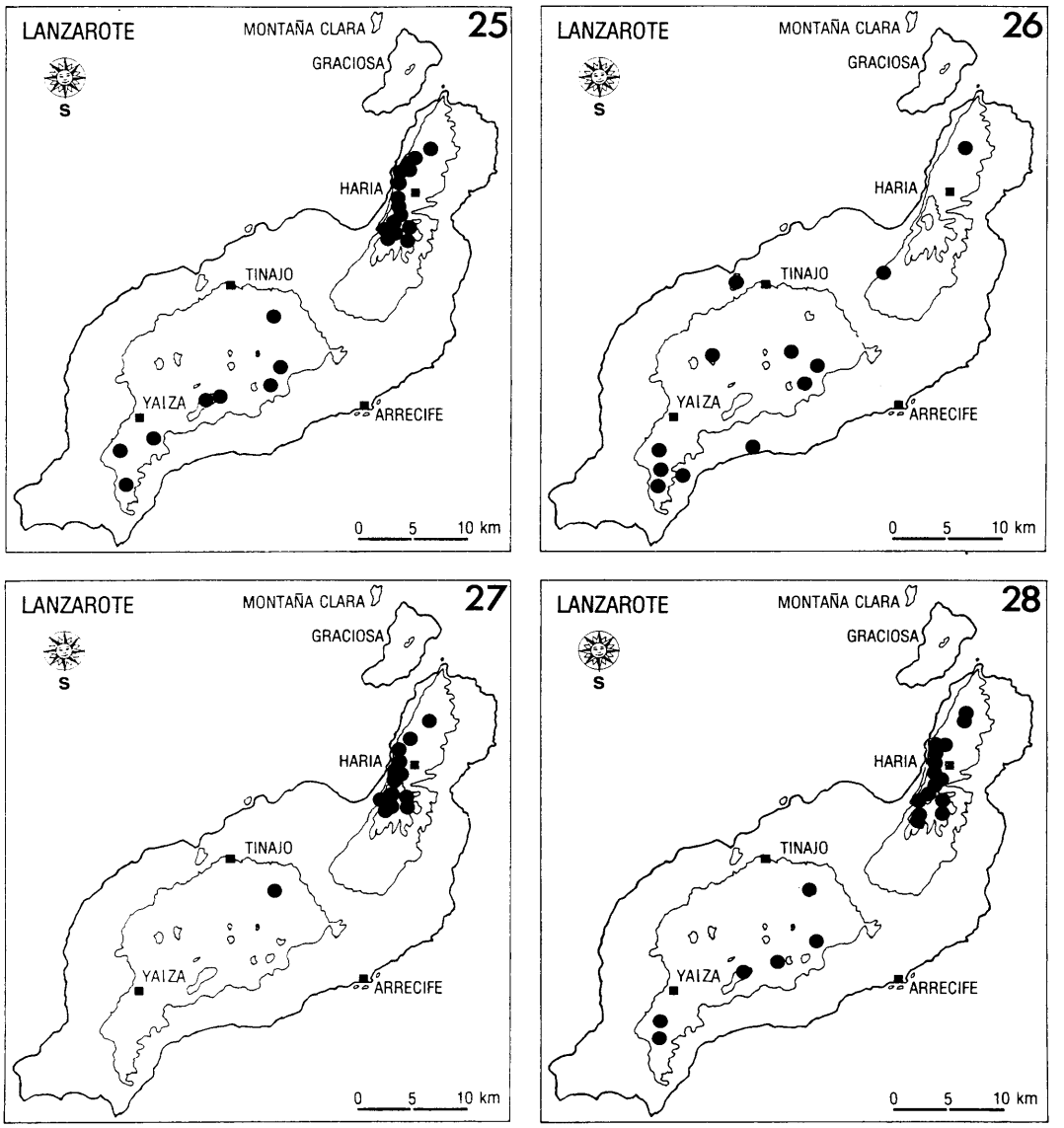
The other Canary Islands. Recorded from Gomera (Schiffner 1902), Gran Canaria (Bryhn 1908), Hierro (Størmer 1959), La Palma (Pitard 1907) and Tenerife (Renauld and Cardot 1902).

Grimmia trichophylla Grev.

Fuerteventura (Fig. 23), common above 500 m, sporadic at lower altitudes.

Lanzarote (Fig. 25), common above 450 m, only sporadic at lower altitudes.

The other Canary Islands. Recorded from Gomera (Størmer 1959), Hierro (Pitard 1907), Gran Canaria, La Palma and Tenerife (Schiffner 1902).



Figs 25-28. Lanzarote. Fig. 25. *Grimmia trichophylla*. Fig. 26. *Gymnostomum calcareum*. Fig. 27. *Homalothecium sericeum* var. *mandonii*. Fig. 28. *Pleurochaete squarrosa*.

Gymnostomum calcareum Nees & Hornsch.

* Fuerteventura. Caracol 310 m and 370 m N, Montaña Escanfraga Barranco 270 m N, Morro Grande 180 m N, Valle de Esquinso Barranco 360 m N, Valle de los Canarios 360 m NE.

Lanzarote (Fig. 26), common between 300 m and 500 m, only sporadic at lower altitudes.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Koppe & Düll 1986), La Palma (Størmer 1959) and Tenerife (Renauld & Cardot 19Q2).

Homalothecium sericeum (Hedw.) B., S. & G. var *mandonii* (Mitt.) Ren. & Card.

Fuerteventura (Fig 24), scattered above 600 m.

Lanzarote (Fig. 27), relatively common above 500 m in the northern part of the island, only sporadic down to 410 m.

The other Canary Islands. Recorded from Gomera (Pitard 1907), Gran Canaria, Hierro, La Palma (Schiffner 1902) and Tenerife (Montagne 1840).

Hypnum cupressiforme Hedw.

Fuerteventura. Reported by Sunding (1971), but the specimen is *Allorgea berthelotiana*.

Lanzarote. Peñas del Chache according to Pitard (1907).

The other Canary Islands. Recorded from Gomera, Gran Canaria, Hierro (Pitard 1907) and Tenerife (Schiffner 1902).

Leptodon smithii (Hedw.) Web. & Mohr

* Fuerteventura. Castillejo Alto 730 m N, Fraile 580 m W, Pico de la Atalaya 610 m N, Pico de la Zarza 780 m W and 807 m N, Valle de Vinamar 690 m W.

Lanzarote. Peñas del Chache several localities above 580 m, especially in small cavities between boulders.

The other Canary Islands. Recorded from Gomera (Schiffner 1902), La Palma (Størmer 1959) and Tenerife (Montagne 1840).

Leucodon canariensis (Brid.) Schwaegr.

Fuerteventura. Castillejo Alto 750 m N, Morro del Jorao 600 m N, Fraile 580 m W, Valle de Vinamar 740 m N, Pico de la Zarza common above 750 m.

* Lanzarote. Peñas del Chache 580 m W.

The other Canary Islands. Recorded from Gomera (Pitard 1907), Gran Canaria (Sunding 1967a), Hierro (Schiffner 1902), La Palma (Long 1978) and Tenerife (Hooker 1820).

Leucodon sciuroides (Hedw.) Schwaegr. var *morensis* (Schwaegr.) De Not.

* Fuerteventura. Morro del Jorao 600 m N, Pico de la Zarza 500 m and 540 m W.
Lanzarote. Peñas del Chache 580 m W, Montaña Ganada 600 m W.
The other Canary Islands. Recorded from Gran Canaria (Schiffner 1902) and Tenerife (Bryhn 1908).

Neckera complanata (Hedw.) Hub.

* Fuerteventura. Pico de la Zarza scattered above 750 m N.
The other Canary Islands. Recorded from Gomera (Mitten 1870), Gran Canaria (Geheeb & Herzog 1910), La Palma (Pitard 1907) and Tenerife (Crundwell 1976).

Neckera intermedia Brid.

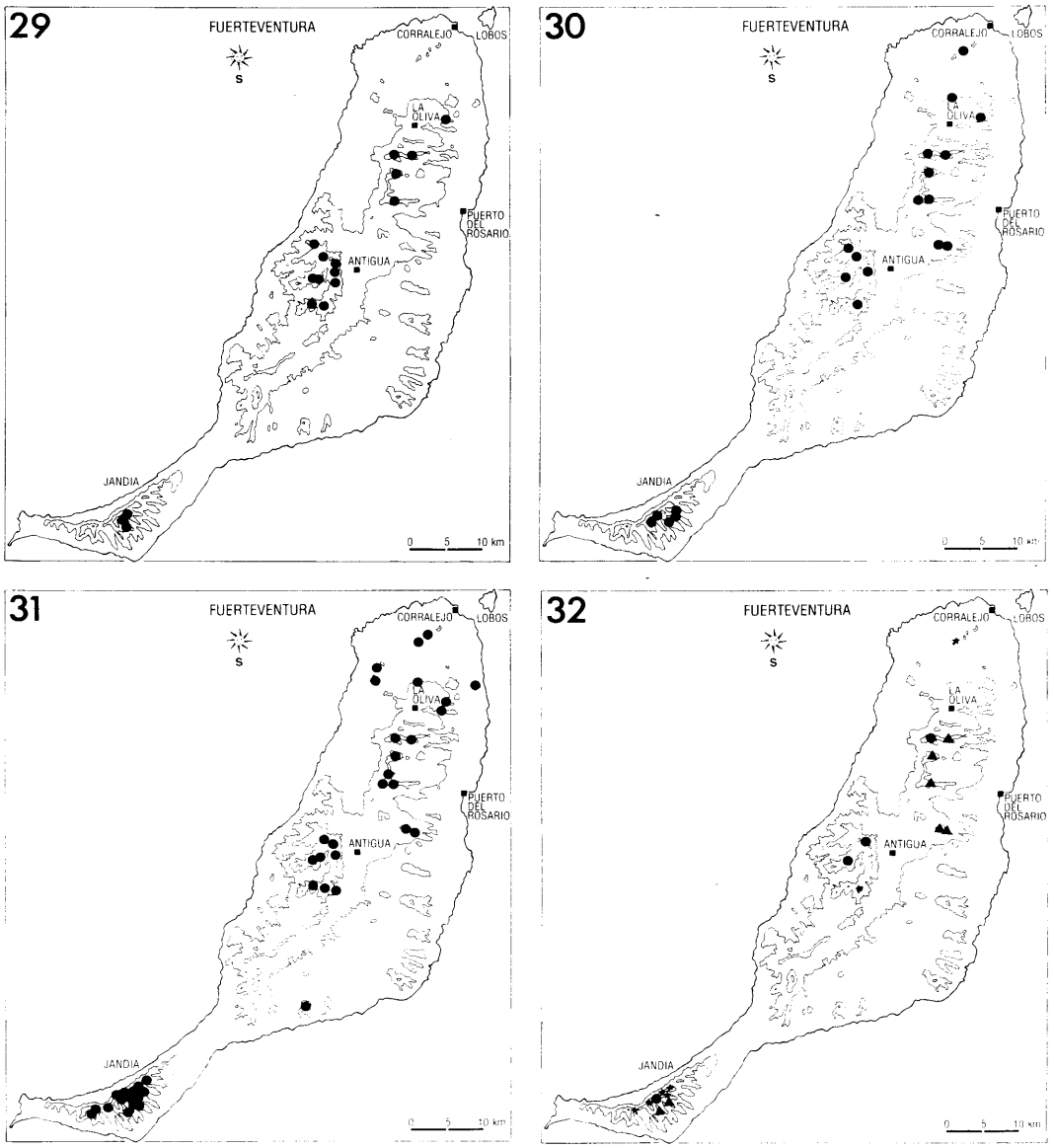
* Fuerteventura. Castillejo Alto 750 m N, Valle de Vinamar 730 m N, Pico de la Zarza common below overhanging rock of N-facing cliffs above 750 m.
The other Canary Islands. Recorded from Gomera, Gran Canaria, Hierro, La Palma (Pitard 1907) and Tenerife (Bridel 1819).

Orthotrichum affine Brid.

Fuerteventura. Castillejo Alto 660 m E, Pico de la Atalaya 700 m N, Valle de Vinamar 690 m W, Pico de la Zarza common above 700 m. All stations as an epiphyte on *Bubonium sericeum*.
The other Canary Islands. Recorded from Gran Canaria (Sunding 1967 a), La Palma and Tenerife (Størmer 1959).

Orthotrichum diaphanum Brid.

* Fuerteventura. Gran Montaña 670 m N as an epiphyte on *Lycium intricatum*; Castillejo Alto 660 m E, Pico de la Atalaya 700 m N, Pico de la Zarza 730 m E and 807 m N, Valle de Vinamar 670 m NW and 690 m W, all stations as epiphyte on *Bubonium sericeum*; Castillejo Alto 730 m N, Gran Montaña 670 m N, Montaña Escanfraga 500 m N, Montaña Muda 620 m N, Pico de la Zarza 790 m E, all on soil intermingled with other bryophytes.
Lanzarote. Caldera del Corazoncillo 310 m and 320 m N, Montaña Bermeja 360 m N, all as epiphyte on *Ficus* sp.; Peñas del Chache 580 m and 610 m epiphytic on shrub associated with *Frullania dilatata*; Montaña Blanca 590 m N, Montaña Bermeja 380 m N, Caldera del Corazoncillo 310 m N, all on soil intermingled with other bryophytes.
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Montagne 1840), Hierro (Størmer 1959), La Palma (Düll 1980) and Tenerife (Mitten 1870).



Figs 29-32. Fuerteventura. Fig. 29. *Pleurochaete squarrosa*. Fig. 30. *Scorpiurium circinatum*. Fig. 31. *Tortella flavovirens*. Fig. 32. *Tortella nitida* (asterisks), *Trichostomopsis australasiae* (triangles), both species (dots).

Phascum cuspidatum Hedw.

* Fuerteventura. Morro de la Cruz 650 m W associated with *Tortella flavovirens*.

Lanzarote. Peñas del Chache (During 1981).

The other Canary Islands. Recorded from Gran Canaria and Tenerife (Long et al. 1981).

Pleurochaete squarrosa (Brid.) Lindb.

Fuerteventura (Fig. 29), common above 500 m.

Lanzarote (Fig. 28), common above 500 m, scattered down to 400 m.

The other Canary Islands. Recorded from Gomera (Schiffner 1902), Gran Canaria (Montagne 1840), Hierro, La Palma and Tenerife (Pitard 1907).

Polytrichum juniperinum Hedw.

Lanzarote. Peñas del Chache according to Pitard (1907). In spite of extensive investigations of this locality I have not been able to find this species again.

The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Pitard & Negri 1908), Gran Canaria (Montagne 1840) and Tenerife (Mitten 1870).

Pottia lanceolata (Hedw.) C. Müll.

Fuerteventura. Los Castillejitos 500 m NE, Morro de la Cruz 650 m W, Montaña Muda 660 m, Pico de la Atalaya 610 m N, Pico de la Zarza 530 m NNW.

Lanzarote. Atalaya de Femés 440 m S, Los Helechos 490 m and 510 m N in the crater, Peñas del Chache common above 520 m, Montaña Tamia 360 m NNW in the crater.

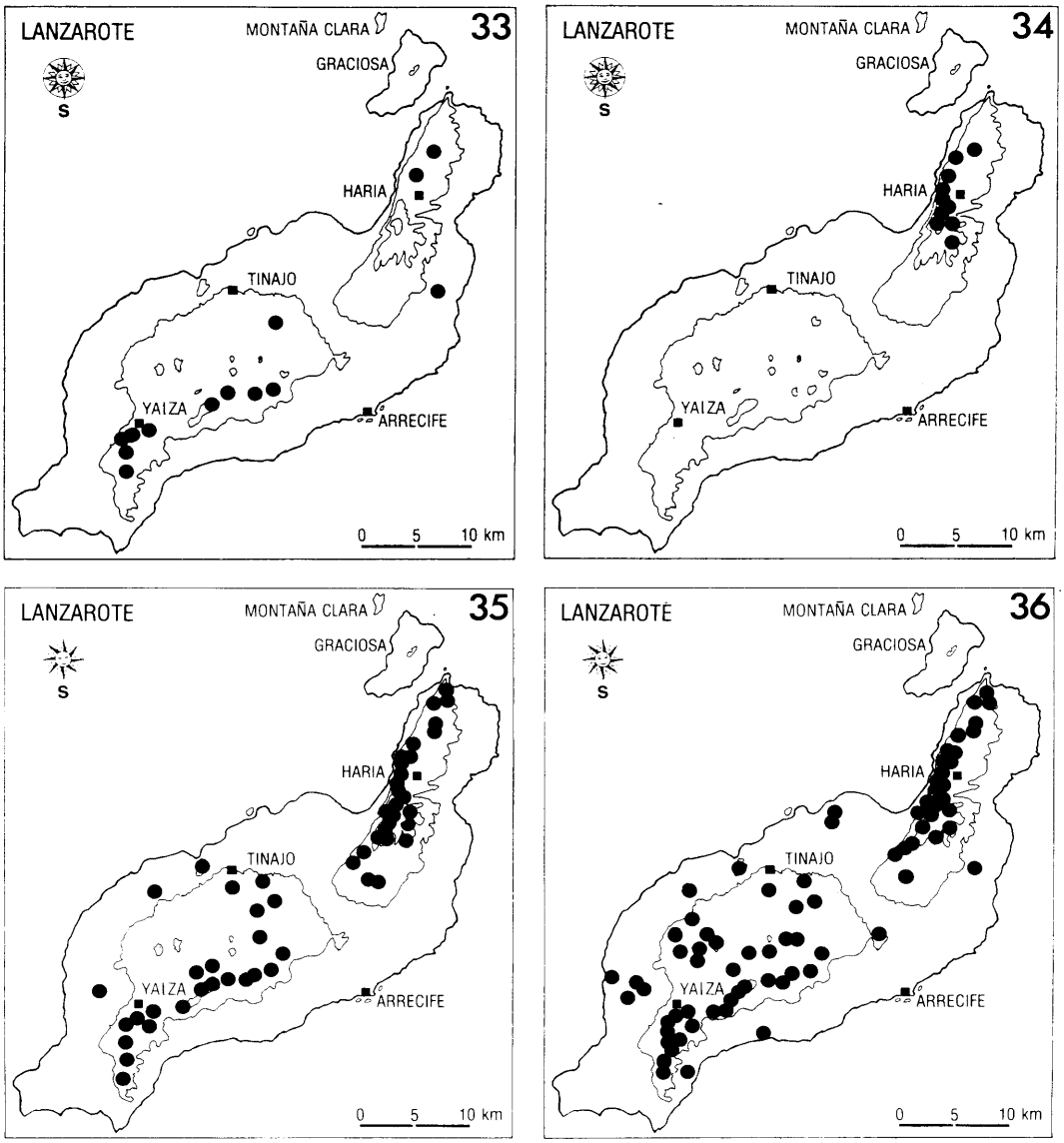
The other Canary Islands. Recorded from Gran Canaria (Bryhn 1908) and Tenerife (Koppe & Düll 1982).

Pottia starckeana (Hedw.) C. Müll.

* Fuerteventura. Agua de Bueyes Barranco 370 m N, Betancuria Barranco 410 m N, Los Castillejitos 500 m and 540 m N, Pico de la Atalaya common above 600 m, Pico de la Zarza 430 m W, Rosa del Taro Barranco 290 m and 460 m N.

Lanzarote. El Agujero 480 m N, La Mesa 380 m N, Monte Corona 410 m and 610 m N, Peñas del Chache common above 520 m.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria (Long et al. 1981) and Tenerife (Koppe & Düll 1982).



Figs 33-36. Lanzarote. Fig. 33. *Pseudocrossidium revolutum*. Fig. 34. *Scleropodium touretii*. Fig. 35. *Scorpiurium circinatum*. Fig. 36. *Tortella flavovirens*.

Pseudocrossidium revolutum (Brid.) Zander

Fuerteventura. Fraile 570 m N, Morro de Tabagosta 580 m N.
Lanzarote (Fig. 33), most common above 400 m, but occurs scattered down to 130 m.
The other Canary Islands. Recorded from Gran Canaria (Montagne 1840), La Palma (Long et at. 1981) and Tenerife (Størmer 1959).

Pterogonium gracile (Hedw.) Sm.

Fuerteventura. Castillejo Alto 750 m N, Gran Montaña 630 m N, Valle de Vinamar 730 m N, Pico de la Zarza common above 750 m.
Lanzarote. Monte Corona 480 m N, Peñas del Chache 640 m N.
The other Canary Islands. Recorded from Gomera, Hierro, La Palma, Tenerife (Pitard 1907) and Gran Canaria (Montagne 1840).

Ptychomitrium nigrescens (Kunze) Wijk & Marg.

* Fuerteventura. Pico de la Zarza 790 m N.
The other Canary Islands. Recorded from Gomera (Størmer 1959), La Palma (Schiffner 1902) and Tenerife (Renauld & Cardot 1902).

Rhynchostegiella curviseta (Brid.) Limpr.

* Lanzarote. Montaña Chupaderos 410 m N, Montaña de Juan Bello in a little cave 430 m N.
The other Canary Islands. Recorded from Gran Canaria (Bryhn 1908), La Palma (Størmer 1959) and Tenerife (Montagne 1840).

Scleropodium touretii (Brid.) L. Koch

* Fuerteventura. Aceitunal 580 m N, Morro de Teteguno 560 m, 600 m and 640 m N, Montaña Muda 620 m N, Pico de la Atalaya common above 550 m, Pico de la Zarza 740 m and 770 m N.
Lanzarote (Fig. 34), common above 500 m in the northern part of the island.
The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Schiffner 1902), Gran Canaria (Montagne 1840) and Tenerife (Mitten 1877).

Scorpiurium circinatum (Brid.) Fleisch. & Loeske

Fuerteventura (Fig. 30), common above 500 m, scattered down to 200 m.
Lanzarote (Fig. 35), common above 350 m, scattered down to about 200 m.
The other Canary Islands. Recorded from Gran Canaria (Bryhn 1908), La Palma (Størmer 1959) and Tenerife (Renauld &

Cardot 1902).

Timmiella barbuloides (Brid.) Monk.

* Fuerteventura. Pico de la Atalaya 610 m N.
Lanzarote. Maguez Barranco 380 m N, Hascha Grande Barranco 300 m W, Los Helechos common above 400 m N in the crater, Monte Corona 500 m and 520 m N in the crater.
The other Canary Islands. Recorded from Gomera, Gran Canaria, Hierro (Pitard 1907), La Palma and Tenerife (Schiffner 1902).

Tortella flavovirens (Bruch) Broth.

Fuerteventura. Fig. 31.
Lanzarote Fig. 36. The most common and widespread species. Common above 300 m on both islands, more scattered down to 100 m; Lanzarote 20 m.
The other Canary Islands. Recorded from Gran Canaria (Schiffner 1902), Hierro, La Palma (Størmer 1959), Lobos (Sunding 1969) and Tenerife (Bryhn 1908).

Tortella nitida (Lindb.) Broth.

* Fuerteventura (Fig. 32), common above 450 m, scattered down to about 300 m.
Lanzarote (Fig. 37), common above 450 m, scattered down to about 300 m.
The other Canary Islands. Recorded from Gomera, Gran Canaria (Schiffner 1901), La Palma (Størmer 1959) and Tenerife (Bryhn 1908).

Tortella tortuosa (Hedw.) Limpr.

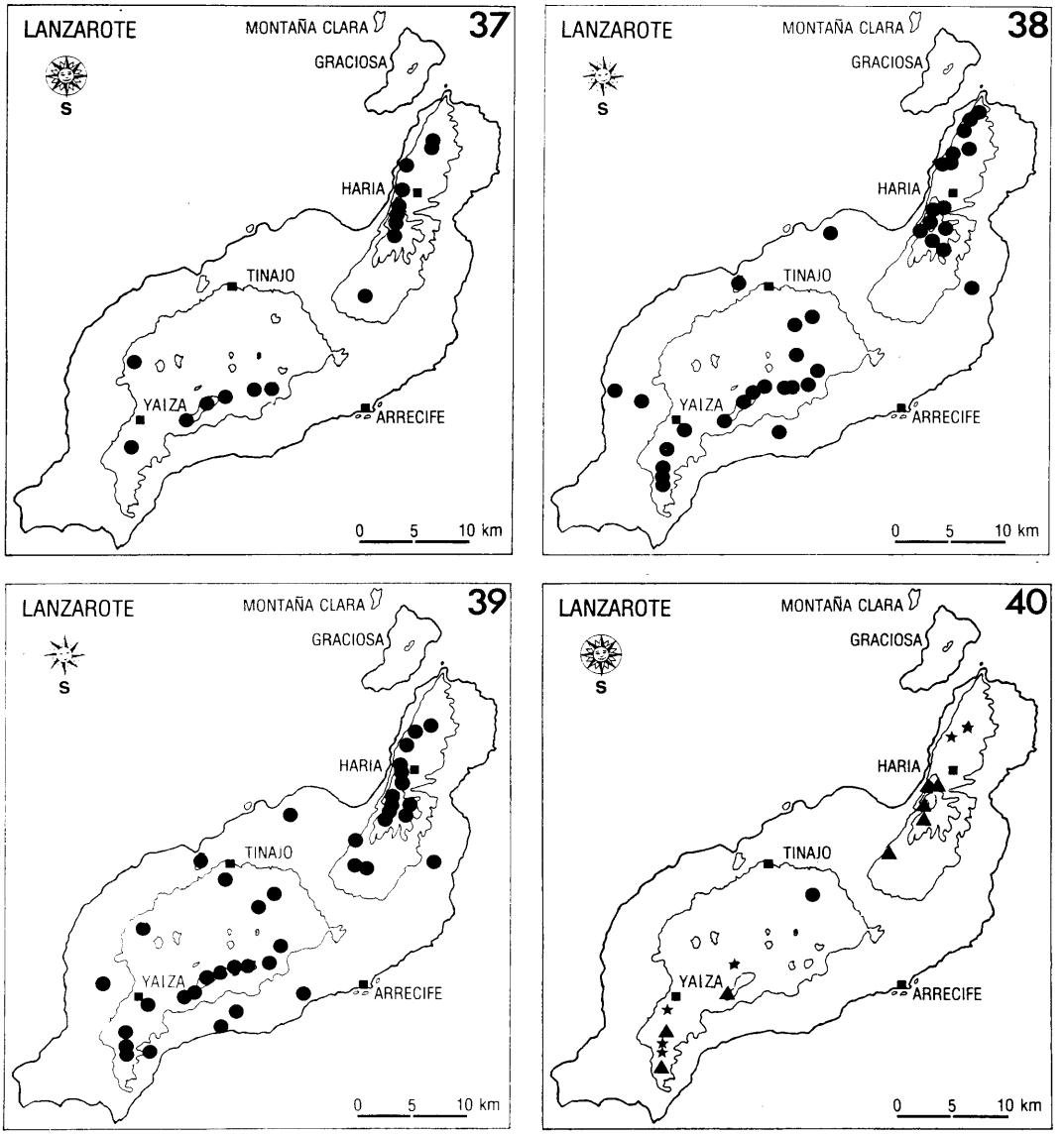
* Fuerteventura. Betancuria Barranco 480 m N, Gran Montaña 630 m NW, Pico de la Zarza 740 m and 750 m NW.
Lanzarote. Guanapay 480 m, Mirador del Rio 340 m N.
The other Canary Islands. Recorded from Hierro (Schiffner 1902), La Palma (Pitard & Negri 1908) and Tenerife (Winter 1914).

Tortula ampliretis Crundw. & Long

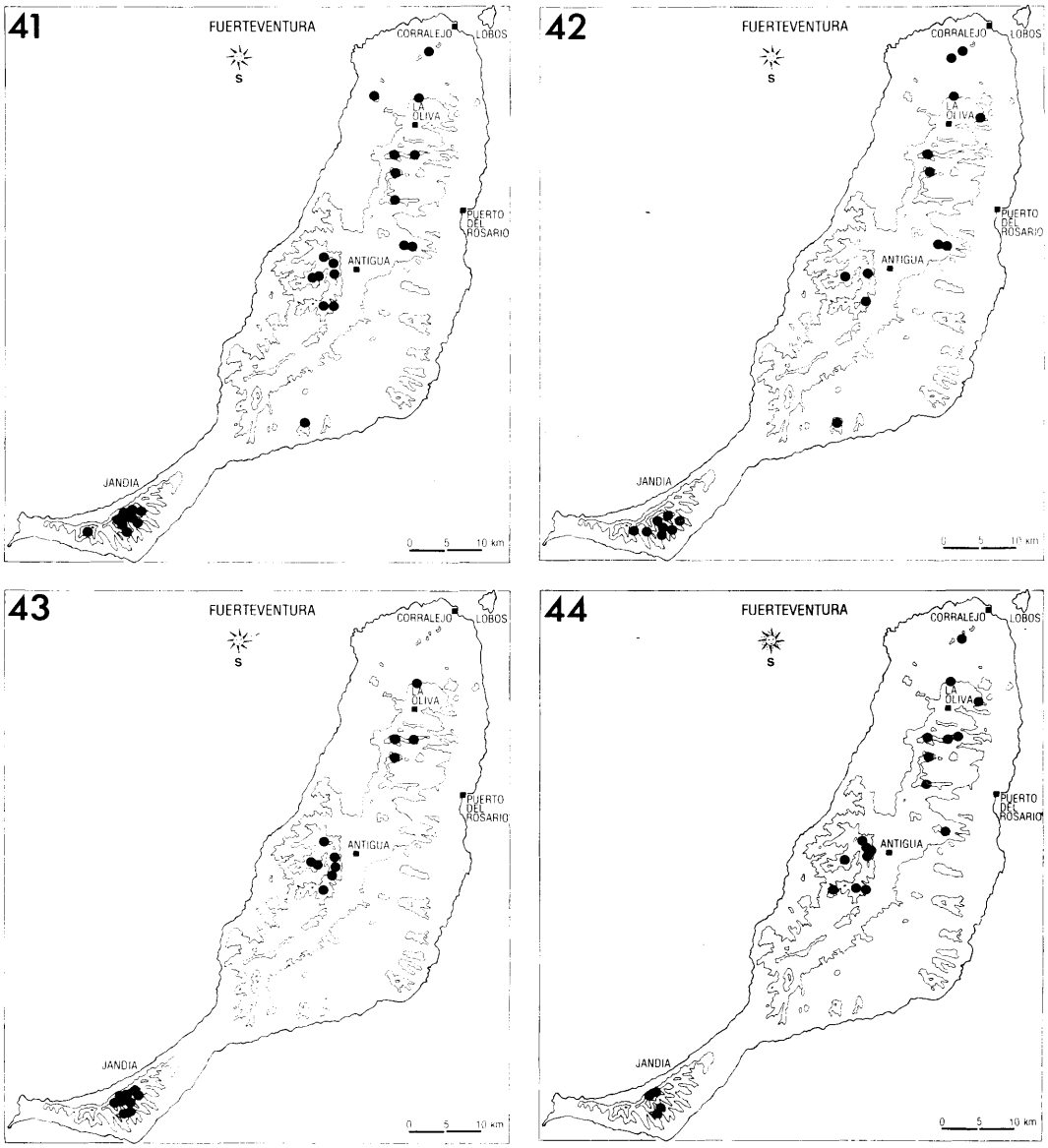
Lanzarote. Reported by During (1981).
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), La Palma and Tenerife (Crundwell et al. 1978).

Tortula atrovirens (Sm.) Lindb.

Fuerteventura (Fig. 41), common above 400 m.



Figs 37-40. Lanzarote. Fig. 37. *Tortella nitida*. Fig. 38. *Tortula atrovirens*. Fig. 39. *Tortula muralis*. Fig. 40. *Trichostomopsis australasiae* (asterisks) and *Trichostomum crispulum* (triangles), both species (dots).



Figs 41-44. Fuerteventura. Fig. 41. *Tortula atrovirens*. Fig. 42. *Tortula muralis*. Fig. 43. *Trichostomum brachydontium*. Fig. 44. *Weissia condensa*.

Lanzarote (Fig. 38), common above 250 m, only sporadic at lower altitudes, but found down to 20 m.

The other Canary Islands. Recorded from Gomera, Hierro, La Palma (Størmer 1959), Gran Canaria, Tenerife (Bryhn 1908) and Lobos (Sunding 1969).

Tortula cuneifolia (With.) Turn.

* Lanzarote. Found once at Peña de Juan Estévez 550 m N on soil.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria, La Palma (Pitard 1907) and Tenerife (Winter 1914).

Tortula inermis (Brid.) Mont. var. *inermis*

* Fuerteventura. Morro de Teteguno 560 m and 640 m N on soil.

* Lanzarote. Peñas del Chache 620 m W on soil-covered rocks.

The other Canary Islands. Recorded from Gran Canaria (Schiffner 1902) and Tenerife (Long et al. 1981).

Tortula laevipila (Brid.) Schwaegr. var. *laevipila*

* Fuerteventura. Pico de la Zarza 690 m W and 807 m N, both localities as an epiphyte on *Bubonium sericeum*. Morro del Jorao 600 m N, Montaña Muda 600 m and 620 m N on soil intermingled with *Zygodon baumgartneri*.

* Lanzarote. Caldera del Corazoncillo 320 m N as an epiphyte on *Ficus* sp., Monte Corona 480 m N on soil in the crater intermingled with *Tortella flavovirens*.

The other Canary Islands. Recorded from Gomera (Schwab et at. 1986), Gran Canaria (Pitard 1907), La Palma (Størmer 1959) and Tenerife (Mitten 1870).

Note. All my specimens belong to var. *laevipila* as circumscribed by Barkman (1963).

Tortula muralis Hedw.

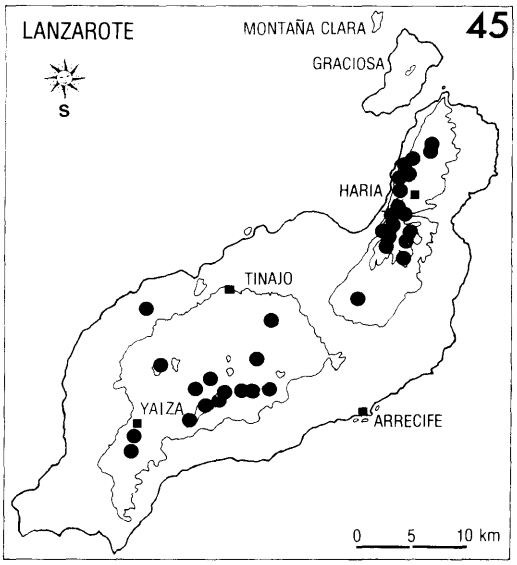
Fuerteventura. Fig. 42.

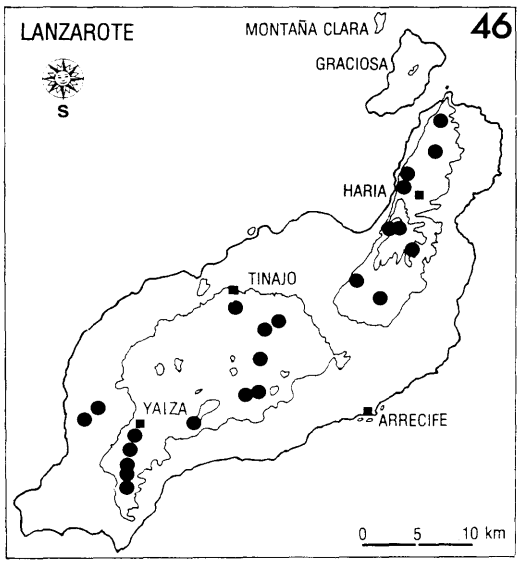
Lanzarote. Fig. 39. Most of the localities on both islands are situated between 300 m and 500 m, but the species occurs scattered down to 20 m on Lanzarote.

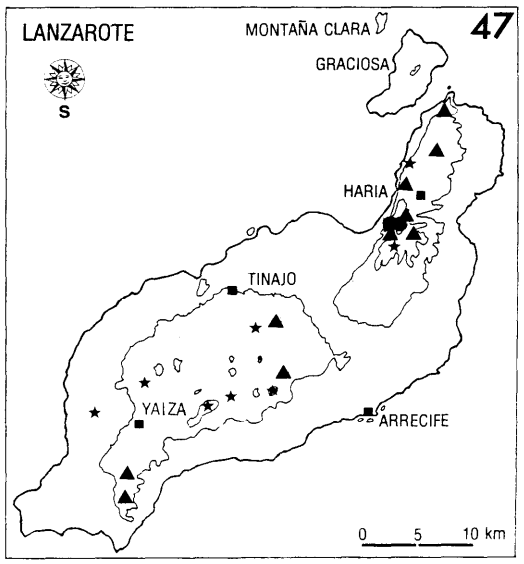
The other Canary Islands. Recorded from Gomera, Hierro, La Palma, Tenerife (Pitard 1907), Graciosa (Sunding 1971), Gran Canaria (Montagne 1840) and Lobos (Sunding 19699).

Tortula revolvens (Schimp.) G. Roth. var. *obtusata* Reim.

* Lanzarote. Caldera Trasera 160 m NW, Atalaya de Femés 440 m S, Hascha Grande 300 m W, 350 m E and 490 m NNE.







Figs 45-47. Lanzarote. Fig. 45. *Trichostomum brachydontium*. Fig. 46. *Weissia condensa*. Fig. 47. *Weissia controversa* (triangles) and *Zygodon baumgartneri* (asterisks), both species (dots).

The other Canary Islands. Recorded from La Palma (Long et al. 1981) and Tenerife (Crundwell et al. 1978).

Tortula solmsii (Schimp.) Limpr.

* Fuerteventura. Calderon Hondo 200 m NNW, Los Castillejitos 540 m NE

Lanzarote. Monte Corona 500 m N in the crater, Montaña Blanca 360 m N, Peñas del Chache 590 m, 610 and 620 m N.

The other Canary Islands. Recorded from Gomera, Hierro (Størmer 1959), Gran Canaria, Tenerife (Bryhn 1908) and La Palma (Schiffner 1902).

Trichostomopsis australasiae (Hook. et Trev.) Robins

* Fuerteventura (Fig. 32), common above 600 m.

Lanzarote (Fig. 40), common above 400 m, more sporadic down to 300 m.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), Gran Canaria, Hierro, Tenerife (Størmer 1959) and La Palma (Long et al. 1981).

Trichostomum brachydontium Bruch

Fuerteventura (Fig. 43), common above 500 m and scattered down to 400 m.

Lanzarote (Fig. 45), common above 450 m and scattered down to 300 m.

The other Canary Islands. Recorded from Gomera (Størmer 1959), Graciosa (Sunding 1971), Gran Canaria, Hierro, La Palma (Schiffner 1902), Lobos (Sunding 1969) and Tenerife (Montagne 1840).

Trichostomum crispulum Bruch

* Fuerteventura. Agua de Bueyes Barranco 370 m N, Betancuria Barranco 480 m N, Pico de la Zarza 150 m N and 750 m NW, Valle de los Canarios Barranco 360 m NE, Valle de Esquinso Barranco 360 m N.

Lanzarote. Fig. 40.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986), La Palma and Tenerife (Long et al. 1981).

Weissia condensa (Voit) Lindb.

* Fuerteventura (Fig. 44), common above 450 m, a few localities down to 200 m.

Lanzarote (Fig. 46), common above 400 m, a few localities down to about 200 m.

The other Canary Islands. Recorded from Gomera (Schwab et al. 1986.

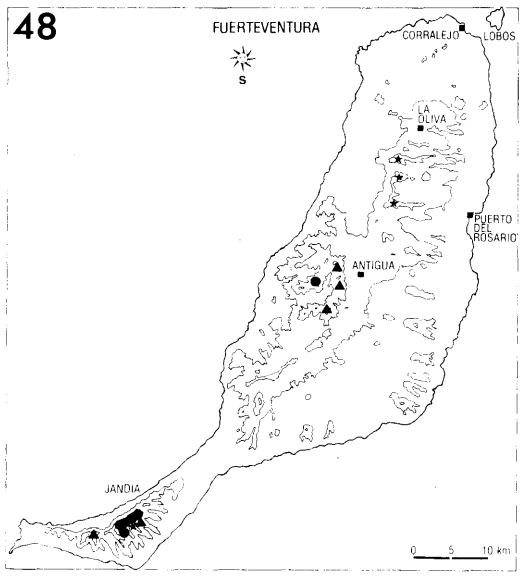


Fig. 48. Fuerteventura. *Weissia controversa* (triangles) and *Zygodon baumgartneri* (asterisks), both species (dots).

Weissia controversa Hedw.

Fuerteventura (Fig. 48), scattered above 600 m, a few localities down to 450 m.

Lanzarote (Fig. 47), more common above 500 m, scattered down to 400 m.

The other Canary Islands. Recorded from Gomera (Størmer 1959), Gran Canaria (Montagne 1840), Hierro (Pitard 1907), La Palma (Schiffner 1902) and Tenerife (Renauld & Cardot 1902).

Weissia controversa Hedw. var. *crispata* (Nees et Hornsch.) Nyholm

Fuerteventura. Fraile 570 m N, Morro del Jorao 600 m N, Morro de Teteguno 580 m N, Pico de la Zarza 780 m W, Valle de los Canarios Barranco 460 m N.

Lanzarote. Del Rio 480 m NNW, Monte Corona 500 m N, Peñas del Chache 590 m and 640 m N, Valle del Malvaso 480 m NNW.

The other Canary Islands. Recorded from Gomera, Gran Canaria, Hierro, La Palma (Størmer 1959) and Tenerife (Dixon 1911).

Weissia longifolia Mitt.

Lanzarote. Peñas del Chache according to During (1981).
The other Canary Islands. Recorded from Gomera (Schwab et al. 1986) and Gran Canaria (Long et al. 1981).

Zygodon baumgartneri Malta

* Fuerteventura (Fig. 48), scattered above 600 m.
Lanzarote (Fig 47), scattered avbove 400 m. This species was found both as epiphyte on bark of trees and intermingled with other bryophytes on soil.
The other Canary Islands. Recorded from La Palma (Düll 1980) and Tenerife (Long et al. 1981).

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