FLORA OF THE CANARY ISLANDS: THE *CRUCIFERAE*, THE *CRASSULACEAE* AND THE FERNS AND THEIR ALLIES

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PREFACE

The vascular plants of the Canary Islands have been the subject of systematic research since the mid 1800's when WEBB and BERTHELOT produced their outstanding work, «Histoire Naturelle des Iles Canaries» (1). This natural history contained a descriptive flora and general notes on the local and extralimital range of many of the vascular plants of the Islands. «Les Iles Canaries. Flore de l'archipel» (2), of PITARD and PROUST supplemented this work with an annotated list of vascular plants, Musci and Hepaticae known from the Islands. A number of other lists of vascular plants of the Canary Islands have since been published, as well as many papers on taxonomy of isolated species and genera. None have attempted, however, to organize the scattered lists and descriptions of vascular plants into a modern flora providing keys and illustrations as well as synonomy, vernacular names, ecology and distribution of species to assist in identification.

Included in this manuscript are illustrated keys to the genera and species of three of the major groups of plants on the Islands: the *Crassulaceae,* the *Cruciferae* and the *ferns* and their allies. All credible taxa within these groups have been included in the keys. Synonymns and questionable records are noted when appropriate. The scientific name according to the rules and regulations of the International Botanical Congresses is given for each species as well as the common name or names given to taxa by local inhabitants. We found the latter to be of immeasurable assistance in the field, particularly in locating rare species. A morphologic description of individuals of each species

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(1) WEBB P. B., and BERTHELOT S. *Histoire Naturelle des Iles Canaries. III. Phytographia Canariensis.* Paris. Sect. I: 1836-40. Sect. II: 1836-50. Sect. III: 1836-50.

(2) PITARD J., and PROUST J. 1908. *Les Iles Canaries. Flore de l'archipel.* Klincksieck, Paris, 503 pp., 10 pls.

is given which includes the habit of the plants and details of leaves, inflorescence and flower which are of use in identification. The distribution as well as notes on the ecology of each species are indicated.

Species endemic to the Canary Islands are illustrated except in cases where adequate material was not available. Illustrations were prepared from a combination of slides of plants taken in the field, herbarium collections and live material.

The preparation of these contents were commenced in 1966 with the late Dr. Kornelius LEMS, authority on the vascular plants of the Canary Islands, as senior author. After his accidental death in 1968, his associate, Dr. Christina HOLZAPFEL continued work on the text and prepared the bulk of the illustrations. Dr. LEMS wrote prolifically on the vascular flora of the Canary Islands, his major contributions including «Phytogeographic Study of the Canary Islands» (3) and «Floristic Botany of the Canary Islands» (4).

Collection of materials in the Canary Islands by Dr. LEMS and Dr. HOLZAPFEL was made possible by a fellowship to the senior author from the John Simon Guggenheim Memorial Foundation. The support of the National Science Foundation, grants GB 5246 to Dr. LEMS and GB 13104 to the Museum of Zoology, University of Michigan, where Dr. HOLZAPFEL did much of her work, is gratefully acknowledged. The assistance of Dr. Reed Clark ROLLINS and the cooperation of the staff of the Gray Herbarium, Harvard University, during completion of the section *Crassulaceae* is also appreciated. The following institutions were of invaluable assistance in procuring specimens:

University Herbarium, University of Michigan, U. S. A.
The Herbarium Royal Botanic Gardens, Kew, Great Britain.
Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris, France.
Rijksherbarium, Leiden, Netherlands.
National Museum, Smithsonian Institution, Washington, D. C., U. S. A.
Sloan Herbarium of the British Museum of Natural History, London, Great Britain.
Herbarium of the University of California, Berkeley, California.
Laboratorio de Botánica de la Facultad de Farmacia, Madrid, Spain.
Missouri Botanical Garden, St. Louis, Missouri, U. S. A.
United States National Arboretum, Washington, D. C., U. S. A.
Botanical Museum and Herbarium, Utrecht, Netherlands.

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(3) LEMS K., 1958. *Phytogeographic study of the Canary Islands.* PhD. Thesis. University of Michigan, 204 pp.

(4) LEMS K., 1960. *Floristic Botany of the Canary Islands.* Sarracenia, 5: 1-94.

Family *CRUCIFERAE*

Key to the genera

1. Small shrubs of half-shrubs, branches woody, perennial
   2. Flowers white, pink, violet, or purple
      3. Fruit more than 3 X as long as wide, a silique
         4. Silique with horns near the tip
            5. Horns of the silique about equalling the valves, with forked tips; flowers white or pale violet — 11. *Parolinia*
            5. Horns of the silique 1-2 mm; flowers usually purplish — 5. *Matthiola*
         4. Silique pointed, without appendages near the tip
            6. Low perennial, branching near the ground; flowers white — 10. *Arabis*
            6. Small shrubs, the branches diffuse or upright; flowers purple to violet
               7. White-tomentose half-shrub; siliques slender, to 1.5 mm wide — 4. *Malcomia*
               7. Grayish or green dwarf-shrub; siliques about 2-3 mm when mature — 3. *Cheiranthus*
      3. Fruit rounded, at most 2 X as long as wide
         8. Inflorescence a voluminous panicle; leaves large, usually rough hispid — 32. *Crambe*
         8. Inflorescences short racemes at the tips of the stems; leaves small, linear or lanceolate — 14. *Lobularia*
   2. Flowers yellow
      9. Leaves dissected into linear or rounded segments, delicate and lacy — 1. *Descurainia*
      9. Leaves simple, or with a few large lobes

10. Flowers clear yellow; silique ending in conical beak
    11. Cauline leaves sessile and clasping — 23. *Brassica*
    11. Leaves petiolate, not clasping — 22. *Sinapodendron*
10. Flowers drab yellowish; silique ending in a flattened or horned stigma — 5. *Matthiola*

1. Annual or perennial herbs; base occasionally woody, but then not persisting more than a year
    12. Flowers white, violet or purple, or petals inconspicuous or absent
        13. Fruit more than 3 X as long as wide, a silique
            14. Silique with 2 protuberances at the tip
                15. Silique less than 1 cm long — 12. *Notoceras*
                15. Silique more than 2 cm long — 5. *Matthiola*
            14. Silique tapered to a point
                16. Leaves compound or deeply lobed, at least the basal ones
                    17. Leaf segments rounded or elliptic, entire
                        18. Perennial, rooting at the nodes; seeds in 2 rows in each locule of the silique — 8. *Nasturtium*
                        18. Annual with basal rosette; seeds in one row in each locule — 9. *Cardamine*

17. Leaf segments serrate - dentate, not round — 2. *Sisymbrium*

16. Leaves all simple, dentate

19. Perennial with sterile offshoots at the base — 10. *Arabis*

19. Annual without sterile offshoots

20. Flowers white; very small plant — 6. *Arabidopsis*

20. Flowers pink-violet; more robust — 4. *Malcolmia*

13. Fruit less than 3 X as long as wide, a silicle

21. Fruit consisting of an upper and lower half, corky and indehiscent, breaking apart; leaves fleshy — 30. *Cakile*

21. Fruit with two valves, not with an indehiscent upper half

22. Valves flattened parallel with the septum, hence the septum round or elliptic like the valves — 14. *Lobularia*

22. Valves flattened at right angles to the septum, hence the septum narrow

23. Inflorescence more or less flat-topped, the outer petals slightly larger than the inner — 21. *Iberis*

23. Inflorescence elongate, petals alike

24. Silicle an inverted triangle, widest at the top — 16. *Capsella*

24. Silicle broadest near the middle

25. Fruit broader than long — 19. *Coronopus*

25. Fruit elliptic or round

26. Valves of the fruit winged, 1 seed in each locule — 18. *Lepidium*
26. Valves of the fruit not winged, several seeds per locule — 17. *Hymenolobus*

12. Flowers yellow, sometimes pale with violet veins
    27. Fruit less than 4 X as long a wide
        28. Fruit pendulous, winged
            29. Fruit flat, one seeded — 13. *Isatis*
            29. Fruit round, with flat wing, several-seeded — 28. *Carrichtera*
        28. Fruits not pendulous
            30. Leaves compound or deeply lobed, at least the lower ones
                31. Fruits spiny with 2 1-seeded segments side by side — 29. *Succowia*
                31. Fruit not spiny, the upper segment one-seeded, the lower empty — 31. *Rapistrum*
            30. Leaves simple
                32. Valves flattened parallel to the septum; leaves entire not clasping — 15. *Alyssum*
                32. Fruit of 2 1-seeded halves separated by a narrow septum; leaves dentate, the upper ones clasping — 20. *Biscutella*
    27. Fruit more than 4 X as long as wide, a silique
        33. Fruit not distinctly beaked, the style and stigma less than 3 mm long
            34. Siliques appressed
                35. Siliques broadest at the base, tapering to a point — 1. *Sisymbrium*

35. Siliques linear, with a beak that is swollen above the base — 27. *Hirschfeldia*

34. Siliques diverging

36. Fruiting pedicels less than 5 mm long

37. Siliques with pointed tip — 2. *Sisymbrium*

37. Siliques with obtusely horned or broad flattened tip — 5. *Matthiola*

36. Fruiting pedicels 5 mm or more

38. Silique 2 mm thick — 7. *Barbarea*

38. Silique 0.7-1.5 mm thick

39. Cauline leaves sessile, clasping — 25. *Erucastrum*

39. Cauline leaves petiolate or narrowed to the base — 2. *Sisymbrium*

33. Fruit with a distinct beak above the seeds, usually more than 3 mm long

40. Mature silique less than 1.5 mm thick

41. Siliques appressed on erect pedicles

42. Beak swollen above the base, with seed in it — 27. *Hirschfeldia*

42. Beak slender — 23. *Brassica*

41. Siliques spreading

43. Siliques sessile to very short pedicelled — 5. *Matthiola*

43. Siliques pedicelled — 25. *Erucastrum*

40. Mature silique 1.5 mm wide or more

44. Beak somewhat flattened

45. Siliques on short erect pedicels; flowers with violet veins — 24. *Eruca*

45. Siliques on diverging pedicels; flowers yellow — 26. *Sinapis*

44. Beak terete

46. Flowers yellow; beak short, conical — 23. *Brassica*

46. Flowers pale with violet veins; beak long, often curved — 33. *Raphanus*

1. *DESCURAINIA* Webb & Berth.

1. Leaves of the flowering stems simple, linear, the lower with 1-3 pairs of linear pinnae — 6. *D. gonzalezi*

1. Cauline leaves with at least one pair of pinnae, the lower leaves usually more compound

2. Leaves green, glabrous or with sparse glandular pubescence, pinnate with 5 to 9 pairs of pinnae, the latter linear, rarely with one or 2 secondary pinnae — 3. *D. preauxiana*

2. Leaves grayish to whitish green with abundant stellate pubescence, pinnate or bipinnate

3. Ultimate divisions of the leaves linear or lanceolate, with small linear divisions along the base of the midrib

4. Fruits 6-16 mm at maturity on widely diverging pedicels; flowers golden yellow — 4. *D. bourgaeana*

4. Fruits more than 16 mm, on erect or ascending pedicels; flowers lemon yellow or pale yellow — 5. *D. gilva*

3. Ultimate divisions of the leaves ovate with small rounded lobes, absent from the very base of the petiole

5. Leaves grayish green, the ultimate divisions to 3 mm wide — 2. *D. artemisioides*

5. Leaves whitish, the ultimate divisions 1 mm or less — 1. *D. millefolia*

1. *Descurainia millefolia* (Jacq.) Webb & Berth.

Subshrub to 80 cm with slender, pale branches densely clothed with finely divided bipinnate leaves, white with very fine stellate hairs. inflorescence stalks leafy, flowers pale yellow; fruits on divergent or erect pedicels 10-16 mm long, the siliques usually 12-20 mm.

Distr.: Endemic to Tenerife, Gomera and Palma. *Ecol.:* Fairly common in shaded barrancos and cliffs, sea level to 800 m. *Evol.:* The following species is an insular derivative of *D. millefolia. Syn.: Sisymbrium millefolium* Jacq.

Fig. 1

2. *Descurainia artemisioides* Svent.

Subshrub similar to the preceding species, but with more robust habit, leaves, and fruits. Leaves bipinnate with ultimate divisions to 3 mm; fruits to 30 mm long.

Distr.: Endemic to one cliff on Gran Canaria (Guayedra). *Ecol.:* Shaded cliffs, 700 m, extremely local. *Evol.:* Robust derivative of the preceding, which does not occur on Gran Canaria.

Fig. 2

3. *Descurainia preauxiana* Webb.

Subshrub with densely tufted leaves and long inflorescence stalks which are almost leafless; leaves green, glabrate with glandular hairs (rarely with sparse tufts of stellate pubescence), pinnate, the division linear, 4-15 mm long, sometimes with one or two secondary pinnae. Flowers yellow; fruits on erect or slightly divergent pedicels, fusiform, 6-12 mm long.

Distr.: Endemic of Gran Canaria. *Ecol.:* Scattered throughout the dry southern part of the island, on cliffs between 400 and 1,500 m. *Evol.:* Highly variable in pubescence and size of leaves and flowers, extremely broad leaved, large flowered plants may be distinguished as var. *briquetii* (Pit.). *Syn.: Sisymbrium briquetii* Pitard, *Sisymbrium preauxianum* Webb.

Fig. 3

4. *Descurainia bourgaeana* (Webb in Fourn.) Webb in Christ - «Mostaza del Teide».

Stiffly branched subshrub forming hemispherical bushes to 1 m, with pale stems, leafy below with tripartite, pinnate, or bipinnate leaves

with filiform divisions, often with axillary tufts of leaves; inflorescence stalks long, leafy below, with numerous fruits along the upper half, on strongly divergent pedicels; fruits 6-16 mm long; flowers near the tip, golden yellow.

Distr.: Endemic to Tenerife. *Ecol.:* Very common in the subalpine cinder and pumice fields about 2,000-2,200 m, occasionally down to 1,600 m.

Fig. 4

5. *Descurainia gilva* Svent.

Subshrub forming compact bushes, the leaves close, grayish green, pinnate or bipinnate with linear of linear-lanceolate divisions, densely stellate pubescent. Flowers lemon yellow on long inflorescence stalks, the fruits 15-22 mm long, on erect or divergent pedicels 6-10 mm long. Seeds dark reddish brown.

Distr.: Endemic of Tenerife and Palma. *Ecol.:* In dry rocks and boulder fields about 1,800-2,000 m. *Evol.:* Related to the preceding, but also with traits reminiscent of *D. millefolia.* The Palma form with more linear leaf segments.

6. *Descurainia gonzalezi* Svent.

Low shrub forming stiffly branched bushes, the leaves filiform, with 1-3 pairs of linear divisions, the upper ones simple. Fruits about 20 mm long on erect pedicels.

Distr.: Endemic of Tenerife. *Ecol.:* Very rare, in boulder fields of the South central Canadas, about 2,200 m. *Evol.:* Related to *D. bourgaeana,* and possibly a robust derivative of it.

2. *SISYMBRIUM* L.

1. Silique closely appressed to the stem, less than 20 mm long — 1. *S. officinale*

1. Silique not appressed, longer .
   2. Pedicels markedly thinner than the fruit, to 20 mm long — 4. *S. irio*
   2. Pedicels thick, scarcely thinner than the fruit

3. Petals 8-10 mm; plant softly pubescent	2. *S. orientale*
3. Petals 1-3 mm; plant glabrous	3. *S. erysimoides*

1. *Sisymbrium officinale* (L.) Scop.

Annual or biennial with pinnately lobed basal leaves; flowers very short pedicelled; petals 2-4 mm yellow; silique 10-20 mm, appressed, tapering from base to tip.

Distr.: Throughout Europe, N Africa, Madeira, Gran Canaria, Tenerife, and probably elsewhere on the Canary Islands. *Ecol.:* Weed, scarce.

2. *Sisymbrium orientale* L.

Annual, softly pubescent, upper leaves tending to become simple, the terminal portion lanceolate; petals 8-10 mm, yellow; silique 5-100 mm, patent.

Distr.: S and W Asia, Mediterranean, Tenerife. *Ecol.:* Weed, dry regions near S coast. *Syn.: S. columnae* Jacq.

3. *Sisymbrium erysimoides* Desf.

Annual, more or less glabrous, with pinnately compound, petiolate leaves with acute, serrate lobes; the terminal segment broadly rhombic; inflorescence with minute pale yellow flowers, overtopped by the patent siliques; fruiting pedicels to 5 mm long, thick; silique 30-50 mm.

Distr.: SW Europe and N Africa, Madeira, Graciosa, Fuerteventura, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Roadsides and weedy fields, locally common.

4. *Sisymbrium irio* (L.).

Glabrous or pilose annual, with deeply lobed to almost simple leaves; flowers 3-4 mm, yellow, overtopped by the siliques; pedicels thin, silique 25-65 mm.

Distr.: Mediterranean, Madeira, reported from all of the Canary Islands. *Ecol.:* Rather common weed in the subtropical zone.

3. *CHEIRANTHUS* L.

1. Leaves entire, pubescence of appressed 2-pronged hairs (medifixed) — 1. *C. scoparius*

1. Leaves remotely serrate, pubescence of stellate, 3-4 pronged hairs — 2. *C. mutabilis*

1. *Cheiranthus scoparius* Brouss. ex Willd. - «Alhelí del Teide».

Subshrub to 80 cm, with stiffly ascending branches, often forming compact hemispherical bushes; leaves ascending, grayish green, entire, 3-7 cm long, 2-4 mm wide, with pubescence of medifixed hairs appressed lengthwise on the leaf surface; inflorescences on long stalks, the flowers crowded, cream colored when young, soon turning purple; sepals 4, the outer saccate at the base, the inner with keel-like appendage near the tip; petals with long claws, 10-15 mm long; stamens 6, 2 with slender filaments and slightly shorter than the 4 dilated stamens; fruit a silique, to 3 mm wide, covered by stellate and medifixed hairs, style persistent, less than 3 mm long.

Distr.: Endemic to Gran Canaria and Tenerife. Reports from other islands refer to the next species. *Ecol.:* Abundant at 2,000 m in pumice fields of Tenerife among the subalpine scrub, and also in lava of W Tenerife from 700 m upwards; not common in Gran Canaria above 1,200 m in the E central part. *Syn.: Ch. cinereus* Webb & Berth. (a more sparse form from W Tenerife), *Ch. cumbrae* Link in Buch. *Evol.:* The more lax, broadleaved form of Gran Canaria may be called var. *lindleyi* Webb in Christ. The species is closely related to *Ch. mutabilis* and connected with it by intermediates.

Fig. 7

2. *Cheiranthus mutabilis* L'Herit. - «Alhelí montuno».

Subshrub to 60 cm of variable form, often with gnarled branches bearing tufts of leaves, or hemispherical in outline; leaves green or grayish remotely serrate, variable in length and width, usually lanceolate, pubescence of stellate hairs with 3 to 4 prongs, and medifixed hairs on the veins; inflorescence similar to preceding species; flowers identical; fruits similar, but often covered with stellate hairs with 5, 4 or 3 prongs; style often over 3 mm long.

Distr.: Madeira, Tenerife, Palma and Hierro. Its presence on Gomera is uncertain; the Gran Canaria plants may all belong to the preceding

species. *Ecol.:* At high elevation (1,900 m) on La Palma, scarce. On Tenerife limited to cliffs of the NW, on Hierro in cliffs and cinder fields of the montane belt. *Syn.: Ch. virescens* Webb in Christ. *Evol.:* The Canarian material belongs to the var. *virescens* (Webb) which is transitional between var. *mutabilis* of Madeira and *Ch. scoparius*.

Fig. 8

4. *MALCOLMIA* R. Br.

1.	Perennial with white tomentose leaves	1. *M. littorea*
1.	Annual with grayish pubescent leaves	2. *M. maritima*

1. *Malcolmia littorea* (L.) R. Br.

Perennial, woody at the base, with numerous leafy stems, the leaves entire or dentate, white-tomentose with stellate hairs; flowers purple; silique with long point.

Distr.: W Mediterranean, reported on Lanzarote and Fuerteventura. These reports are old, and probably spurious.

2. *Malcolmia maritima* (L.) R. Br.

Annual with spathulate leaves, entire to slightly dentate; flowers reddish purple; siliques ascending, pointed.

Distr.: Cultivated plant native to the E Mediterranean region and reported from Gran Canaria and Tenerife. *Ecol.:* Very rare and escaped from cultivation.

5. *MATTHIOLA* R. Br.

1.	Fruits on pedicels 7-25 mm long, the silique somewhat flattened, 3-5 mm wide; petals over 20 mm long	1. *M. incana*
1.	Fruits sessile or on pedicels to 3 mm long, the silique terete, 1 mm thick; petals less than 20 mm	
2.	Perennial with vegetative rosettes of leaves	2. *M. fruticulosa*

2. Annual, often somewhat branched and woody at the base
   3. Petals 6-10 mm long, sepals 4-6 mm — 3. *M. parviflora*
   3. Petals more than 10 mm long, sepals 6 mm or more
      4. Petals linear, to 2 mm wide, yellowish or brownish purple — 4. *M. longipetala*
      4. Petals obovate, 3-5 mm wide, violet
         5. Leaves all obtuse, ovate to lanceolate, somewhat fleshy; petals obtuse to retuse, 4-5 mm wide — 7. *M. bolleana*
         5. Leaves linear or lanceolate, narrowed to a small blunt point, not fleshy; petals rounded
            6. Silique topped by two horns and projecting stigma, in the shape of a cross — 5. *M. tricuspidata*
            6. Silique without projecting stigma, two-horned — 6. *M. lunata*

1. *Matthiola incana* (L.) R. Br.

Upright half-shrub to 80 cm with grayish lanceolate leaves; flowers large, varying from white to purple; siliques stalked, compressed, to 5 mm thick, stigma not conspicuously horned.

Distr.: Coasts of S and W Europe, Azores, Tenerife, Gran Canaria. *Ecol.:* Very rare, and probably not native.

2. *Matthiola fruticulosa* (L.) Maire.

Branched shrub to 60 cm with linear to oblong leaves, somewhat stellate pubescent; flowers practically sessile, yellowish to reddish purple, sepals 6-14 mm, petals 12-20 mm, silique 1-2 mm thick, the stigma without horns, or with horns to 3 mm.

Distr.: Mediterranean region, reported from Lanzarote, Fuerteventura, Gran Canaria. *Ecol.:* Dry fields near sea level; records probably refer to annual species with woody base, and need to be reexamined. *Syn.:* *M. tristis* R. Br.

3. *Matthiola parviflora* (Schousboe) R. Br.

Annual, 5-20 cm, with lanceolate, sinuate-dentate leaves; flowers sessile, sepals 4-6 mm, petals 6-10 mm, pink or purplish; silique narrow, with prominent horns at the tip.

Distr.: W Mediterranean, reported from all of the islands. *Ecol.:* Dry fields and open ground from sea level to 900 m, especially on the southern slopes.

4. *Matthiola longipetala* (Vent.) DC.

Annual, branched from the base, the leaves mostly linear-lanceolate; flowers sessile, yellowish purple to lead-colored; the petals about 15 mm long, 2 mm wide; fruits with obtuse horns at the tip.

Distr.: Greece, N Africa, Lanzarote, Gran Canaria, Tenerife. *Ecol.:* Scarce in very dry stony places with sparse vegetation. *Syn.: M. livida* (Del.) DC.

5. *Matthiola tricuspidata* (L.) R. Br.

Similar to the preceding, but with pinkish violet flowers, petals obovate, with flat limb; fruit topped by a cross formed by the two horns and the prolonged stigma.

Distr.: Mediterranean Region, Lanzarote, Fuerteventura. *Ecol.:* Very dry stony places. *Evol.:* Appears to intergrade with the following species.

6. *Matthiola lunata* DC.

Similar to the preceding, and distinguished only by the prominent horns, which often curve forward, and the absence of protruding stigma.

Distr.: Algeria to S Spain and Marocco, Lanzarote. *Ecol.:* Locally abundant on abandoned fields near sea level. *Evol.:* All of the annual *Matthiola* species of the Canaries need further study and confirmation.

7. *Matthiola bolleana* Webb in Christ.

Very small annual, simple or with short basal branches, leaves whitish gray, somewhat fleshy, the rosette leaves lanceolate, sinuate dentate, the cauline leaves ovate, obtuse, less than 1 cm long; flowers showy

white to purple, sepals 8 mm long, gray-tomentose petals 12 mm long, 4-5 mm wide, often retuse at the tip; fruits gray-tomentose, 1 mm thick, the stigma with small triangular prominences, not horned.

Distr.: Endemic to S Fuerteventura. *Ecol.:* Very local, near the beach among scattered Chenopodiaceous vegetation.

Fig. 6

6. *ARABIDOPSIS* Heynh.

Arabidopsis thaliana (L.) Heynh.

Small annual, the leaves mostly in basal rosette, ovate, with forked hairs. Stem simple or branched, flowers white, small, fruits 10-18 mm long, upright on thin, divergent pedicels.

Distr.: Europe, N Africa, Madeira, Gran Canaria, Tenerife, Gomera, Palma; Hierro. *Ecol.:* Not common in open soil in the temperate zone, 700-1.100 m. Syn.: *Stenophragma thaliana* Celak.

7. *BARBAREA* R. Br.

Barbarea verna (Mill.) Aschers.

Practically glabrous biennial with basal rosette of pinnate leaves with 6-10 pairs of lobes; cauline leaves pinnate; flowers yellow in long racemes, fruits on pedicels 5-10 mm, the silique 3-6 cm long, to 2 mm thick, not beaked. Seeds in 1 row.

Distr.: S W Europe, Azores, Madeira, Tenerife, Palma. *Ecol.:* Rare, in damp places in the montane zone. *Syn.: B. praecox* R. Br.

8. *NASTURTIUM* R. Br.

Nasturtium officinale R. Br. in Ait.

Procumbent creeping herb, rooting at the nodes, practically glabrous; leaves pinnately compound with elliptical leaflets, the terminal leaflet the largest, rounded; flowers in small terminal racemes, white; siliques about 15 mm long, with 2 rows of seeds per locule.

Distr.: Most of Europe, N Africa, Madeira, Azores, Gran Canaria, Tenerife, Gomera. *Ecol.:* Springs, streams, marshy places, especially in the montane zone, fairly common in wet habitats.

9. *CARDAMINE* L.

Cardamine hirsuta L.

Low annual, most leaves in basal rosette, pinnately compound, the leaflets round, the terminal one largest; flowers with very small, inconspicuous white petals; fruits upright, 15-25 mm long, 1.5 mm wide.

Distr.: Europe, N Africa, Azores, Madeira, Tenerife, Gomera, Palma. *Ecol.:* Scarce, montane zone.

10. *ARABIS* L.

Arabis caucasica Schlecht in Willd.

Perennial chamaephyte with branched rosettes of oblanceolate, dentate leaves, densely short-tomentose with stellate hairs; inflorescence to 30 cm, flowers white, fruits long-pedicelled, to 65 mm long.

Distr.: Asia Minor, S Europe, N Africa, Madeira, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Scattered in shaded cliffs of the upper montane zone, 800-2,000 m, often with *Greenovia*. *Syn.:* Regarded by some as a ssp. of *Arabis alpina* L.; *A. albida* Steven. Canarian material has characteristics of both *A. alpina* and *A. caucasica*.

11. *PAROLINIA* Webb.

1. Leaves about 3 cm long, erect; seed-bearing portion of the fruit about 10 mm long — 1. *P. ornata*

1. Leaves about 2 cm long, spreading; seed-bearing portion of the fruit about 5 mm long — 2. *P. schizogynoides*

1. *Parolinia ornata* Webb.

Stiffly erect shrub to 1 m, stems and leaves grayish white with very short stellate pubescence; leaves linear, 2-4 cm long, 2 mm wide, appressed or ascending; flowers in the axils of reduced leaves, pale violet; fruit a curiously appendaged silique, the body about 10 mm long, each valve prolonged into an antler-like appendage about the length of the body, bearing 2 curved teeth at the tip.

Distr.: Genus and species endemic to the Canaries, Lanzarote, Fuerteventura, Gran Canaria, Tenerife. *Ecol.:* In dry scrub land, usually between 200 and 300 m on the S slope, often associated with *Schizogyne sericea* and *Cneorum pulverulentum,* to which it is strikingly similar in habit.

Fig. 9

2. *Parolinia schizogynoides* Svent.

Diffusely branched small shrub, leaves and twigs white pubescent; leaves linear, 15-25 mm long, 1-1.5 mm wide, diverging; flowers white, later pale violet; siliques short, the body to 7 mm, with appendages at the tips of the valves about 4-7 mm, toothed at the tip.

Distr.: Endemic of SW Gomera (Argaga). *Ecol.:* Extremely rare, only one colony on ledges of dry cliffs, 100-300 m.

Fig. 10

12. *NOTOCERAS* R. Br.

Notoceras bicorne (Ait.) Amo.

Small, often procumbent annual, with stiffly diverging branches from below the short inflorescences, leaves lanceolate, entire, to 3 cm long with appressed medifixed hairs; petals white, flowers inconspicuous; fruits about 5 mm long, almost sessile, each valve with a short horn or point near the tip.

Distr.: Israel, N Africa, S Spain, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera. *Ecol.:* Common especially on the eastern islands on very dry rocky terrain near sea level. *Syn.: Notoceras canariense* R. Br.

13. *ISATIS* L.

Isatis tinctoria L.

Glaucous tall biennial herb, cauline leaves sessile and clasping with acute auricles; flowers yellow, in long branched racemes; fruits pendulous, winged, 1-seeded.

Distr.: Europe, W Asia, N Africa, Madeira, reported once from Hierro. *Ecol.:* Perhaps escaped from cultivation, used for its blue dye.

14. *LOBULARIA* Desv.

1. Fruits with 3-5 seeds in each of the 2 locules; annuals or short-lived perennials
   2. Prostrate annual; silicles with irregularly convex valves, margins not thickened — 1. *L. lybica*
   2. Branched, somewhat woody plant; silicles more or less flat, with thickened margins — 2. *L. marginata*

1. Fruits with 1-2 (rarely 3) seeds per locule; woody perennials
   3. Fruit round and flat, 1 seed per locule — 3. *L. maritima*
   3. Fruit round to elliptic, valves somewhat convex, usually 2 seeds per locule — 4. *L. intermedia*

1. *Lobularia lybica* (Viv.) Webb & Berth.

Branched, more or less prostrate annual herb with grayish silky lanceolate leaves; flowers in short terminal racemes, white; fruits elliptic, 4-6 mm long, the valves parallel with the persistent, silvery white septum, each locule with 3-5 flat, winged seeds. Valves typically convex and bulging around each of the seeds.

Distr.: Israel, N Africa, S Spain, Alegranza, Graciosa, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, Hierro. *Ecol.:* Sandy and stony soils near the sea level, fairly common on the eastern islands, on the western islands only along the dry S coasts. *Syn.: Koniga lybica* R. Br.

2. *Lobularia marginata* Webb in Christ.

Dwarf shrub with short, divergent branches and silvery leaves; flowers in short terminal racemes, white with purplish center; silicles round, flat, with thickened margin, 4-6 mm the valves often purple, seeds 2-4 per locule.

Distr.: Anti Atlas of Morocco, Lanzarote, Fuerteventura. *Ecol.:* Cliffs on the highest crests, locally common; 400-800 m.

Fig. 12

3. *Lobularia maritima* (L.) Desv.

Spreading or decumbent dwarf shrub with grayish green oblanceolate leaves; flowers white in racemes, elongating in fruit; fruits flat round, 2-3.5 mm, each locule with one seed.

Distr.: S Europe, N Africa, Azores, Madeira, Gran Canaria, Tenerife, Gomera. *Ecol.:* Much rarer than the following species, 0 to 900 m. *Syn.: Koniga maritima* (L.) R. Br.

4. *Lobularia intermedia* Webb & Berth.

Diffusely branched dwarf shrub with grayish pubescent, linear to lanceolate leaves; highly variable in leaf shape and size, inflorescence, flower, etc. Flowers white, sometimes suffused with purple; fruits elliptic, valves somewhat bulging, 2.5-4 mm long; seeds 2-3 per locule.

Distr.: Apparently endemic to the Canary Islands, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Stony soil and cliffs, sea level to 800 m, common in the upper subtropical zone. *Evol.:* Very closely related to the preceding species; differentiated into insular and local varieties of little consequence, including *L. intermedia* var. *palmensis* (Webb) Pit. & Proust. *Syn.: L. palmensis* Webb.

Fig. 11

15. *ALYSSUM* L.

Alyssum minus (L.) Rothm.

Small, branched annual with ascending branches, grayish green, with oblong-lanceolate leaves; flowers with very small pale yellow petals; fruits 4-6 mm in diameter, flattened parallel with the septum, the valves with stellate hairs; seeds 2 in each locule. Stamens winged or appendaged.

Distr.: Mediterranean region, Gran Canaria. *Ecol.:* Rare, near the highest points of the island (1,400 m). *Syn.: Alyssum campestre* L.

16. *CAPSELLA* Medic.

1. Silicles with straight or convex sides, shallowly notched, petals distinctly longer that the sepals — 1. *C. bursa-pastoris*

1. Silicles with slightly hollow sides, deeply retuse, petals scarcely exceeding the sepals — 2. *C. rubella*

1. *Capsella bursa-pastoris* (L.) Medic.

Rosette annual, basal leaves lobed, the upper lanceolate, clasping the stem with sagittate base; flowers white, petals exceeding the sepals; silicles triangular, flattened at right angles to the septum.

Distr.: Throughout Europe and elsewhere, Madeira, Lanzarote, Gran Canaria, Tenerife, Hierro. *Ecol.:* Roadside weed, not very common, mostly in the montane zone. Some reports may refer to the following species.

2. *Capsella rubella* Reuter.

Robust rosette annual, resembling the preceding, but differing from it by its shorter petals, reddish tinged calyx, and silicles with somewhat attentuated base, hollow sides, and deeply notched tip.

Distr.: S Europe, N Africa, known from Tenerife, probably elsewhere. *Ecol.:* Weed in fields, especially subtropical zone.

17. *HYMENOLOBUS* Nutt.

Hymenolobus procumbens (L.) Nutt. ex Torrey & Gray.

Delicate, usually procumbent annual with simple or pinnately compound leaves. Flowers very small, white, silicles to 5 mm long, somewhat notched at the tip, flattened at right angles to the septum; seeds 4-8 per locule.

Distr.: S Europe, N Africa, reported from Gran Canaria, Tenerife. *Ecol.:* Reported only twice, to be confirmed. *Syn.: Noccaea procumbens* (L.) Reichenb., *Hutchinsia procumbens* (L.) Desv., *Cardamine procumbens* (L.) Fries.

18. *LEPIDIUM* L.

1. Silicles 5-6 mm long; petals twice as long as the sepals; glabrous plant ..... 1. *L. sativum*

1. Silicles less than 5 mm long; petals slightly exceeding or shorter than the sepals; sparsely short-pubescent

2. Petals equalling or slightly exceeding the sepals; leaves laciniate, the upper ones shallowly so	2. *L. virginicum*
2. Petals very short, hidden within the calyx; leaves pinnate, the divisions in turn laciniate	3. *L. bonariense*

1. *Lepidium sativum* L.

Annual with glaucous, pinnate-laciniate leaves, upper leaves linear, entire; flowers white to pink, the petals markedly longer than the sepals; fruit a notched silicle 5-6 mm long, flattened at right angles to the narrow septum; each locule with a single seed.

Distr.: Widely cultivated and escaped, reported from Tenerife. *Ecol.:* The Garden Cress is cultivated for its pungent flavor, but rare in the Canaries.

2. *Lepidium virginicum* L.

Similar to the preceding but green and very short-pubescent; petals small, white; leaves lacinate, the upper ones simple or with shallow teeth; silicles to 3 mm notched.

Distr.: Introduced from America, reported on Tenerife. *Ecol.:* Roadside weed, scarce.

3. *Lepidium bonariense* L.

Similar to the preceding, but with more dissected leaves divided into linear segments; even the upper leaves laciniate; silicles to 4 mm long, notched.

Distr.: Introduced from S America on Tenerife. *Ecol.:* Rare, along roadside in banana plantations.

19. *CORONOPUS* Haller.

1. Fruits 1.5 × 2-3 mm, notched at the top, pedicels longer than the fruits	1. *C. didymus*
1. Fruits larger, apiculate, short-pedicelled	2. *C. squamatus*

1. *Coronopus didymus* (L.) Sm.

Spreading annual, to 30 cm, leaves pinnately compound, the segments incised; flowers and fruits in small axillary racemes, petals very short or absent; fruit of 2 globose units, with wrinkled surface.

Distr.: Weed of uncertain origin, Europe, N Africa, Madeira, Gran Canaria, Tenerife, Palma, Hierro. *Ecol.:* Roadsides and trails, an inconspicuous plant, 0-500 mm. *Syn.: Senebiera pinnatifida* DC.

2. *Coronopus squamatus* (Forsk.) Aschers.

Spreading annual, leaves pinnate, flowers and fruits in short racemes, petals exceeding the sepals; fruit to 4 mm broad, with ridges and warts, and short point at the top.

Distr.: Europe, N Africa, Madeira, Fuerteventura, Gran Canaria, Tenerife. *Ecol.:* Weed along roadsides, not common, 0-600 m. *Syn.: Coronopus ruellii* Hall.

20. *BISCUTELLA* L.

Biscutella auriculata L.

Upright annual with simple, oblong leaves, somewhat wavy-dentate; cauline leaves clasping with auricles; flowers large, pale yellow; fruit flattened at right angles to the septum, winged, broadly cordate.

Distr.: W Mediterranean Region, Tenerife, Palma. *Ecol.:* Very scarce, along roadsides in the subtropical zone.

21. *IBERIS* L.

Iberis odorata L.

Low, branched annual with linear leaves, somewhat pinnately lobed, flowers white, in a flat-topped cluster, the outer petals slightly longer than the inner; fruit an ovate silicle, notched between the two points, flattened at right angles to the septum.

Distr.: Greece, Turkey, N Africa, reported once from Gran Canaria. *Ecol.:* A doubtful record, to be confirmed.

22. *SINAPODENDRON* Lowe.

1. Leaves glaucous, glabrous — 1. *S. bourgeaei*

1. Leaves appressed pubescent — 2. *S. palmense*

1. *Sinapodendron bourgeaei* Webb in Christ.

Small half-shrub with woody branches, leaves glaucous, glabrous, ovate or elliptic, 4-5 cm long, with dentate margin; flowers yellow in branched inflorescences; siliques on diverging pedicels about 2 cm long, the fruits about 75 mm long, valves with strong midvein and numerous anastomosing lateral veins.

Distr.: Endemic of Tenerife, Gomera, Hierro. *Ecol.:* Very rare, found a few times in barrancos on N coasts in the subtropical zone. *Syn.: Brassica bourgeaei* Webb. *Evol.:* Although similar in habit, its fruit suggests no close relationship to the Madeiran species of this genus.

Fig. 13

2. *Sinapopendron palmense* Ktze.

Small halfshrub with woody branches, leaves petiolate, appressed pubescent, ovate, serrate-dentate, the blade about 3 cm long; flowers yellow.

Distr.: Endemic of Palma. *Ecol.:* Extremely rare, collected at Breña in the upper subtropical zone. *Syn.: Brassica palmensis* Ktze.

Fig. 14

23. *BRASSICA* L.

1. Upper cauline leaves clasping around the stem — 1. *B. oleracea*

1. Upper cauline leaves not clasping — 2. *B. nigra*

1. *Brassica oleracea* L.

Glabrous biennial with woody base and fleshy leaves; flowers large, pale yellow; silique to 7 cm long, 4 mm thick, with conical beak.

Distr.: Europe, reported from Tenerife. *Ecol.:* Cabbage is commonly cultivated and may occasionally escape and set seed.

2. *Brassica nigra* (L.) Koch.

Large annual, the lower leaves pinnate with few small lobes and large terminal segment, hispid, cauline leaves petiolate; flowers yellow; fruits appressed to the stem on short pedicels, slender with short, thin beak.

Distr.: Europe, N Africa, Azores, Madeira, reported once from Tenerife, to be confirmed.

24. *ERUCA* Mill.

Eruca vesicaria (L.) Cac. ssp. sativa (Mill.) Thell.

Sturdy annual with pinnately dissected leaves, the terminal lobe larger than the lateral ones; flowers yellow, pale yellow or violet, usually with dark veins; silique to 25 mm, fairly thick, the valves with one strong vein, the beak flattened; seeds in 2 rows in each locule.

Distr.: Mediterranean region, Lanzarote, Tenerife, Gomera, Hierro. *Ecol.:* Sometimes cultivated, and escaped, upper subtropical zone.

25. *ERUCASTRUM* Presl.

Erucastrum canariense W. & B.

Hispid, branched annual to 40 cm, the basal leaves with 4 to 6 rounded lobes, cauline leaves dentate, sessile and clasping. Flowers yellow, fruits on diverging pedicels 8-15 mm long, the valves about 30 mm long, with prominent midvein, torulose (wavy), with a very short, cylindrical beak.

Distr.: Reported from coastal Morocco, known from Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Dry fields and open terrain, 0-500 m. *Evol.:* Perhaps related to *E.* varium of N Africa.

Fig. 15

26. *SINAPIS* L.

1. Silique with more than 8 seeds, beaded — 1. *S. arvensis*

1. Silique with 4-8 seeds, somewhat wavy

   2. Siliques on pedicels 6-15 mm long; petals about 10 mm; valves of the fruit often hispid — 2. *S. alba*

2. Siliques on short stout pedicels; petals smaller; valves of the fruit usually glabrous 3. *S. flexuosa*

1. *Sinapis arvensis* L.

Annual, the stems and leaves sparingly hispid; leaves simple or with a few small basal lobes; flowers yellow; fruit a silique to 45 mm, with an attentuate beak, valves somewhat constricted between the seeds.

Distr.: Much of Europe, N Africa, Madeira, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, Hierro. *Ecol.:* Common in pastures and roadsides.

2. *Sinapis alba* L.

Annual, with retrorsely hispid branches, leaves pinnate with rounded crenate lobes; flowers yellow, the petals 10 mm long or more, including the claw; fruits on diverging pedicels about 1 cm long; valves bulging over the seeds; usually long-hispid, with prominent veins, beak flat, somewhat curved, about as long as the valves.

Distr.: Most of Europe, N Africa, Madeira, Tenerife, Palma, Hierro, probably elsewhere. *Ecol.:* Common weed in pastures and roadsides.

3. *Sinapis flexuosa* Poir.

Annual with scabrous foliage, resembling the preceding, but the petals shorter and siliques on shorter pedicels.

Distr.: SW Mediterranean, reported from Lanzarote; Tenerife. The material is inconclusive, and needs further confirmation.

27. *HIRSCHFELDIA* Moench.

Hirschfeldia incana (L.) Lagr.-Foss.

Robust, branched annual, retrorsely hispid especially near the base; lower leaves pinnately lobed, upper simple, narrowed to sessile base; flowers yellow; fruit on short upright pedicels, appressed to the stem, to 15 mm long, with beak 3-5 mm, swollen above the base.

Dist.: Mediterranean region, Madeira, on all of the Canary Islands. *Ecol.:* Very common weed of roadsides and fields, from sea level to 1,500 m. *Syn.: Brassica adpressa* Boiss.

28. *CARRICHTERA* DC.

Carrichtera annua (L.) Aschers.

Branched annual 5-40 cm, leaves once or twice pinnate with filiform segments; flowers pale yellow with dark veins, fruits deflexed on short pedicels, the lower segment ovoid with several seeds, the upper flat and leafy, ovate.

Distr.: Asia Minor and N Africa, Mediterranean Islands, S Spain, Lanzarote, Fuerteventura, Gran Canaria, Tenerife. *Ecol.:* Weedy, in pastures, fields, and open soil, abundant in Lanzarote and Fuerteventura, sea level to 600 m. *Syn.: C. vellae* DC.

29. *SUCCOWIA* Medic.

Succowia balearica (L.) Medic.

Annual with pinnate leaves, the segments dentate or dissected; flowers yellow; fruits to 6 mm in diameter, with long spines.

Distr.: W Mediterranean, one old report from Tenerife is to be confirmed.

30. *CAKILE* Mill.

Cakile maritima Scop. ssp. aegyptiaca (Willd.) Nyman.

Glabrous, succulent-leaved annual, the leaves lobed, stems branched, with pale violet flowers; fruit corky, consisting of two one-seeded portions, the upper portion conical, the lower irregularly obconical.

Distr.: The species along European and N African sea coasts, the ssp. Mediterranean, Madeira, Lanzarote, Fuerteventura. *Ecol.:* In dune sand near the ocean, rare.

31. *RAPISTRUM* Crantz.

Rapistrum rugosum (L.) All.

Annual with hispid stems, the leaves somewhat toothed, the lower ones with a few small triangular basal lobes; flowers pale sulphur-yellow,

the petals rounded, 6-8 mm; silicles one-seeded, with beak-like style, and reduced, stalk-like basal section, upright on short pedicel.

Distr.: Mediterranean, Madeira, Lanzarote, Gran Canaria, Tenerife, probably other islands. *Ecol.:* Roadsides and weedy fields up to 500 m, fairly common.

32. *CRAMBE* L.

1. Leaves glabrous, somewhat carnose	1. *C. laevigata*
1. Leaves scabrous or hispid, firm but not carnose	
2. Leaves laciniate to deeply lobed, or occasionally absent	
3. Leaves scarce or absent, plant diffusely branched from the base	2. *C. scoparia*
3. Leaves in dense spirals, pinnatifid to bipinnate; plant with few branches, seldom branched from the base	3. *C. arborea*
2. Leaves large, ovate, sometimes with a few small lobes at the base of the blade	
4. Leaf blade cordate or truncate at the base, leaf broadest near the base; stems glabrous	4. *C. strigosa*
4. Leaf blade never cordate, usually cuneate or gradually narrowed, occasionally truncate; stems scabrous, spiny or hispid	
5. Rosettes practically sessile, on stems to 5 cm high; leaf blade lobed at the base with several lobes	5. *C. gomeraea*
5. Rosettes less tight, on branches of several decimeters	
6. Stems and petioles retrorse scabrous-hispid; lower leaves with decurrent leaf blade and auricles at the base	6. *C. scaberrima*
6. Stems and petioles spiny with erect bristles; all leaves petiolate	7. *C. pritzelii*

1. *Crambe laevigata* DC.

Simple or sparingly branched half-shrub with glabrous woody stem up to 30 cm; leaves glaucous, carnose, oblong, acute, narrowed to the petiole, the margin dentate with large teeth, sometimes doubly dentate; inflorescence large, branched, flowers white.

Distr.: Endemic to W Tenerife. *Ecol.:* In the humid, shaded ravines below Masca, 200-1,200 m. Typical cliff plant. *Evol.:* Distinctive species which must have differentiated early in the evolution of the section Dendrocrambe.

Fig. 16

2. *Crambe scoparia* Svent.

Diffusely branched shrub with switch-like arching branches, sparingly leafy with small leaves with remote lobes or large teeth; inflorescence persistent, voluminous; fruit ovoid-fusiform with long beaked style.

Distr.: Endemic to W Gran Canaria. *Ecol.:* Shaded cliffs above Aldea, at 600 m, extremely rare. *Evol.:* Placed in a separate section *Rhipocrambe* by the author, on the basis of the growth form, and fruit.

3. *Crambe arborea* Webb in Christ.

Tall, sparingly branched or simple shrub, to 1.5 m, stem somewhat prickly, soon becoming smooth; leaves with prickly petiole, leaf blade variously dissected, either with toothed lobes, or laciniate with segments 2-3 mm wide; inflorescence very large, diffusely branched; fruits sharply angled, or winged.

Distr.: Endemic to one cliff on Tenerife. *Ecol.:* Very rare, cliff plant at 600 m on the Ladera de Güimar. *Evol.:* Very distinctive plant, not closely related to the other species of Dendrocrambe.

Fig. 17

4. *Crambe strigosa* L'Herit.

Simple or sparingly branched half-shrub, usually about 60 cm, occasionally (var. *gigantea* Ceb. & Ort.) to 3 m; stems glabrous, leaves sparingly scabrous-hispid, green; ovate, broadest near the cordate base, petiolate, often with small pair of lobes on the petiole; margin finely dentate; inflorescence large, branched, flowers white.

Distr.: Endemic of Tenerife, Palma, Hierro, Gomera. *Ecol.:* Locally common in deep soil in laurel forest and tree heaths, not a cliff plant as the other species, 500-1,000 m. *Evol.:* Morphologically similar to the following several species, but ecological distinct.

Fig. 18

5. *Crambe gomeraea* Webb in Christ.

Practically sessile cliff plant with short woody caudex; rosette of very hispid leaves, short petiolate with lobes on the petiole and lobed base of the blade; leaves ovate-rhombic, tip acute, margin closely doubly dentate; inflorescence branched, to 60 cm, flowers showy, white.

Distr.: Endemic of Gomera. *Ecol.:* Rare, forming colonies on damp cliffs, 400-1,300 m. *Evol.:* Insular isolate related to the preceding and following species.

Fig. 19

6. *Crambe scaberrima* Webb.

Sparingly branched shrub to 1 m, with retrorsely scabrous stems, the internodes with three low ridges below each leaf base; leaves petiolate or with decurrent blade and auriculate, very rough, margin unevenly dentate; inflorescence very large and diffuse; fruits with prominent ribs.

Distr.: Endemic to W and SW Tenerife. *Ecol.:* Cliffs and talus slopes about 100-500 m, very rare, mostly in deep barrancos. *Evol.:* Very close to the next species, also related to *Cr. strigosa.*

Fig. 20

7. *Crambe pritzelii* Bolle.

Sparingly branched low shrub, to 80 cm, with spiny branches; leaves ovate or oblong, petiolate, rarely with small lobes on the spiny petiole; margin closely and irregularly dentate; inflorescence large, diffusely branched, flowers white; fruits with prominent, often winged ribs.

Distr.: Endemic of E Gran Canaria. *Ecol.:* Rare, on cliffs 700-1,200 m. *Evol.:* Hardly distinct from the preceding species.

Fig. 21

33. *RAPHANUS* L.

1. Flowers pale yellowish with purple veins; siliqua slender, to 5 mm thick, beaded with 3-6 seeds, the pointed beak longer than the beads 2. *R. raphanistrum*

1. Flowers white to violet; siliqua thick, 1 or few-seeded with short beak 1. *R. sativus*

1. *Raphanus sativus* L.

The radish is a cultivated plant rarely escaped from cultivation. The root and hypocotyl are thickened into an edible spongy tuber.

2. *Raphanus raphanistrum* L.

Somewhat hispid annual with pinnatifid leaves, the lobes increasing in size towards the rhombic end segment, margins rough-denticulate; flowers cream with purple veins, the calyx purplish; siliques on divergent pedicels, erect or patent, indehiscent, beaded, with long curved beak.

Distr.: Mediterranean, Madeira, Lanzarote, Gran Canaria, Tenerife, Gomera, and probably other islands. *Ecol.:* Appears in masses in abandoned fields from sea level to 600 m, but local.

LAMINA I

Fig. 1. Descurainia millefolia

Fig. 2. Descurainia artemisioides

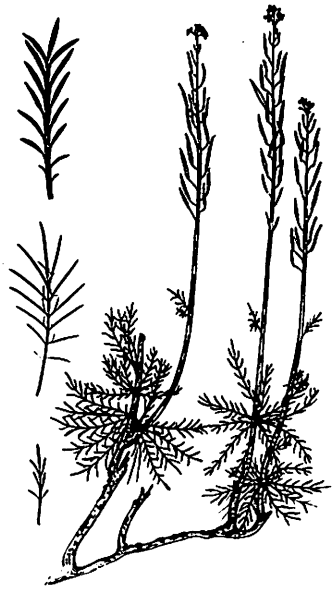

Fig. 3. Descurainia preauxiana

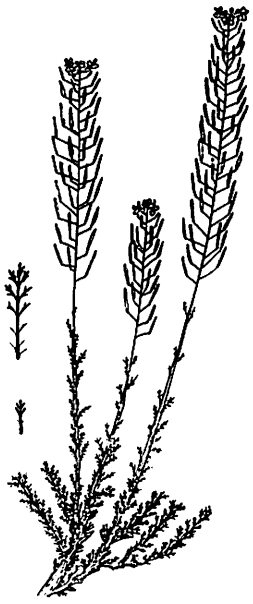

Fig. 4. Descurainia bourgaeana

LAMINA II

Fig. 5. Descurainia gilva

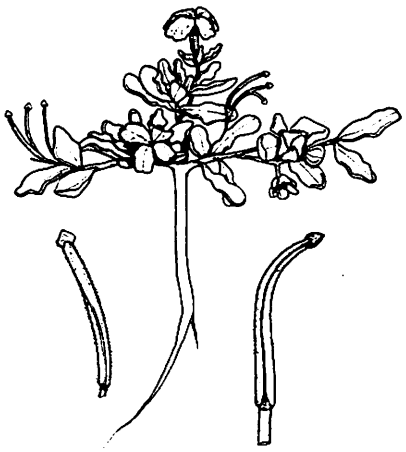

Fig. 6. Matthiola bolleana

Fig. 7. Cheiranthus scoparius

Fig. 8. Cheiranthus mutabilis

LAMINA III

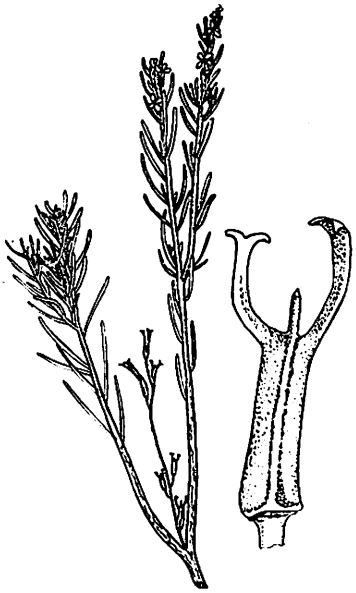

Fig. 9. Parolinia ornata

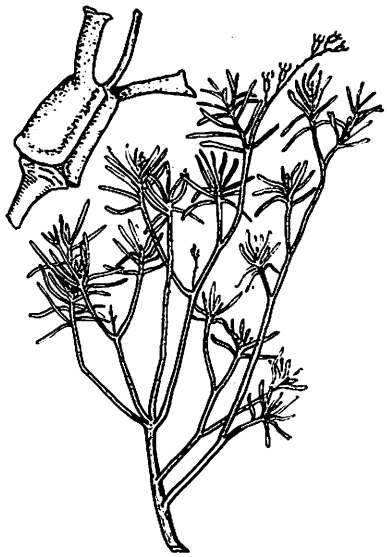

Fig. 10. Parolinia schizogynoides

Fig. 11. Lobularia intermedia

Fig. 12. Lobularia marginata

LAMINA IV

Fig. 13. Sinapodendron bourgeaei

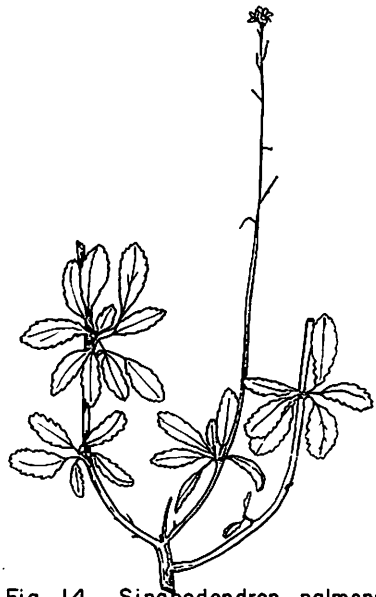

Fig. 14. Sinapodendron palmense

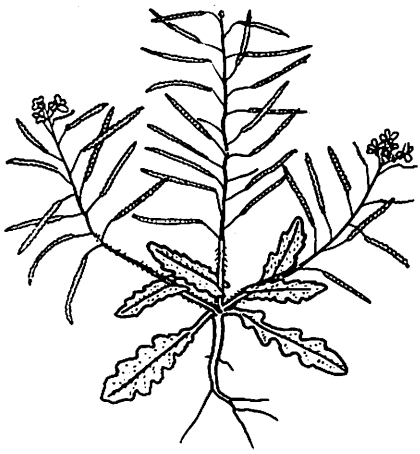

Fig. 15. Erucastrum canariense

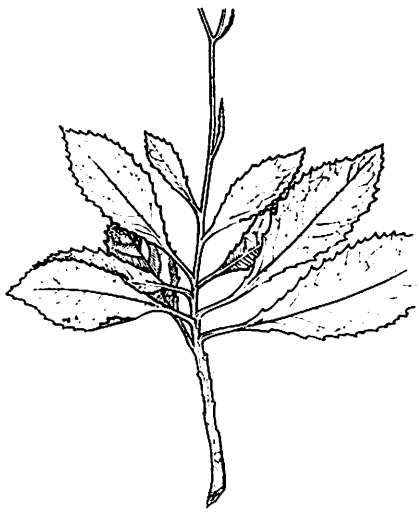

Fig. 16. Crambe laevigata

LAMINA V

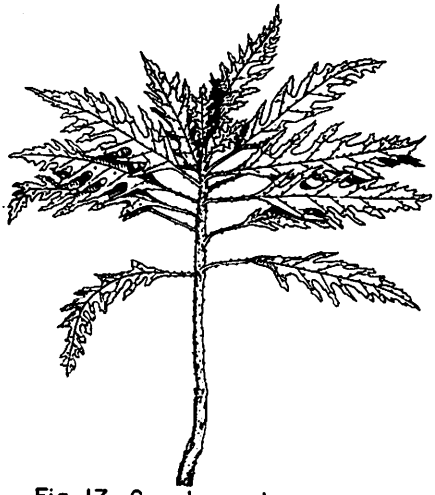

Fig. 17. Crambe arborea

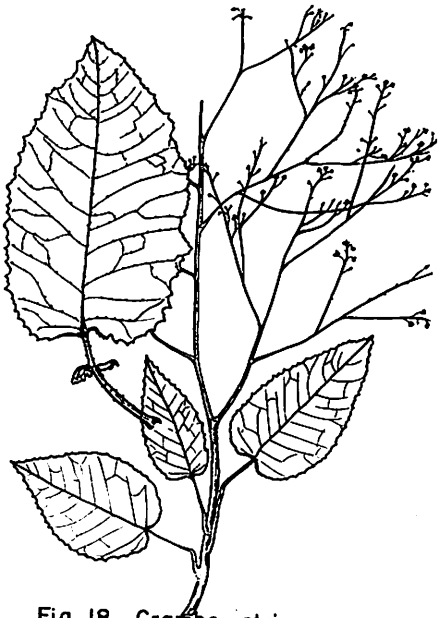

Fig. 18. Crambe strigosa

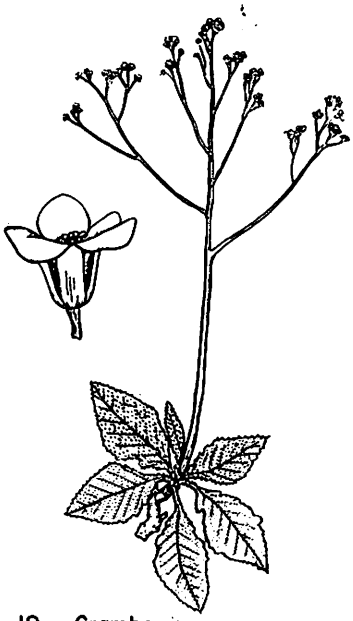

Fig. 19. Crambe gomeraea

Fig. 20. Crambe scaberrima

LAMINA VI

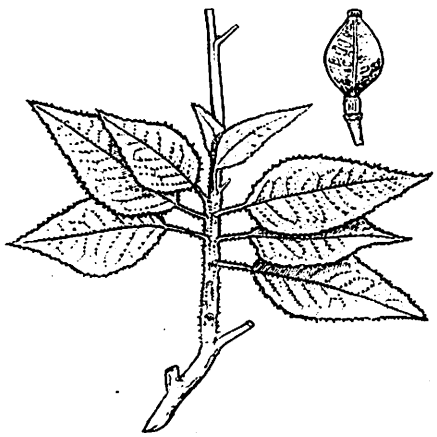

Fig. 21. Crambe pritzelii

Family *CRASSULACEAE*

Key to the Genera

1. Petals fused to form a tubular or bell-shaped corolla
   2. Leaves opposite or in whorls; calyx and corolla both tubular, or bell-shaped — 2. *Bryophyllum*
   2. Leaves alternate or mostly basal; calyx fused only at the base
      3. Leaves orbicular, peltate; perennial from underground tuber — 3. *Umbilicus*
      3. Leaves oblong, cylindrical; annual — 4. *Mucizonia*

1. Petals separate, not forming a tubular or bell-shaped corolla
   4. Petals 3-5
      5. Petals 3 (rarely 4); tiny creeping annual — 1. *Crassula*
      5. Petals usually 5; perennial or erect annual — 9. *Sedum*
   4. Petals 6 or more
      6. Petals 20 or more, always yellow — 6. *Greenovia*
      6. Petals up to 12 in number, yellow, greenish, white or pink
         7. Small annuals or biennials, not woody
            8. Leaves flattened; flower yellow — 7. *Aichryson*
            8. Leaves very small, thick, grayish; flowers purplish green — 8. *Monanthes*
         7. Perennial, often woody
            9. Flowers on long filiform pedicels, singly or few together, with thick, prominent glands between the stamens; leaves grayish; small plants, rarely more than 15 cm — 8. *Monanthes*

9. Flowers on short pedicels in compound inflorescences; glands not readily seen; leaves various; plants usually more than 10 cm tall	5. *Aeonium*

1. *CRASSULA* L.

Crassula tillaea Lest.-Garl.

Very small moss-like annual with creeping stems, leaves crowded, opposite and fused at the base, 2 mm long; flowers sessile, very small, with 3-4 white or pinkish petals 1 mm long.

Distr.: S and W Europe, N Africa, Azores, Madeira, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, Hierro. *Ecol.:* Open places in subtropical and montane belts, common, but inconspicuous. *Syn.: Tillaea muscosa* L. *Crassula muscosa* (L.) Roth.

2. *BRYOPHYLLUM* Salisb.

Several species of *Bryophyllum* are commonly cultivated in gardens. The following is sometimes found escaped:

Bryophyllum pinnatum (Lam.) Oken.

Perennial halfshrub to 1 m, woody at the base; leaves opposite or whorled, succulent, the upper one pinnately dissected, crenate, with young plantlets often arising from the indentations of the margins; flowers large, greenish pink, mottled, both calyx and corolla tubular.

Distr.: Madagascar, introduced in most subtropical countries, Azores, Madeira, Gran Canaria. *Ecol.:* Escaped from cultivation, in subtropical thickets and roadsides, rare. *Syn.: Bryophyllum calycinum* Salisb.

3. *UMBILICUS* DC.

1. Flowers golden yellow	1. *U. heylandianus*
1. Flowers greenish to purple, not yellow	
2. Corolla lobes lanceolate, acute	2. *U. horizontalis*
2. Corolla lobes ovate, short-pointed	3. *U. pendulinus*

1. *Umbilicus heylandianus* Webb & Berth.

Perennial from underground corm, stem simple, with round peltate basal leaves, the cauline leaves progressively smaller and narrower; inflorescence very dense, somewhat one-sided; flowers soon reflexed, golden yellow, the corolla of 5 fused petals, constricted below the lanceolate lobes.

Distr.: Spain and Portugal, Gran Canaria, Palma. *Ecol.:* Very scarce, in open habitats at high elevation, upper montane.

2. *Umbilicus horizontalis* (Guss.) DC. «Sombrerillo».

Perennial from corm, stems simple or branched, basal leaves round, peltate, cauline leaves smaller; flowers along the upper half of the stems, horizontal, corolla greenish pink to reddish, not constricted, lobes lanceolate, long-pointed.

Distr.: Mediterranean region, Azores, Madeira, Cape Verde Islands, reported from all of the islands, but perhaps referring to the next species. *Ecol.:* Soil pockets in cliffs, old walls, especially in the montane zone, leaves conspicuous in winter and spring. *Evol.:* Classification of this and the following species has been much confused; plants with lanceolate carpels may be distinguished as *U. gaditanus* Boiss.; further study of the genus is needed. *Syn.: Cotyledon horizontalis* Guss.

3. *Umbilicus pendulinus* DC.

Similar to the preceding, but with flowers along more than half of the stems; flowers pale, nodding, corolla lobes ovate with mucronate tip.

Distr.: W and S Europe, N Africa, Azores, Madeira, reported from several of the Canary Islands, but confused with the preceding species. *Ecol.:* Old walls, ledges and cliffs. *Evol.:* See above. *Syn.: Cotyledon umbilicus-veneris* L., *Umbilicus rupestris* (Salisb.) Dandy.

4. *MUCIZONIA* (DC.) A. Berger.

Mucizonia hispida (Lam.) A. Berger in Engl. & Prantl.

Small, branched annual with oblong, red-streaked leaves; flowers in lax glandular-pubescent inflorescence, corolla bell-shaped, of 5 fused petals, greenish yellow tinged with red.

Distr.: Spain and Portugal, Morocco, collected once from Tenerife. *Ecol.:* Unknown, not collected since Broussonet. To be confirmed. *Syn.:* *Cotyledon hispida* Lam.

5. *AEONIUM* Webb & Berth.

1. Leaves on the back with imbedded longitudinal glands, which are dark green when young, turning reddish or purplish with age
   2. Leaves strap-shaped, pointed to 6 cm long, with long white cilia along the margins — 33. *A. caespitosum*
   2. Leaves obovate, blunt-tipped, not with long cilia, less than 4 cm long
      3. Stems thick, succulent, with very long hairs below the leaves; leaves with wavy edges — 32. *A. smithii*
      3. Stems twiggy, glabrous or short glandular
         4. Leaves flattish, the margin with bead-like teeth
            5. Branches diverging, ascending — 30. *A. spathulatum*
            5. Branches upgriht, coppery red — 31. *A. cruentum*
         4. Leaves very thick, red streaked; margin not beaded — 29. *A. sedifolium*

1. Leaves lacking longitudinal glands, sometimes with pigment streaks which do not differ in texture from the rest of the surface
   6. Leaf margin with a row of fine whitish teeth or cilia, different from any pubescence that may or may not be present on the surface
      7. Plants monocarpic, i. e. with an unbranched stem and single rosette, producing one inflorescence
         8. Rosette sessile, flat against the substrate — 5. *A. tabulaeforme*
         8. Rosette stalked, on a thick trunk
            9. Growing in clusters, the stems producing new buds at the very base; flowers yellow — 12. *A. undulatum*
            9. Stems strictly single

10. Leaves up to 15 or 20 cm wide, very thick, orange hued; marginal teeth scarce; flowers dark red — 7. *A. nobile*
10. Leaves much narrower and thinner; flowers white or pink
    11. Stems below the leaves with rhombic leaf scars, the edges of wich are roughened — 19. *A. ciliatum*
    11. Stems below the leaves smooth
        12. Leaves heavily glaucous, pinkish or purplish hued; leaf tip broad, often bent upwards — 17. *A. hierrense*
        12. Leaves green or pale, not pinkish or purplish, the tip acute, pointed, not curled inward or upward — 18. *A. urbicum*

7. Plants branched, not monocarpic

13. Leaves of the rosette flattened, forming flat discs during the summer, but even during the growing season the young leaves tightly appressed against the older ones; flowers mostly yellow
    14. Stems branched from the base only; leaves often with somewhat undulated margins, the tips broadly rounded, with a small apiculus — 12. *A. undulatum*
    14. Stems branched from below the rosettes; leaves not undulate, more or less acuminate

15. Inflorescence and calyx short-pubescent; calyx teeth lanceolate — 11. *A. manriqueorum*
15. Inflorescence and calyx glabroux; calyx teeth triangular
16. Flowers pale with reddish base and midrib; inflorescence short, hemispherical — 10. *A. rubrolineatum*
16. Flowers bright yellow; inflorescences ovoid-conical
17. Leaves falling when dry; inflorescence more than 15 cm long — 8. *A. holochrysum*
17. Leaves persistent on the old stems after drying; inflorescence less than 15 cm long — 9. *A. vestitum*

13. Leaves of the rosette not flattened against one another, the young ones arising from the stem tip at an angle to the older leaves
18. Leaves without a reddish or purplish margin, grayish green or glaucous
19. Sessile rosettes of large leaves to 25 cm long; plant forming leafy horizontal stolons — 6. *A. cuneatum*
19. Branched small shrubs or dwarf bushes; leaves to 8 cm
20. Branches erect; marginal cilia dense — 13. *A. balsamiferum*
20. Branches diffuse
18. Leaves with reddish or purplish margin, especially near the tip
21. Stems below the leaves with rhombic pattern of rough ridges separating the leaf scars
22. Leaves less than 5 cm long; inflorescence with 6-12 branches; stems very rough even between the leaves — 20. *A. decorum*

22. Leaves more than 8 cm long; inflorescence with more than 12 branches; stems rough only in lines between old leaf scars — 19. *A. ciliatum*

21. Stems below the leaves not with pattern of rough ridges

23. Leaves pubescent on the surface and pinkish purple to brownish green — 16. *A. valverdense*

23. Leaves at most with some scattered glands on the surface, or, if pubescent, then clear green

24. Flowers pale to tawny yellow

25. Leaves shining, green; flowers buff — 24. *A. burchardii*

25. Leaves dull, glaucous; flowers pale orange-yellow — 21. *A. haworthii*

24. Flowers white or pink

26. Leaves purplish pink — 14. *A. percarneum*

26. Leaves green or glaucous, purplish only near the edge or tip

27. Leaves very acute, orange tinged in the upper portion — 15. *A. lancerottense*

27. Leaves more or less rounded and apiculate, glaucous or with reddish edge

28. Twiggy bush, hemispherical in outline

29. Teeth almost contiguous along the upper margin; young leaves with red edge — 21. *A. haworthii*

29. Teeth scattered; young leaves mostly pale green — 22. *A. castello-paivae*

28. Loosely branched shrub, the leaves only slightly glaucous, or green — 23. *A. gomerense*

6. Leaf margins not toothed or ciliate, or with hairs not different from those on the surface
   29. Leaves large and pubescent, forming sessile rosettes, the short stems concealed under the leaves
      30. Flowers pale greenish — 1. *A. canariense*
      30. Flowers lemon yellow
         31. Leaves abruptly broadened near the tip, the terminal portion transversely elliptic, rosettes flattened — 4. *A. subplanum*
         31. Leaves gradually broadened, obovate; rosettes forming cups
            32. Leaves often orange tinged; inflorescence branches, short, ascending — 3. *A. palmense*
            32. Leaves light green; inflorescence lax — 2. *A. virgineum*
   29. Leaves not both large (over 10 cm) and pubescent; stems visible below the rosettes
      33. Monocarpic, a single rosette on thick trunk
         34. Leaves up to 15 or 20 cm broad, orange tinged, blunt tipped — 7. *A. nobile*
         34. Leaves oblong-lanceolate, shining green or slightly glaucous, with sharp point — 18. *A. urbicum*
      33. Branched plants
         35. Plants with glabrous, non-viscous leaves
            36. Leaves shining, green tinged with red; stems roughened — 20. *A. decorum*
            36. Leaves glaucous, pale green; stems not clearly roughened

37. Leaves long-acuminate, tinged with orange; stem thick and succulent — 15. *A. lancerottense*
37. Leaves rounded with short apiculus, glaucous or with faint reddish marks; twigs slender — 22. *A. castello-paivae*

35. Leaves glutinous, glandular, sticky or clammy
38. Flowers pink; leaves flat — 25. *A. goochiae*
38. Flowers yellow; leaves convex, at least below
39. Leaves forming globose buds during the summer
40. Branches mainly upright, tortuous; leaves streaked with red, glandular but not notably pubescent — 29. *A. sedifolium*
40. Branches pendulous, long diverging; leaves pubescent — 28. *A. saundersii*
39. Leaves not forming globose buds
41. Upper branches glabrous or short-puberulent, glandular and clammy; scales between the stamens not incised
42. Leaves very thick, more than 4 mm — 26. *A. lindleyi*
42. Leaves somewhat flattened, less than 4 mm thick — 27. *A. viscatum*
41. Branches hairy; scales between the stamens cleft — see: Genus *Aichryson*

Section *CANARIENSIA* Praeger.

Low rosette plants, woody only at the base; inflorescences rather lax, with yellow or greenish yellow flowers.

1. *Aeonium canariense* (L.) Webb & Berth. - «Bejeque».

Sessile rosette perennial with several short branches bearing further rosettes; leaves 10-40 cm long, 5-10 cm wide, rather pale green, with

velvety pubescence; inflorescence to 1 m high, loosely ovoid pyramidal with lax branches, glandular pubescent; flowers greenish 8-10 parted.

Distr.: Endemic to Tenerife. *Ecol.:* Cliff plant found in large colonies on fairly moist rocks and banks along the N coast, from near sea level to 600 or 1,000 m. *Evol.:* Very closely allied to the following 3 species, but larger, and with paler flowers. *Syn.: Sempervivum caneriense* L.

Fig. 1

2. *Aeonium virgineum* Webb & Berth.

Similar in growth form to the preceding, but often more branched, the leaves smaller (10-15 cm); inflorescence to 70 cm high, fairly lax, glandular; flowers lemon yellow, 6-9 parted.

Distr.: Endemic to Gran Canaria. *Ecol.:* Common only locally along the N coast, on cliffs from sea level to 1,000 m. *Evol.:* Closely related to the preceding and next 2 species.

Fig. 2

3. *Aeonium palmense* Webb in Christ.

Similar in growth form to the preceding; leaves often orange tinged, about 15 cm long; inflorescence with spaced but ascending branches, to 75 cm high; flowers lemon yellow, 7-10 parted.

Distr.: Endemic to Palma and Hierro. *Ecol.:* Soil banks and cliffs, fairly dry habitats, near sea level up to 1,250 m; local. *Evol.:* Closely related to the preceding species; the plants from the two islands differ slightly in habit, but not enough to warrant specific distinction.

Fig. 3

4. *Aeonium subplanum* Praeger.

Flat rosette perennial, sometimes unbranched and flowering but once, or producing a few short branches; leaves pubescent, more or less appressed against one another, with very broad upper portion, the tip broadly rounded to retuse, with small apiculus; inflorescence to 60 cm, glandular pubescent, lax, flowers lemon yellow, 11-12 parted.

Distr.: Endemic to Gomera. *Ecol.:* Characteristic of the cliffs of the N coast, in the montane zone, 300-1,000 m. *Evol.:* The most reduced member of the branched rosette plants listed above, and similar to *A. glandulosum* of Madeira.

Fig. 4

5. *Aeonium tabulaeforme* (Haw.) Webb & Berth.

Monocarpic flat rosette plant, appressed against its substrate; leaves in intricate spirals, closely appressed against one another, glabrous and green, except for the long white cilia along the margins; inflorescence developing after 3 or more years, to 60 cm, laxly branched; flowers 7-10 parted, pale yellow.

Distr.: Endemic to Tenerife. *Ecol.:* Common on soil banks and cliffs of the N coast, below 600 m. *Evol.:* A highly specialized rock plant, its habit similar to *A. glandulosum* of Madeira, from which it differs in floral and leaf morphology.

Fig. 5

6. *Aeonium cuneatum* Webb & Berth.

Rosette perennial, the main stem very short, forming horizontal leafy stolons with new rosettes at the tips; leaves to 25 cm long, 8 cm wide, acute, glabrous and somewhat glaucous, with densely ciliate margin; inflorescence stalks to 1.3 m tall, bearing rather lax branches along the upper third; flowers 8-9 parted, golden yellow.

Distr.: Endemic to Tenerife. *Ecol.:* Local in the laurel forest regions of the eastern and western ends of the island, on banks and cliffs, 500-1,200 m. *Evol.:* A well-marked species, perhaps distantly allied to *A. glutinosum* of Madeira, which it resembles in growth form.

Fig. 6

Section *MEGALONIUM* Berger.

7. *Aeonium nobile* Praeger.

Short stalked monocarpic woody plant to 60 cm high; leaves large, thick, concave, the margin rounded, with a few scattered teeth on the lower half, the leaf surface glabrous, dull orange or reddish green; inflorescence very dense, dome shaped in outline, branched from near the rosette, the flowers 6-10 parted, dark red to maroon.

Distr.: Endemic to Palma. *Ecol.:* On dry slopes and cliffs where it survives for perhaps a decade before flowering, near sea level to 750 m, rare. *Evol.:* A completely distinctive species forming a monotypic section within the genus.

Fig. 7

Section *HOLOCHRYSA* Praeger.

Shrubs with succulent, thick stems, sparingly branched, with flattish glabrous leaves, green or streaked with purple, with ciliate margins; flowers mostly bright yellow.

8. *Aeonium holochrysum* Webb & Berth. - «Pastel del Risco».

Shrub to 1 m tall, thick branches tipped with flat rosettes; leaves smooth, green occasionally with brown streaks, ciliate, the cilia curved forward; inflorescence ovoid-conical, 15-30 cm long, to 15 cm wide, rather dense, totally glabrous; flowers 9-11 parted, the calyx lobes glabrous, triangular, petals bright yellow.

Distr.: Endemic to Tenerife, Gomera, Palma, Hierro. *Ecol.:* Most common in the *Euphorbia* scrub of the N coast, but ranging from near sea level to 1,500 m, locally common, especially on Tenerife. *Evol.:* Closely allied to the following two species; its occurrence on Gomera needs to be confirmed.

Fig. 8

9. *Aeonium vestitum* Svent.

Somewhat smaller than the preceding species, but very similar to it; leaves somewhat more brownish green, persisting on the stem after drying; inflorescence smaller, to 15 cm long, dense, conical; flowers 9-10 parted, yellow.

Distr.: Endemic of Palma. *Ecol.:* Recently discovered in western Palma on dry cliffs in the lower pine forest, 500-700 m. *Evol.:* This may be merely a local form of the preceding.

Fig. 9

10. *Aeonium rubrolineatum* Svent.

Small shrub, to 80 cm, with thick branches; leaves often streaked with red, occasionally wholly suffused with red pigment; inflorescence with reddish branches, the panicle hemispherical or cone shaped, 10-15 cm tall and wide, glabrous; flowers 9-12 parted, the calyx with triangular lobes, with purple margin; petals pale with purple base and veins.

Distr.: Endemic to Gomera. *Ecol.:* Fairly common only in the SW sector, on cliffs from near sea level to 1,200 m. *Evol.:* A darkly pigmented, small derivative of *A. holochrysum*.

Fig. 10

11. *Aeonium manriqueorum* Bolle.

Shrub, often forming voluminous bushes, resembling *A. holochrysum* in growth form, but tending to produce more adventitious roots from the branches; inflorescence dense, ovoid, 15-25 cm long, glandular puberulent; flowers 10-11 parted, calyx lobes long, lanceolate; flowers bright yellow.

Distr.: Endemic to Gran Canaria. *Ecol.:* Rather more limited to cliffs than *A. holochrysum,* 200-1,200 m. *Evol.:* Very similar to *A. holochrysum* except for the puberulent inflorescence.

Fig. 11

12. *Aeonium undulatum* Webb & Berth.

Tall thick-stemmed plant branching only near the base, forming small clumps; leaves imbricate, but with undulate margin, broadly rounded toward the tip, with small apiculus; flowers in large dense ovoid to hemispherical panicle, glabrous; calyx with blunt segments, 8-12 parted, petals bright yellow.

Distr.: Endemic to Gran Canaria. *Ecol.:* Here and there in the montane zone on banks and cliffs, 350-1,500 m, on N and E exposure.

Fig. 12

13. *Aeonium balsamiferum* Webb & Berth.

Small shrub with rather stiffly erect branches, 30-80 cm high; leaves in cup-shaped rosettes, not strictly imbricate, grayish green, ciliate on the margin, with black lines on the back of the older leaves; inflorescence ovoid, 7-10 cm long, dense; flowers 9 parted, glabrous, yellowish; seldom seen in flower; plant with odor of balsam.

Distr.: Endemic to Lanzarote and perhaps Fuerteventura. *Ecol.:* Very scarce, in crevices of boulder fields and cliffs. *Evol.:* In habit similar to *Aeonium arboreum* of Morocco.

Fig. 13

Section *URBICA* Praeger.

Woody plants with glaucous or green, often red-rimmed leaves, the margin usually with cartilaginous teeth; inflorescence pyramidal, flowers usually white or pink.

14. *Aeonium percarneum* (Murray) Pit. & Proust.

Sturdy shrub to 1 m with thick gray branches; leaves 8-12 cm long, glaucous, pinkish purple, the margin with cartilaginous cilia; inflorescence pyramidal, up to 50 cm high and wide, dense; flowers 8-9 parted, the calyx, and sometimes the petals glandular, petals white with red streaks, giving a pink effect.

Distr.: Endemic to Gran Canaria and Palma. *Ecol.:* Typical of the *Euphorbia* scrub, but extending from 100 to 1,200 m; common on Gran Canaria, local on Palma. *Evol.:* The plant of Palma is more slender and glandular in the inflorescence, and has more obtusely pointed leaves; it probably merits taxonomic recognition. Rather similar to the next 2 species.

Fig. 14

15. *Aeonium lancerottense* Praeger.

Compact branched woody plant to 45 cm high, with thick, smooth branches; leaves pointed, glaucous, with orange hue, 5-8 cm long, concave, the margin with blunt teeth; inflorescence rather flat topped, 8-25 cm wide; flowers glabrous, 8 parted, pink.

Distr.: Endemic to Lanzarote. *Ecol.:* Local, in crevices and boulder fields, 250-600 m. *Evol.:* Fairly distinctive relative of the preceding.

Fig. 15

16. *Aeonium valverdense* Praeger.

Sturdy branched woody plant to 30-100 cm, with thick branches; leaves glaucous, grayish to orange or purplish, the surface very short pubescent, margin densely ciliate; inflorescence broadly conical or rounded, flowers 7-8 parted, with erect pink petals.

Distr.: Endemic to Hierro. *Ecol.:* Rather wide spread, most common in the subtropical belt, sea level to 750 m. *Evol.:* Sometimes mistaken for *A. percarneum*, but fairly distinct. It appears to hybridize with *A. palmense* and *A. hierrense*.

Fig. 16

17. *Aeonium hierrense* (Murray) Pit. & Proust.

Monocarpic plant resembling a cabbage, with thick short trunk and large leaves generally curving upward or inward; leaves broadly rounded; to 30 cm long, bluish glaucous with reddish edge, teeth close, curved

upward; inflorescence large, dome shaped, to 60 cm wide; flowers 6-8 parted, pink, pubescent.

Distr.: Endemic of Hierro. *Ecol.:* Locally abundant on soil banks and cliffs, 300-1,000 m. *Evol.:* A very distinctive plant, only distantly related to the next species.

Fig. 17

18. *Aeonium urbicum* (Chr. Sm.) Webb & Berth. - «Bejeque de los Tejados».

Monocarpic woody plant 90-200 cm tall, with unbranched thick trunk and a large rosette of green or slightly glaucous leaves, 12-25 cm long, glabrous, acute with a sharp point, margin red with forward curving cilia; inflorescence very large, pyramidal, up to 75 cm wide, dense; flowers 8-9 parted, greenish white to pink.

Distr.: Endemic to Tenerife and Gomera. *Ecol.:* Not common on cliffs, slopes, and rooftops, sea level to 1,200 m. Reports from Palma may refer to the next species. *Evol.:* Distinctive plant, probably related to the next species.

Fig. 18

19. *Aeonium ciliatum* (Willd.) Webb & Berth. - «Biquequillo».

Woody perennial 50-80 cm branched from near the base or unbranched; stems fairly thick with characteristic rhombic pattern of tubercles; leaves glabrous green, shining, the margin red with dense cilia, 10-20 cm long; inflorescence pyramidal, up to 70 cm wide, finely pubescent; flowers 7-8 parted, white or pink.

Distr.: Endemic to Tenerife, Palma, perhaps Gomera. *Ecol.:* Fairly common in the montane forest belt, occasionally lower, 100-1,000 m. *Evol.:* The species has undergone considerable differentiation in growth form; on Tenerife it is a low branched bush, on Palma it is usually unbranched monocarpic, some plants on Gomera are intermediate between *A. ciliatum* and *A. decorum* with smaller leaves and inflorescences, but larger flowers.

Fig. 19

20. *Aeonium decorum* Webb ex Bolle.

Small woody perennial with loosely branched, rather weak stems, the young twigs with rough horizontal ribs and cracks around the bases of the leaves and leaf scars; leaves smooth, shiny, green with reddish tinge, 2-4 cm long, rather thick, the margin with scattered short teeth;

inflorescence to 50 cm tall, the stem with distant rounded bracts, panicle of 6-12 branches, rather lax; flowers 6-8 parted, petals rose with white edges.

Distr.: Endemic to Gomera. *Ecol.:* Common between 100 and 900 m on dry cliffs. *Evol.:* A distinctive species, perhaps a dwarfed derivative of *A. ciliatum.*

Fig. 20

21. *Aeonium haworthii* (Salm. Dyck.) Webb & Berth.

Small densely branched twiggy bush, 30-60 cm; leaves 2-6 cm long, glaucous with red edge, the tip sharply pointed, the margin with curved cilia; inflorescence rather lax, 25-50 cm high; glabrous; flowers 7-9 parted, cream, occasionally with a reddish tinge.

Distr.: Endemic to Tenerife. *Ecol.:* Locally common along the N coast, especially in the forested zone, on exposed cliffs, 100-850 m. *Evol.:* A dwarfed form, perhaps distantly related to *A. ciliatum.*

Fig. 21

22. *Aeonium castello-paivae* Bolle.

Densely branched low bush, 30-50 cm, branches slender; leaves 3-4 cm long, very glaucous, the margin typically without red pigment, cilia scattered or absent; inflorescence 30-50 cm high, leafy, rather lax, 10-20 cm wide; flowers 7-8 parted, glandular, the petals erect with recurved tips; greenish white to pink.

Distr.: Endemic to Gomera. *Ecol.:* Fairly common on cliffs, 200-900 m.

Fig. 22

23. *Aeonium gomerense* Praeger.

Loosely branched shrub with fairly thick stems; leaves green or slightly glaucous, about 6 cm long, the tips broadly rounded, apiculate, faintly reddish tinged, margin with scattered blunt cilia; inflorescence 40-50 cm high, about 20 cm wide; flowers 8 parted, usually glabrous, greenish white with erect petals.

Distr.: Endemic of Gomera. *Ecol.:* Very rare, on dry cliffs, 500-1,000 m. *Evol.:* Little known, distinct from the other endemic species of Gomera.

Fig. 23

24. *Aeonium burchardii* Praeger.

Slender shrub to 30 cm high, the stems smooth, rich brown; leaves 6-10 cm long, keeled on the back, green, shiny, cilia scattered short; inflorescence small, rather flat; flowers 8-9 parted, ochre or buff colored.

Distr.: Endemic to Tenerife (Masca). *Ecol.:* Very local on sunny cliffs, 800-900 m.

Section *GOOCHIAE* Praeger.

Small, twiggy bushes, or rarely sessile, with small leaves and inflorescences, flowers ordinarily yellow. Often forming hanging masses on cliffs.

25. *Aeonium goochiae* Webb & Berth. - «Melera».

Small twiggy bush, sometimes forming hanging tresses; leaves flat, narrowed to a petiolar base, clammy pubescent, the margin without teeth, softly pubescent; inflorescence very short, rather lax and few-flowered; flowers 7-8 parted, glandular, pink.

Distr.: Endemic of Palma. *Ecol.:* Locally abundant in the NE sector, on cliffs in the lower montane and upper subtropical zone, 200-700 m. *Evol.:* Rather distinctive, closest to *A. viscatum*.

Fig. 24

26. *Aeonium lindleyi* Webb & Berth. - «Higuereta».

Densely branched small shrub, often forming hanging masses; leaves very thick, obovate or rhomboid, very sticky pubescent, to 20 mm long, 6 mm thick; inflorescences flattish, 5-10 cm wide; flowers 8-9 parted, bright yellow, glandular.

Distr.: Endemic of Tenerife and Palma. *Ecol.:* Locally abundant on eastern Tenerife, rare in Palma, on sunny cliffs of the subtropical zone, sea level to 600 m. *Evol.:* Most closely related to *A. viscatum* of Gomera.

Fig. 25

27. *Aeonium viscatum* Webb in Christ. - «Melosa».

Densely branched low shrub to 30 cm, the twigs somewhat sticky; leaves short pubescent, almost smooth in appearance, clammy, flat on

top, rounded below, to 4 cm long, 1 cm wide, and 3 mm thick; inflorescence small, to 15 cm high, glandular; flowers 7-9 parted, yellow.

Distr.: Endemic of Gomera. *Ecol.:* Fairly common on dry cliffs, 100-800 m. *Evol.:* An insular variant of *A. lindleyi.*

Fig. 26

28. *Aeonium saundersii* Bolle.

Twiggy hanging cliff plant, the branches much elongated and divergent; leaves flattish, rounded, to 2 cm long, pubescent, during the summer months imbricated to form a round bud; inflorescence very small, scarcely branched with few rather large flowers; flowers 12-16 parted, long pubescent, pale yellow.

Distr.: Endemic of Gomera (Las Lajas). *Ecol.:* On cliffs in the lower montane zone, 150-800 m; found in one small area only. *Evol.:* A unique plant, distantly related to the next species.

Fig. 27

29. *Aeonium sedifolium* (Webb ex Bolle) Pit. & Proust.

Dwarf shrub short, tortuous branches tipped by clusters of glutinous thick leaves, 10 mm long, 3-4 mm thick, shining green and red; inflorescence stalks coppery red, 5-10 cm, with a small cluster of flowers at the tip; flowers 9-12 parted, petals bluntish, bright yellow.

Distr.: Endemic of Tenerife and Palma. *Ecol.:* Rare, forming colonies on very dry cliffs in the Santiago region of Tenerife and El Time on Palma, 200-1,000 m. *Evol.:* Distinctive, but with several characteristics of *A. cruentum.*

Fig. 28

30. *Aeonium spathulatum* (Hornem.) Praeger.

Much branched low shrub, to 60 cm, the branches laxly ascending, reddish brown; leaves spatulate or obovate-rhombic, rounded or bluntly apiculate, to 3 cm long, somewhat sticky, with conspicuous linear embedded glands on the back, margin beaded; inflorescences on long stalks, flattish, to 10 cm wide; flowers 8-11 parted, golden yellow.

Distr.: Endemic of Gran Canaria, Tenerife, and Gomera. Reports from Palma and Hierro may refer to the next species. *Ecol.:* Upper montane zone, occasionally subalpine, 750-2,100 m, rare on Gran Canaria, locally common on Tenerife, very restricted on Gomera. *Evol.:* This species merges with *A. cruentum,* which may be a subalpine ecotype.

Fig. 29

31. *Aeonium cruentum* Webb & Berth.

Twiggy dwarf shrub with stiffly erect inflorescence branches; leaves rounded obovate, similar to those of the preceding species; inflorescence stalks deep red; flowers golden yellow.

Distr.: Endemic to Tenerife, Palma, Hierro. *Ecol.:* Upper montane and subalpine zone, on dry cliffs, 600-2,000 m. *Evol.:* Perhaps an extreme ecotype of the preceding species.

Fig. 30

32. *Aeonium smithii* (Sims) Webb & Berth. - «Pastel del Risco».

Small densely branched perennial 15-45 cm high, with succulent, long-hairy branches; leaves with irregularly wavy margin, pubescent, with embedded linear glands on the back, 4-5 cm long, 2-3 cm wide; inflorescence stalked, to 30 cm high, panicle of few branches, 5-8 cm wide; flowers 8-12 parted, yellow.

Distr.: Endemic of Tenerife. *Ecol.:* Rare cliff plant, upper montane and subalpine zones, 1,000-2,100 m. *Evol.:* Although the glandular leaves place it near *A. spathulatum,* this is a highly distinctive plant.

Fig. 31

33. *Aeonium caespitosum* (Chr. Sm.) Webb & Berth.

Sessile rosette plant, often forming thick corms with thinner offsets; leaves strap-shaped, elongate, 4-7 cm long, 5-8 mm wide, the margin with long white cilia, the surface with embedded linear glands on the back; inflorescence stalks produced from the sides of the rosettes; flowers in small clusters, 7-9 parted, golden yellow.

Distr.: Endemic of Gran Canaria. *Ecol.:* Upper montane, locally common on cliffs in the center of the island, descending to 500 m. *Evol.:* Highly unique in the genus for its habit and leaf type.

Fig. 32

6. *GREENOVIA* Webb & Berth.

1. Rosette leaves glandular pubescent — 4. *G. aizoon*

1. Rosette leaves glabrous, glaucous
   2. Stalk of the inflorescence with bracts equal in size, or increasing in size upwards; petals widened above the middle; sterile rosettes closed, bud-like during summer — 1. *G. diplocycla*

2. Stalk of the inflorescence with gradually reduced bracts; petals narrow; sterile rosettes cup-like during the summer
   3. Rosette 8-25 cm across, during the summer forming erect cups — 2. *G. aurea*
   3. Rosette 5-8 cm across, during the summer urn-shaped — 3. *G. gracilis*

1. *Greenovia diplocycla* Webb ex Bolle.

Monocarpic, or rarely branched perennial herb, somewhat woody at the base of the short stem; leaves in a rosette, glaucous and glabrous, with white margin, tip rounded or somewhat retuse; during the dry season often forming closed buds within the rosette; inflorescence stalks clothed with equal bracts, sometimes the upper bracts larger than the middle ones; inflorescence rather dense, somewhat flat topped; flowers about 20-parted, bright yellow, the petals blunt or acute, often twisted, broadly lanceolate.

Distr.: Endemic of Gomera, Palma, Hierro. *Ecol.:* Cliff plant typical of the montane zone in shaded places or N exposures, 400-2,100 m; usually unbranched, but not always. *Evol.:* The genus Greenovia forms a distinctive taxon within the *Sempervivum* group, and is endemic to the Canary Islands.

Fig. 33

2. *Greenovia aurea* (Chr. Sm.) - «Pastel del Risco».

Sessile rosette perennial, forming clusters; rosettes very characteristic, pale glaucous, forming erect cups of leaves, the inside lined by the appressed younger leaves; flowering stalks with progressively reduced bracts, inflorescence rather dense, often one-sided; flowers 20-32 parted, golden yellow, petals linear-lanceolate.

Distr.: Endemic to Gran Canaria, Tenerife, Hierro, perhaps also Gomera. *Ecol.:* Typical of dry cliffs in the upper pine forest, but ranging from 300-2,300 m. *Evol.:* Closely related to the next species.

Fig. 34

3. *Greenovia gracilis* Bolle.

Dwarf rosette plant with long offsets; rosettes very small, somewhat closed during summer, glaucous or pinkish; inflorescence flattish, about 12 flowered; flowers 18-22 parted with linear yellow petals.

Distr.: Endemic to Tenerife. *Ecol.:* Dry, warm cliffs 250-900 m, very rare in the E and W part of the island. *Syn.:* The name *G. dodrantalis* (Willd.) Webb & Berth. probably refers to an *Aichryson,* while *Sempervivum dodrantale* DC. refers to *G. aurea.*

4. *Greenovia aizoon* Bolle.

Sessile rosette plant forming clusters; leaves green, glandular pubescent, with apiculate tip, rosettes remaining open during the summer; inflorescence few flowered, short, flattish; flowers 20 parted, bright yellow, petals broadly oblanceolate, acute.

Distr.: Endemic to Tenerife. *Ecol.:* Rare, most numerous in the subalpine zone, about 2,000 m, but descending to 800 m.

7. *AICHRYSON* Webb & Berth.

1. Densely branched dwarf shrubs, the stems tortuous and woody, perennial	
2. Compact, dense plant forming low cushions; petals radiating	1. *A. tortuosum*
2. Dwarf shrub; petals erect and curved inward	2. *A. bethencourtianum*
1. Herbaceous annuals, biennials, rarely triennial, dying after fruiting	
3. Leaves glabrous, occasionally with scattered hairs	
4. Stems very succulent, more than 1 cm in diameter at the base; leaves with thick, entire edges	3. *A. pachycaulon*
4. Stems thinner, 3-4 mm at the base; leaves with shallow crenations or sunken black dots along the upper margin	
5. Inflorescence less than 15 cm wide	4. *A. punctatum*
5. Inflorescence very voluminous, more than 15 cm wide	5. *A. parviflorum*

3. Leaves densely pubescent
   6. Flowers 9-12 parted; leaf blade broadest near the base; stems simple or with several erect branches — 9. *A. dichotomum*
   6. Flowers 6-10 parted; leaf blade rhombic or obovate; stems simple with diverging branches
      7. Stems and leaves with very dense, sticky and felty pubescence; inflorescence widely branched, often wider than the height of the plant — 10. *A. palmense*
      7. Stems lightly pubescent, leaves not sticky; inflorescence comparatively narrower
         8. Stem with appressed hairs — 6. *A. bollei*
         8. Stem with erect hairs
            9. Plants 15 - 40 cm tall, leaves rhomboidal, purple — 7. *A. porphyrogennetos*
            9. Plants usually smaller; leaves obovate, usually greenish — 8. *A. brevipetalum*

1. *Aichryson tortuosum* (Ait.) Praeger.

Densely branched cliff plant, somewhat woody, often filling large rock crevices with masses of purplish foliage; leaves glandular pubescent, flattish on top, rounded on the back, very thick, obtuse, to 12 mm long; inflorescence short, with few branches, glandular; flowers 8 parted, golden yellow.

Distr.: Endemic to Lanzarote and Fuerteventura. *Ecol.:* Cliff plant of the northern mountain range, 300-600 m, local and rather rare. *Evol.:* Often placed in the genus *Aeonium,* and perhaps transitional between the true hapaxanth *Aichrysons* and the section Goochia of *Aeonium. Syn.: Aeonium tortuosum* Berger, *Aichryson pygmaeum* W. & B.

Fig. 35

2. *Aichryson bethencourtianum* Bolle.

Larger, and more clearly shrubby than the preceding, although with scarcely lignified stems, to 20 cm high; leaves flattish, obovate, nar-

rowed to the base, densely hairy; inflorescence short, few-flowered; flowers 8-9 parted, with incurved petals, yellow.

Distr.: Endemic to S Fuerteventura. *Ecol.:* Limited to the crests of the Jandia mountains, very rare.

3. *Aichryson pachycaulon* Bolle.

Upright, branched biennial, almost entirely glabrous; leaves flat, succulent, with thick, rounded margin, rhombic, about 5-8 cm long; flowers glabrescent, yellow.

Distr.: Endemic to Fuerteventura, Tenerife, Palma. *Ecol.:* Reported to be a wet soil form of the next species, but on Fuerteventura at 800 m it is a cliff plant in the exposed but foggy Jandia mountains. *Evol.:* Derivative of *A. punctatum*.

Fig. 36

4. *Aichryson punctatum* (Chr. Sm.) Webb & Berth.

Upright biennial herb, the first year forming stalked, glabrous rosettes of broadly rhombic leaves about 3 cm long, occasionally lightly hairy; the margin distantly crenate with sunken black dots, inflorescence widely branched, the flowers on thin pedicels, somewhat pubescent, yellow.

Distr.: Endemic to the Canary Islands, and found on all except Lanzarote and Fuerteventura. *Ecol.:* Common in wet places in the montane belt, 150-1,300 m.

Fig. 37

5. *Aichryson parviflorum* Bolle.

Upright biennial herb, similar to the preceding species, the stem stiffly upright, usually about 30-50 cm, glabrous below; leaves glabrous, crenate; inflorescence a widely forked panicle with long branches; flowers not necessarily very small, as in the original description, about 10 parted, yellow.

Distr.: Endemic to NE Palma. *Ecol.:* Locally common on shaded cliffs in the montane zone of several barrancos. *Evol.:* Local derivative of the preceding species.

Fig. 38

6. *Aichryson bollei* Webb ex Bolle.

Annual or biennial to 40 cm characterized by appressed pubescence on stem and inflorescence branches, and pale yellow flowers; petals short and broad.

Distr.: Endemic to Palma, perhaps Tenerife. *Ecol.:* Not found since the original collection. *Evol.:* The status of this species, like several other *Aichrysons,* is doubtful. It may be related to *A. parviflorum.*

7. *Aichryson porphyrogennetos* Bolle.

Annual or biennial with diverging branches, short pubescent throughout; leaves rhombic, markedly longer than broad, purplish red; inflorescence with numerous reduced leaves; flowers 7-9 parted, golden.

Distr.: Endemic to Gran Canaria and Tenerife. *Ecol.:* Cliffs in the montane zone, very local. *Evol.:* Closely related to *A. dichotomum.*

8. *Aichryson brevipetalum* Praeger.

Small annual, to 10 cm, with thin, pilose stems; leaves obovate, pubescent, often with black dots along the margin; inflorescence few-flowered; flowers 6-8 parted, the calyx lobes bluntly pointed; petals often short, yellow with purple, acuminate tip, often streaked with purple on the back.

Distr.: Endemic to Gomera and Palma. *Ecol.:* Mossy cliffs in the lower montane zone, extremely local and inconspicuous. *Evol.:* This reduced plant is hardly distinct from *A. villosum* of Madeira, but also approaches *A. punctatum* var. *subvillosum;* all of these taxa need further evaluation.

Fig. 39

9. *Aichryson dichotomum* (DC.) Webb & Berth.

Stiffly upright annual or biennial, usually branched; leaves petiolate, long-pubescent, broadest near the base, the tip broadly rounded, margin entire; inflorescence not long stalked, diffuse; flowers 9-12 parted, yellow.

Distr.: Endemic to the Canary Islands, and reported from all islands except Lanzarote. *Ecol.:* Common in wet places, especially in the

montane zone, along damp cliffs, shaded springs, etc. *Evol.:* A distinctive plant, resembling *A. porphyrogennetos,* and *A. villosum* of Madeira.

Fig. 40

10. *Aichryson palmense* Webb ex Bolle.

Distinctive small biennial with short, often twisted and diverging branches, the stems covered with long, dense felty hairs; leaves rhombic, the blade as long as wide, broadest slightly below the middle, very sticky pubescent; inflorescence very broad, with reddish branches; flowers to 13 mm in diameter, yellow, 8-9 parted.

Distr.: Endemic of Palma. *Ecol.:* Cliff plant of the montane zone, here and there in the NE sector of the island. *Evol.:* Local derivative of *A. dichotomum,* but very distinctive.

Fig. 41

8. *MONANTHES* Haw.

1. Annual with thin upright stem — 6. *M. icterica*

1. Perennial

2. Stem branched, not bulbous at the base, inflorescences from the tips of the stems
3. Leaves ovoid, obovoid or cylindrical; stems somewhat woody, 5-25 cm high
4. Leaves opposite, ovoid to globose — 1. *M. laxiflora*
4. Leaves alternate, more elongate
5. Plant to 25 cm tall, with green leaves — 2. *M. anagensis*
5. Plant to 10 cm tall, with purplish gray leaves — 3. *M. muralis*
3. Leaves narrowed to a petiolar base; stems creeping or somewhat erect, less than 5 cm high, with rosettes about 1 cm in diameter
6. Stems creeping; inflorescences scarcely branched, the pedicels with long pubescence — 5. *M. polyphylla*
6. Stems caespitose, erect; inflorescences branched several times, with short pubescence — 4. *M. subcrassicaulis*

2. The main rosette sessile on a short bulbous base; inflorescences lateral from the main stem, usually bearing additional reduced leaves
   7. Leaves glabrous, papillose or smooth
      8. Leaves oblanceolate, about 20 in a lax rosette — 7. *M. brachycaulon*
      8. Leaves rhombic-spathulate, very numerous and densely imbricated in a flat-topped or hollow rosette
         9. Leaves rather soft; seeds dark chestnut brown — 8. *M. pallens*
         9. Leaves somewhat cartilaginous; seeds golden — 9. *M. nipophila*
   7. Leaves pubescent with scattered or dense hairs
      10. Leaves ciliate along the margin or towards the base — 10. *M. minima*
      10. Leaves short gray pubescent — 11. *M. dasyphylla*

1. *Monanthes laxiflora* (DC.) Bolle.

Dwarf shrub to 20 cm, diffusely branched with thin, gray stems; leaves opposite, not crowded, ovoid to almost globular, 10-15 mm long, lightly grooved on the upper surface, silvery green; flowers in small clusters at the tips of the stems on filiform pedicels, 5-8 parted, purplish or yellowish green, base of the petals concealed by broad, 2-lobed scales.

Distr.: Endemic to the Canary Islands, found on all except Hierro. *Ecol.:* On cliffs, often in large masses, common in the montane zone, 200-1,000 m. *Evol.:* Well defined endemic; the plants of the crests of Lanzarote and Fuerteventura are more compact and may be distinguished as *M. microbotrys* Bolle. *Syn.: Petrophyes agriostaphis* Webb & Berth.

Fig. 42

2. *Monanthes anagensis* Praeger

Dwarf shrub 15-20 cm high, resembling the preceding in habit; leaves alternate, scattered, 15-25 mm long, lanceolate, round with groove on upper surface, shiny green; inflorescence 3-10 flowered, glabrous; flowers greenish, glabrous.

Distr.: Endemic of E Tenerife. *Ecol.:* Very local, on damp rocks in the laurel zone, 100-1,000 m. *Evol.:* Related to the preceding species, with which it hybridizes.

Fig. 43

3. *Monanthes muralis* (Webb ex Bolle) Christ.

Densely branched dwarf shrub to 10 cm high; leaves alternate; densely crowded, about 7 mm long, purplish, papillose; inflorescence 1-7 flowered, the flowers on filiform pedicels.

Distr.: Endemic to Palma and Hierro, perhaps Gomera. *Ecol.:* On cliffs and walls, fairly common, 300-800 m. *Evol.:* In growth form intermediate between the shrubby *M. laxiflora,* and the next 2 species with their crowded rosettes.

Fig. 44

4. *Monanthes subcrassicaulis* (Ktze.) Praeger.

Densely branched little rosette plant with erect, perennial stems 3-5 cm, the stems branched, several mm thick; rosettes elongate, very densely leafy with small club shaped leaves about 2 mm wide, greenish or purple; inflorescence with several filiform branches, short pubescent; flowers purplish.

Distr.: Endemic of Tenerife, Gomera, Palma. *Ecol.:* In dense colonies on dry cliffs, upper subtropical zone. *Evol.:* Intermediate in form between *M. muralis* and *M. polyphylla,* and hybridizing with the latter. *Syn.: M. amydros* Svent. is said to be intermediate in habit between this and the next species, and may be identical with the hybrid reported by Praeger.

Fig. 45

5. *Monanthes polyphylla* Haw.

Creeping rosette perennial, forming dense networks of horizontal branches, with crowded terminal rosettes about 10 mm in diameter; leaves pinkish to purplish green, papillose, club shaped, about 6 mm long; inflorescence from the tips of the rosettes, 1-few flowered, the filiform pedicels with long glandular hairs; flowers 6-8 parted, greenish or purplish.

Distr.: Endemic of Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Common on banks and cliffs, 100-1,100 m. *Evol.:* Closely related to the preceding species. *Syn.:* The identity of *M. purpurascens* (Bolle & Webb) Christ. of Gran Canaria has never been cleared up; it may be a hybrid between this species and *M. brachycaulon.*

Fig. 46

6. *Monanthes icterica* (Webb ex Bolle) Praeger.

Dwarf annual, the stem erect, 3-5 cm, simple or branched; leaves spatulate, about 8-12 mm long, fleshy; flowers 6 parted, purplish green to yellowish green.

Distr.: Endemic of W Tenerife and Gomera. *Ecol.:* Rare and local, inconspicuous plant of cliffs, 100-1,000 m. *Evol.:* Unique in the genus for its annual habit.

7. *Monanthes brachycaulon* (Webb & Berth.) Lowe.

Dwarf rosette perennial with single short thick stem to 8 mm diameter; leaves in a lax rosette, to 25 mm long, oblanceolate, bluntly pointed; inflorescences numerous, arising from lower leaf axils, each bearing reduced leaves, often in secondary rosettes, with 5-10 flowers on filiform pedicels; flowers greenish or purplish.

Distr.: Endemic to the Selvagens Islands, and to Gran Canaria, Tenerife, Gomera. *Ecol.:* Fairly common in crevices of rocks, 100-2,000 m. *Evol.:* There is much confusion about the number of varieties or species to be recognized. The entire group of bulbous *Monanthes* is very closely related.

Fig. 47

8. *Monanthes pallens* (Webb) Christ.

Similar to the preceding, but with more densely imbricated, more numerous leaves with rhombic or spathulate blade; leaves glabrous, papillate; inflorescences usually leafy below the middle, 5-7 flowered.

Distr.: Endemic of Tenerife, Gomera, Hierro. *Ecol.:* Locally abundant in crevices, 100-2,000 m. *Evol.:* Very similar to the following species.

Fig. 48

9. *Monanthes nipophila* Svent.

Similar to the preceding, and distinguished by the more coriaceous leaves, the aristate petals, and the seeds which are golden, not dark brown.

Distr.: Endemic to Tenerife. *Ecol.:* Crevices of cliff walls in the subalpine zone, rare. *Evol.:* Perhaps merely an ecotype of the preceding.

10. *Monanthes minima* (Bolle) Christ.

Dwarf perennial with short thick stem, leaves spatulate, blunt, with cilia on the margin and petiole; inflorescences short, with small secondary rosettes about the middle, 2-6 flowered.

Distr.: Endemic to E Tenerife. *Ecol.:* Very rare on shaded cliffs of the S lope, 100-250 m. *Syn.:* Specimens of *M. adenoscepes* Svent. from Güimar appear to match Bolle's description of *M. minima.*

Fig. 49

11. *Monanthes dasyphylla* Svent.

Dwarf perennial, similar to the preceding, but distinguished by its ashy-gray pubescence of the leaves, which are mottled with reddish.

Distr.: Endemic to E Tenerife. *Ecol.:* Dry cliffs, 100-250 m, extremely rare. *Evol.:* Perhaps another form of the preceding species. The entire genus *Monanthes* needs further study from living materials.

9. *SEDUM* L.

1. Very small upright annual — 1. *S. rubens*

1. Perennial
   2. Leaves alternate, cylindric — 2. *S. lancerottense*
   2. Leaves opposite, closely imbricate in rows — 3. *S. cf. brevifolium*

1. *Sedum rubens* L.

Upright annual 2-10 cm, with cylindrical, reddish leaves; flowers sessile, with 5 white or pink petals, 5 stamens.

Distr.: Mediterranean region, Madeira, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Springing up in small colonies on open stony ground, upper subtropical and montane zones, not common.

2. *Sedum lancerottense* Murr.

Densely branched dwarf shrub, the slender branches more succulent than woody; leaves cylindrical, blunt, in dense alternate arrangement; flowers sessile along the branches of small cymose panicles, bright yellow, sepals obtuse, fused at the base, the 5 petals acute; stamens 10, carpels 5.

Distr.: Endemic to Lanzarote (Ermita de N. Sra. de las Nieves). *Ecol.:* Hanging or creeping cliff plant in large masses in crevices of rocks, with *Aichryson tortuosum, Monanthes laxiflora;* very local. *Evol.:* Several related species on Madeira, other relatives in mountains of E Africa.

Fig. 50

3. *Sedum cf. brevifolium* DC.

Densely matted perennial with somewhat woody branches; leaves bluntly tapered, opposite, in 4 ranks along the stems (flowers not seen). *Distr.:* Mediterranean region, escaped from cultivation on Tenerife. *Ecol.:* Very local on walls and boulders, apparently escaped from garden.

LAMINA VII

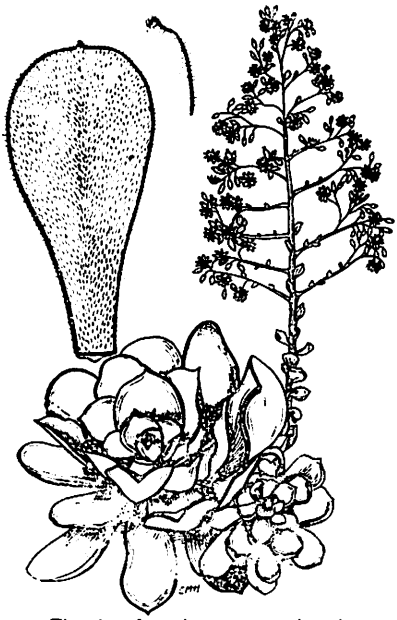

Fig. 1. Aeonium canariensis

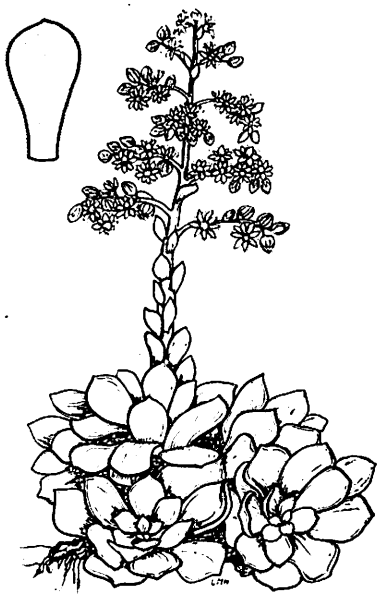

Fig. 2. Aeonium virgineum

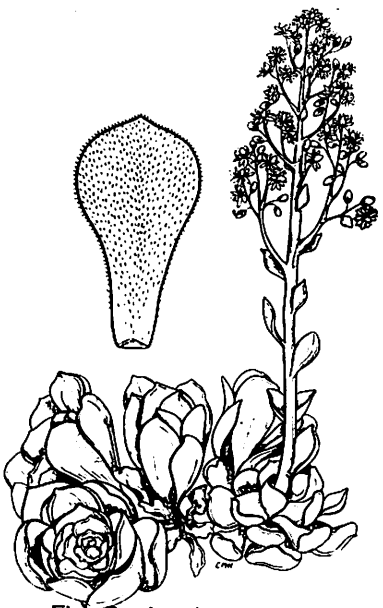

Fig. 3. Aeonium palmense

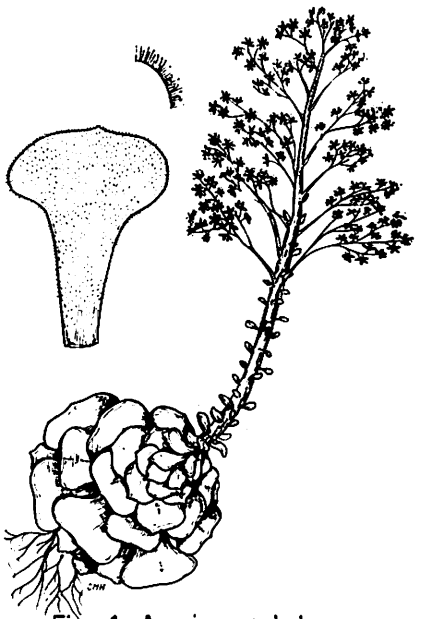

Fig. 4. Aeonium subplanum

LAMINA VIII

Fig. 5. Aeonium tabulaeforme

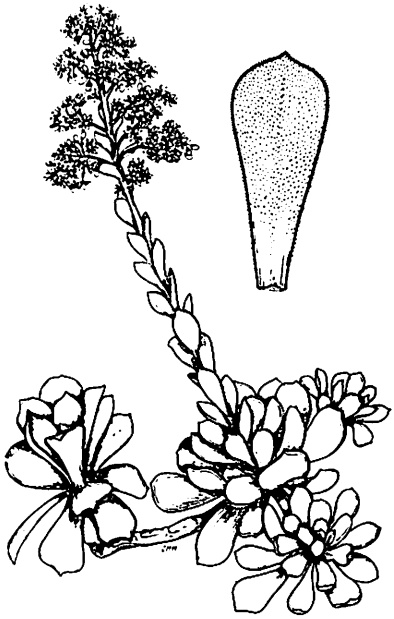

Fig. 6. Aeonium cuneatum

Fig. 7. Aeonium nobile

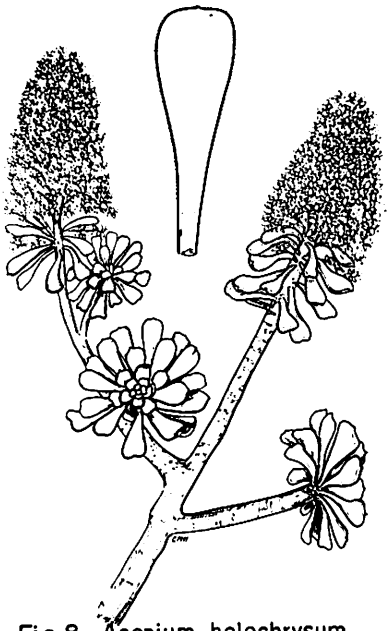

Fig. 8. Aeonium holochrysum

LAMINA X

Fig. 13. Aeonium balsamiferum

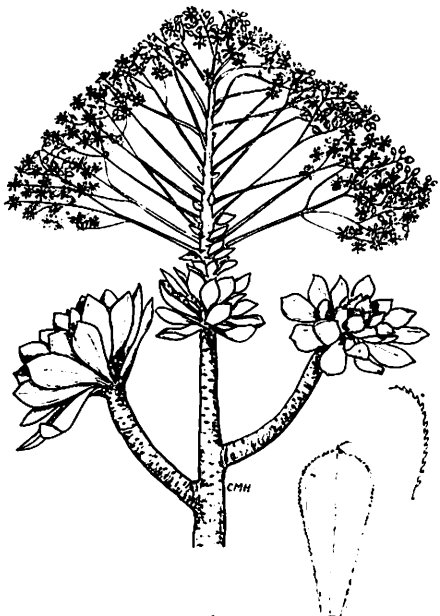

Fig. 14. Aeonium percarneum

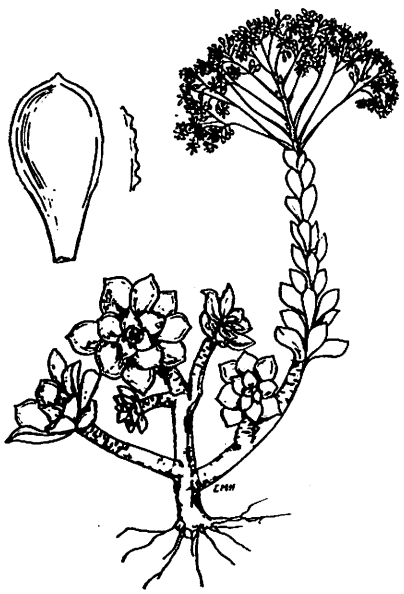

Fig. 15. Aeonium lancerottense

Fig. 16. Aeonium valverdense

LAMINA IX

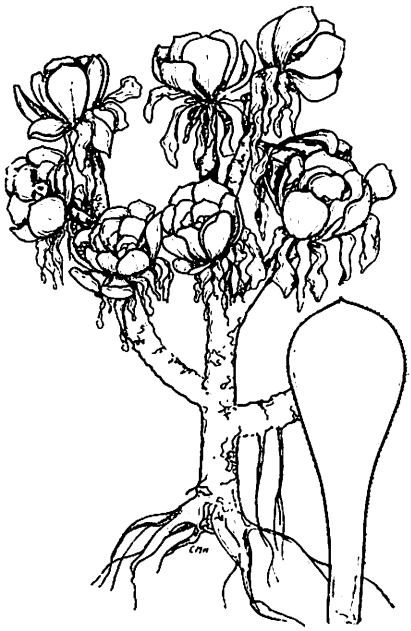

Fig. 9. Aeonium vestitum

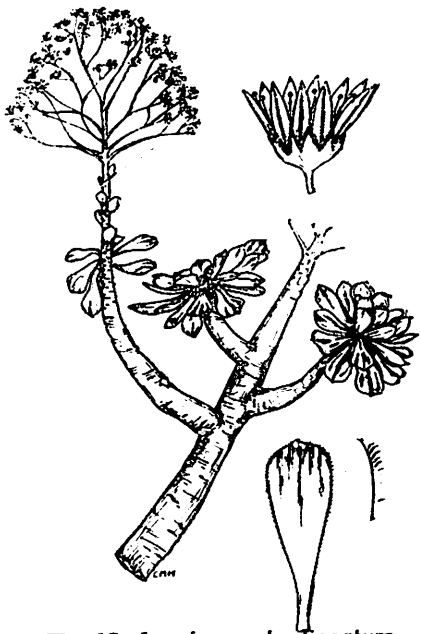

Fig. 10. Aeonium rubrolineatum

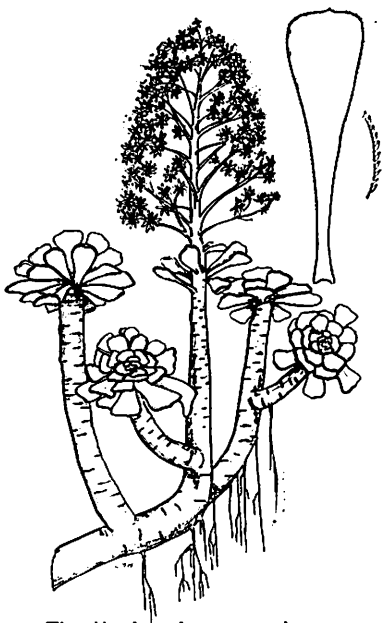

Fig. 11. Aeonium manriqueorum

Fig. 12. Aeonium undulatum

LAMINA XI

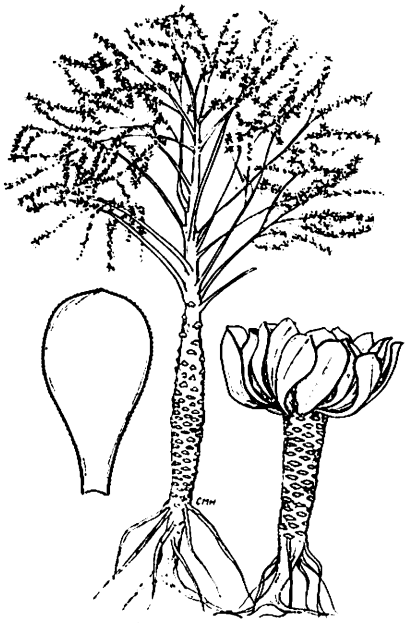

Fig. 17. Aeonium hierrense

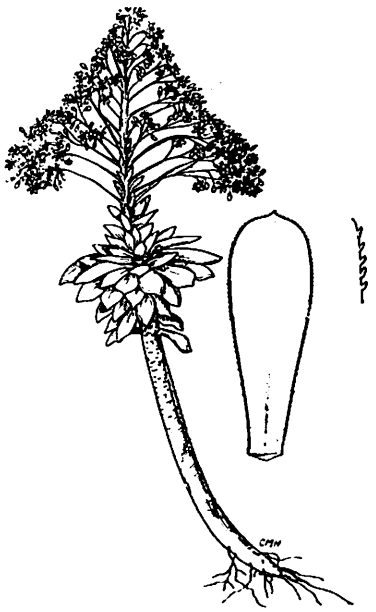

Fig. 18. Aeonium urbicum

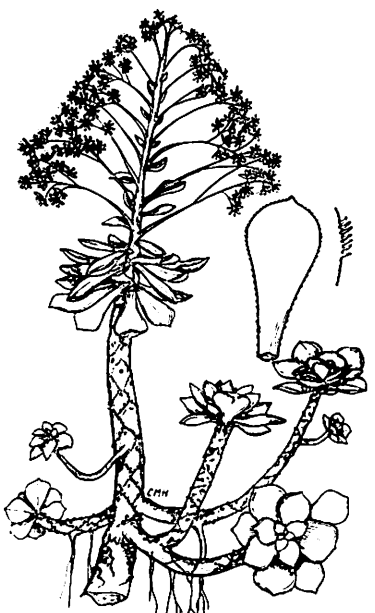

Fig. 19. Aeonium ciliatum

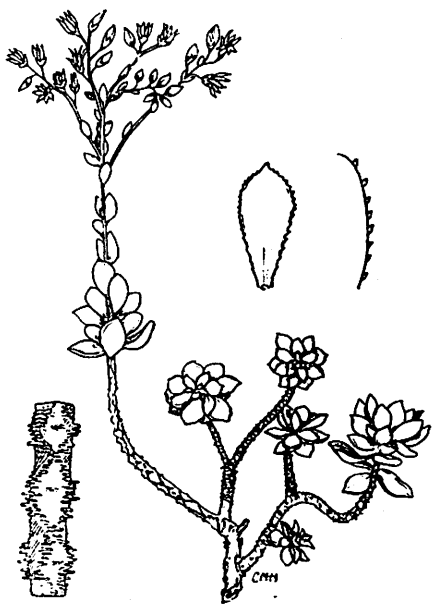

Fig. 20. Aeonium decorum

LAMINA XII

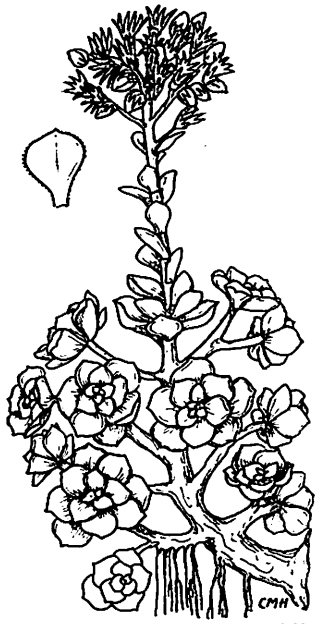

Fig. 21. Aeonium haworthii

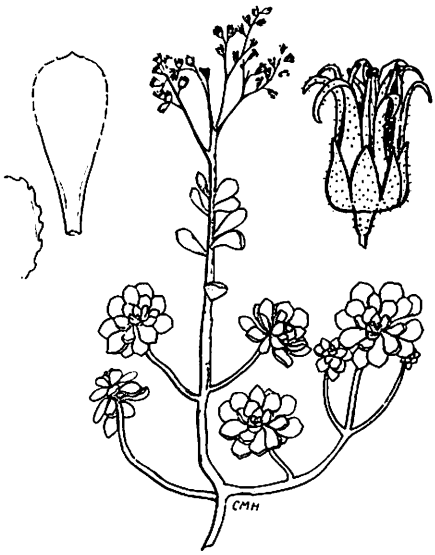

Fig. 22. Aeonium castello-paivae

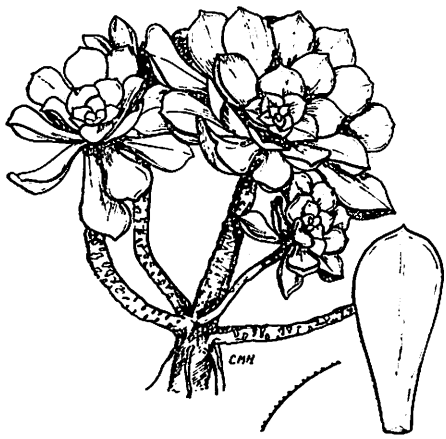

Fig. 23. Aeonium gomerense

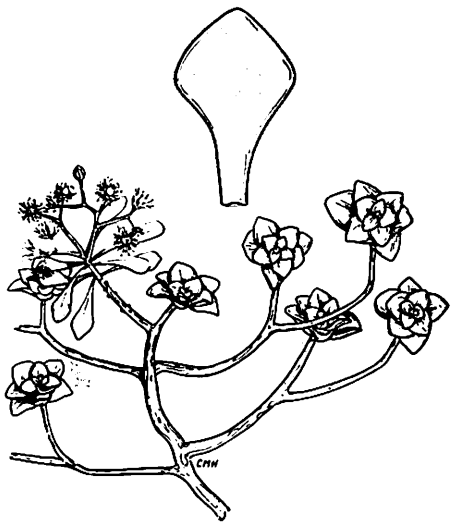

Fig. 24. Aeonium goochiae

LAMINA XIII

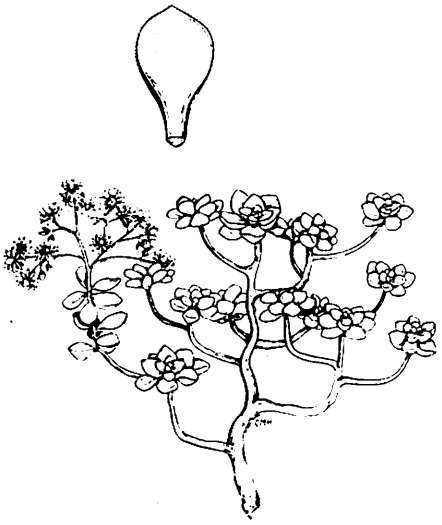

Fig. 25. Aeonium lindleyi

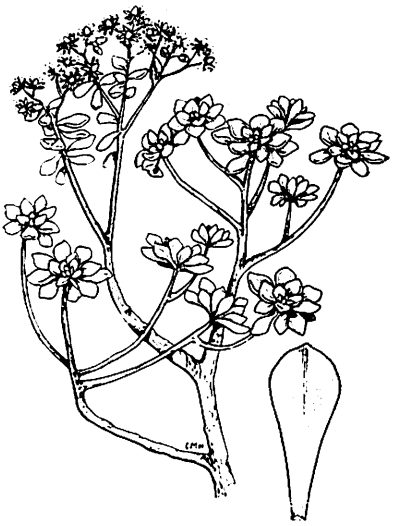

Fig. 26. Aeonium viscatum

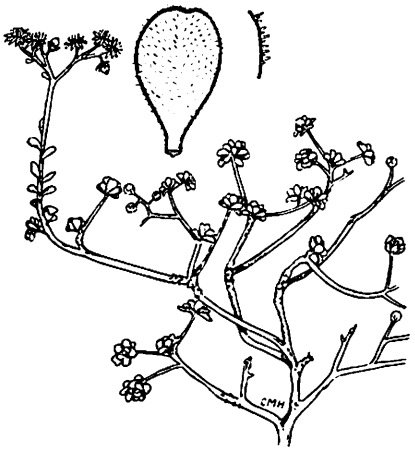

Fig. 27. Aeonium saundersii

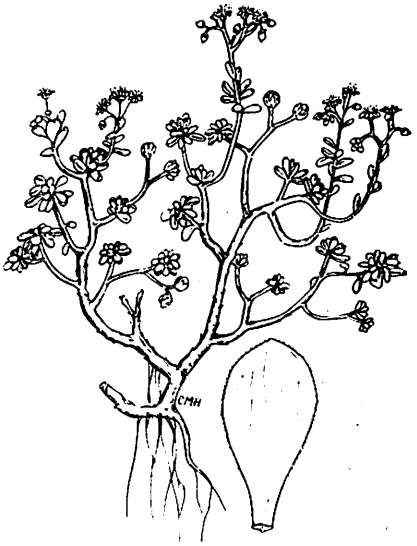

Fig. 28. Aeonium sedifolium

LAMINA XIV

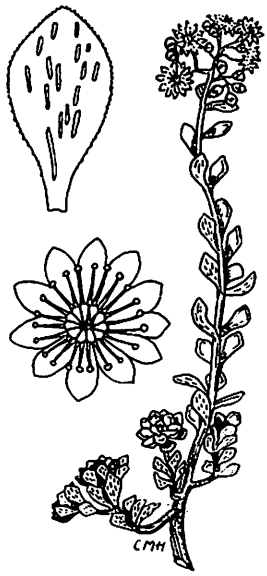

Fig. 29. Aeonium spathulatum

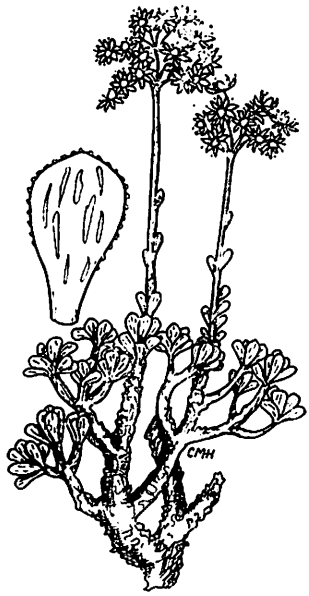

Fig. 30. Aeonium cruentum

Fig. 31. Aecnium smithii

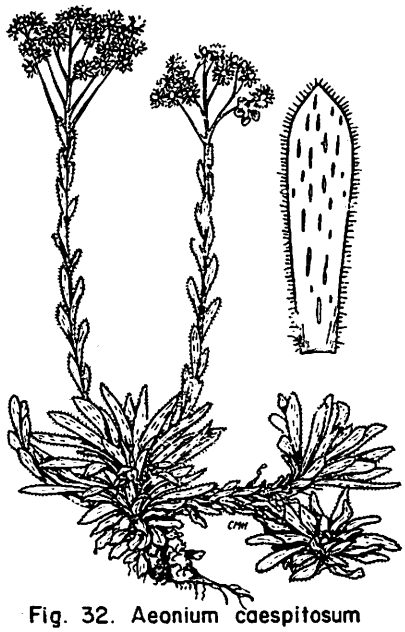

Fig. 32. Aeonium caespitosum

LAMINA XV

Fig. 33. Greenovia diplocycla

Fig. 34. Greenovia aurea

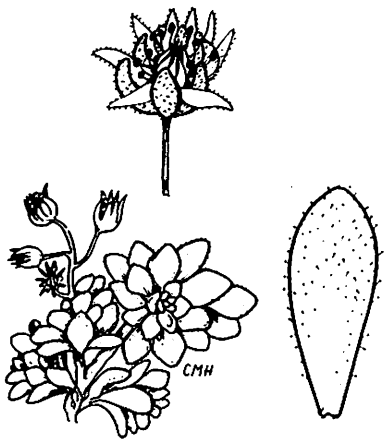

Fig. 35. Aichryson tortuosum

Fig. 36. Aichryson pachycaulon

LAMINA XVI

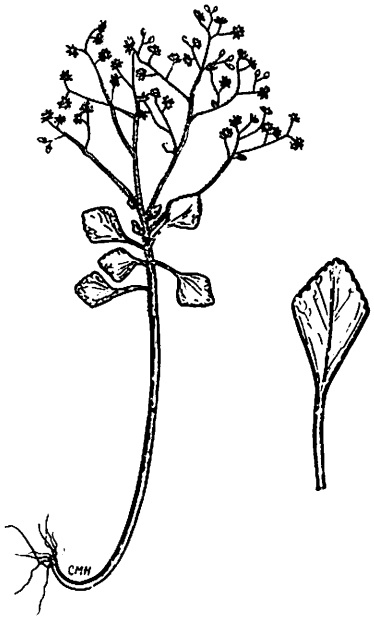

Fig. 37. Aichryson punctatum

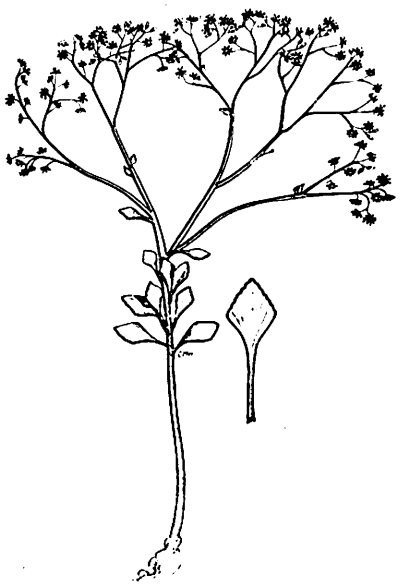

Fig. 38. Aichryson parviflorum

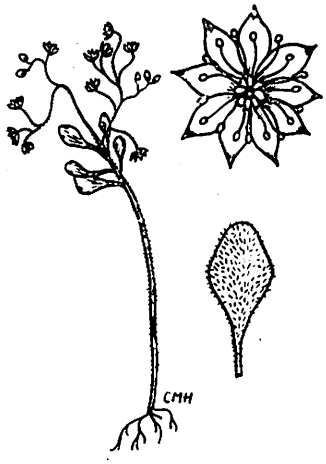

Fig. 39. Aichryson brevipetalum

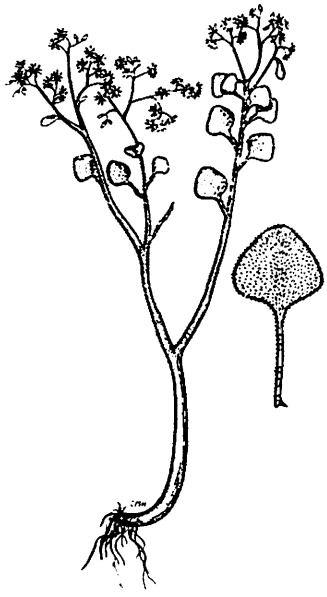

Fig. 40. Aichryson dichotomum

LAMINA XVII

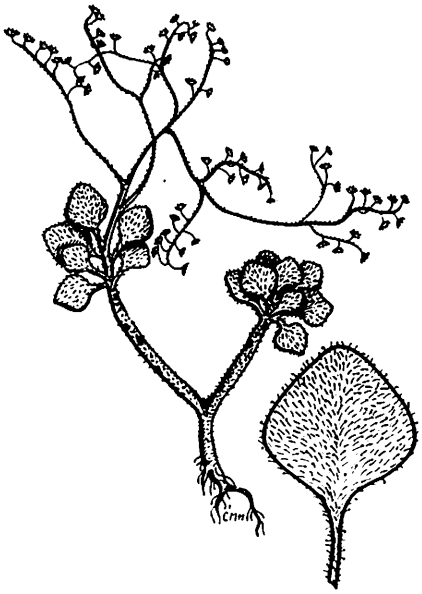

Fig. 41. Aichryson palmense

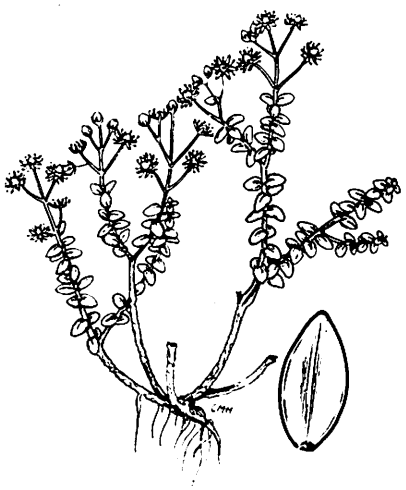

Fig. 42. Monanthes laxiflora

Fig. 43. Monanthes anagensis

Fig. 44. Monanthes muralis

LAMINA XVIII

Fig. 45. Monanthes subcrassicaulis

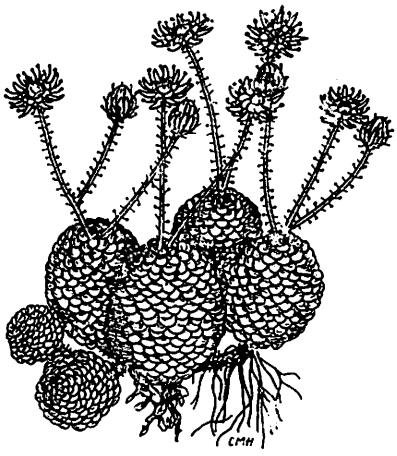

Fig. 46. Monanthes polyphylla

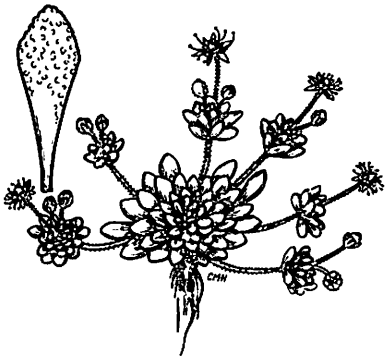

Fig. 47. Monanthes brachycaulon

Fig. 48. Monanthes pallens

LAMINA XIX

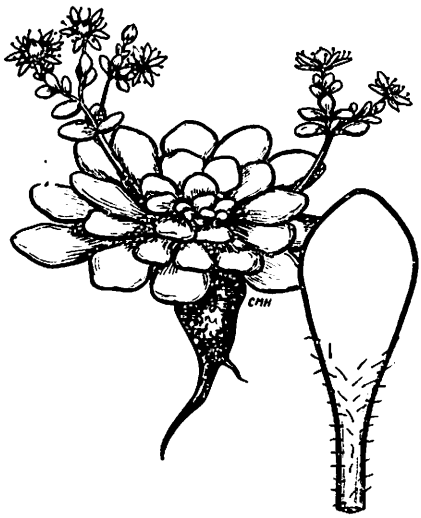

Fig. 49. Monanthes minima

Fig. 50. Sedum lancerottense

DIVISION *LYCOPHYTA*

Family *SELAGINELLACEAE*

Low plants, reproducing by spores which are produced in sporangia in the axils of leafy bracts aggregated into slender, often angular strobili (cone-like structures); stems creeping, producing thin leafless rhizophores bearing clusters of small roots at their tips; leaves minute, with single vein, in our species dimorphic, some appressed on the stems, some at right angles, giving the shoots a flattened appearance.

1. *SELAGINELLA* Beauv.

1. Branches often 25 cm or longer, jointed at nodes where laterals arise; leaves to 4 mm, well separated on the stem — 2. *S. kraussiana*

1. Branches less than 25 cm, not jointed; leaves to 2.5 mm, closely crowded — 1. *S. denticulata*

1. *Selaginella denticulata* (L.) Link.

Moss-like creeping plant with numerous small leafy branches, leaves in flattened ranks; sporangia (rarely seen) in slender terminal strobili on short leafy branches.

Distr.: Mediterranean region, Madeira, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Very common on damp, shaded cliffs, especially in the montane zone.

2. *Selaginella kraussiana* (G. Kunze) A. Braun.

Similar to the preceding, but more robust, the leaves more widely spaced, and stems jointed at the origin of lateral branches.

Distr.: Tropical Africa, introduced in Azores, Gran Canaria (Moya). *Ecol.:* In spray of waterfall, only one colony is known.

DIVISION *ARTHROPHYTA*

Family *EQUISETACEAE*

Plants reproducing by spores which are formed in sporangia on hexagonal scales (sporangiophores) aggregated into a cone-like structure (strobilus) at

the tip of the stem; stems jointed, green, the leaves reduced to whorls of fused, pointed scales; mostly perennial from underground rhizomes.

Equisetum ramosissimum Desf.

Stems branched, from black rhizomes, the main stems hollow 3-7 mm in diameter, the nodes usually with whorls of smaller branches; leaves fused into a green sheath with black band at the node, and dark teeth with whitish margins; strobilus dark, 5-25 mm, with short point.

Distr.: Temperate Asia, S and Central Europe, N and S Africa, Azores, Madeira, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Not common, associated with springs and wet spots 50-500 m; often sold in markets as scouring agent.

DIVISION *PTEROPHYTA*

«HELECHOS»

Key to the genera of ferns

1. Leaves simple, the blade not deeply dissected into pinnae
   2. Fertile portion of the plant club-like on an upright stalk, sterile portion bract-like — 1. *Ophioglossum*
   2. Plants not divided into sterile and fertile portion; sporangia on the underside of the leaves
      3. Leaf blade orbicular, sori along the margin — 4. *Adiantum*
      3. Leaf blade lanceolate or lobed, the sori on the lower surface
         4. Leaf blade palmately lobed — 13. *Asplenium*
         4. Leaf blade lanceolate — 15. *Phyllitis*

1. Leaves divided into pinnae
   5. Lower leaf surface entirely covered by pale brown scales
      6. Leaves pinnate, the incision between the pinnae barely reaching the midrib; pinnae not further dissected — 14. *Caterach*

6. Leaves bipinnate or bipinnatifid, the pinnae completely separate, usually further dissected — 3. *Notholaena*

5. Lower leaf surfase not covered by pale brown scales, although often obscured by the crowded sori

7. Leaves including the petiole less than 5 cm long

8. Annual, the sori covering much of the back of the pinnules — 7. *Anogramma*

8. Perennial, sori restricted

9. Leaves placed along a threadlike creeping rhizome, very thin and translucent — 11. *Hymenophyllum*

9. Leaves tufted — 2. *Cheilanthes*

7. Leaves over 5 cm long

10. Sori associated with the margin of the leaf

11. Sori covered by an indusium wich appears to be a folded-over portion of the leaf margin

12. Fronds dimorphic, the fertile ones with reniform indusia along the rounded pinnules, the sterile ones bluntly and asymmetrically toothed; both types 4-5 pinnatifid — 8. *Culcita*

12. Fronds not notably dimorphic, mostly pinnate to 3-pinnatifid

13. Leaves well over 50 cm long, including the petiole; the latter generally green to light brown

14. Rachis of the leaf pubescent among the pinnae — 6. *Pteridium*

14. Rachis of the leaf glabrous among the pinnae — 5. *Pteris*

13. Leaves generally less than 50 cm long, the petiole and rachis glossy black or deep brown
    15. Ultimate pinnules thin, more than 4 mm wide individually stalked — 4. *Adiantum*
    15. Ultimate pinnules coriaceous, less than 3 mm wide, sessile — 2. *Cheilanthes*
11. Sori in special pocket-like structures
    16. Frond broadly triangular, 4-5 pinnatifid; rhizome fleshy, covered by brown scales — 9. *Davallia*
    16. Frond narrowly triangular, 2-3 pinnatifid; rhizome wiry, covered by black pubescence — 12. *Trichomanes*

10. Sori on the underside of the fronds
    17. Sori round, and covered by a circular or kidney-shaped indusium, attached near center (visible best on young fertile leaves)
        18. Leaf once compound, the pinnae serrate — 10. *Nephrolepis*
        18. Leaf at least bipinnatifid, the pinnae divided
            19. Ultimate divisions of the frond with sharp teeth
                20. Frond bipinnate lanceolate in outline, longest pinnae toward the middle — 19. *Polystichum*
                20. Frond tripinnate, triangular in outline, the longest pinnae at the base — 20. *Dryopteris*
            19. Ultimate divisions of the frond entire or crenate

21. Fronds bipinnatifid, the pinnae divided almost to their midvein; base of the petiole with scales less than 1 mm wide — 18. *Cyclosorus*
21. Fronds tripinnatifid, the pinnae divided into pinnules which are in turn divided almost to the midvein; base of the petiole with broad escales 2-5 mm wide — 20. *Dryopteris*

17. Sori either elongate, with indusium on one side; or if round, then lacking indusium or with hoodlike cover, not with a kidney-shaped or round indusium
22. Sori round
23. Leaf pinnate, the pinnae not further divided
24. Petiole and rachis black, pinnae less than 1 cm long — 13. *Asplenium*
24. Petiole and rachis greenish to light brown; pinnae 2-15 cm long — 23. *Polypodium*
23. Leaf tripinnatifid or even more compound
25. Indusium a pointed sac-like structure which is torn and shriveled at maturity; frond generally less than 40 cm high — 16. *Cystopteris*
25. Indusium a crescent-shaped structure on one side of the sorus, occasionally obscured by the mature sporangia; frond generally more than 40 cm high — 17. *Athyrium*
22. Sori elongate, oval, crescent-shaped or linear
26. Fronds simply pinnate, the pinnae not deeply divided
27. Pinnae to 12 mm long — 13. *Asplenium*
27. Pinnae 15-30 mm long — 21. *Blechnum*

26. Fronds bipinnatifid, or more complex
    28. Fronds bipinnatifid, the pinnae divided to near the midvein; sori end in chain-like rows along both sides of the midvein of each pinnule of a fertile frond — 22. *Woodwardia*
    28. Fronds bi-to tripinnate; sori not in chain-like rows along the midveins of the pinnules
        29. Frond triangular, the lowest pinnae the longest
            30. Leaf blade from tip to lowest pinnae more than 40 cm, fronds often more than 1 m high; petiole black below the pinnae only — 17. *Athyrium*
            30. Leaf blade from tip to lowest pinnae generally less than 25 cm, fronds less than 50 cm high; petiole black, lower part of the rachis among the pinnae also black — 13. *Asplenium*
        29. Frond elongate, lowest pinnae shorter than the ones toward the middle of the frond
            31. Fronds at least 30 cm high, mostly about 40-50 cm — 17. *Athyrium*
            31. Fronds 8-25 cm high — 13. *Asplenium*

Family *OPHIOGLOSSACEAE*

1. *OPHIOGLOSSUM* L.

Ophioglossum lusitanicum L.

Small perennial with underground rhizome, leaves in groups of 1-3, the blade 1-3 cm long, less than 1 cm wide; fertile spike with 10-20 sporangia in 2 rows.

Distr.: W and S Europe, N and SW Africa, Madeira, Cape Verde Islands, St. Helena, known from Gran Canaria and Tenerife. *Ecol.:* Extremely rare and inconspicuous, in open grassy places, in the pine belt, 800-1,400 m.

Family *SINOPTERIDACEAE*

2. *CHEILANTHES* Swartz.

1. Pinnules with revolute green leaf margin; indusium fringed, forming a more or less continuous cover; petioles stout, generally longer than the leaf blade	1. *C. fragrans*
1. Pinnules with small rounded lobes, each of which is revolute and continuous with the lobes of the indusium; indusium with entire or somewhat denticulate margin, discontinuous along the margin; petioles slender, generally shorter than the blade	2. *C. pulchella*

1. *Cheilanthes fragrans* (L. f.) Swartz var. maderensis (Lowe) Menezes.

Perennial from short, stout rhizome densely clothed with old leaf petioles; leaves 8-30 cm long, including the shiny, black to dark brown petiole; leaf blade elongate-triangular, 4-14 cm long, bi to tripinnately compound, the pinnules lanceolate, blunt, with parallel straight sides, the margins revolute, the indusium white to brownish, with fringed edge, attached all along the leaf margin.

Distr.: The species from C Asia to S Europe and N Africa, the var. native to Madeira, Lanzarote, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Crevices of cliffs and boulders, lava fields, and other dry, stony places, fairly common in the montane belt, especially in pine woodland; also in the upper subtropical and lower subalpine belts (350-2,000 m). *Evol.:* The *Cheilanthes* of the Canaries is highly variable; there appear to be intermediate populations between the two species, as well as dwarfed ecological forms; cytotaxonomic and experimental work is needed to clear up these relationships. *Syn.:* Dwarf forms may be *C. guanchica* Bolle, very similar but alleged to be a hybrid is *Ch. sventenii* Benl; the Macaronesian plants have been called *Ch. maderensis* Lowe.

2. *Cheilanthes pulchella* Bory ex Willd.

Small perennial, the leaves tufted at the tip of a short rhizome; leaves 4-10 cm long, the blade equal to or slightly longer than the black petiole; leaves bipinnate, the pinnules shallowly lobed, each lobe revolute, associated with a lobe of the indusium; indusium whitish to light brown, entire or erose along the margin.

Distr.: Endemic to Gran Canaria, Tenerife, perhaps Palma. *Ecol.:* Rare, in steep cliffs of the montane belt. *Evol.:* A local derivative of the preceding species, with which it apparently hybridizes.

Fig. 1

3. *NOTHOLAENA* R. Br.

1. Upper leaf surface green, glabrous; fronds bipinnate, 20-80 cm long	1. *N. marantae*
1. Upper leaf surface grayish pubescent; fronds bipinnatifid to bipinnate, 5-25 cm long	2. *N. vellea*

1. *Notholaena marantae* (L.) R. Brr.

Perennial with tufted leaves at tip of short stout rhizome, the fronds lanceolate in outline, bipinnate, the underside of the pinnules densely covered with pale brown scales, the upper surface (sometimes concealed in curled-up dry plants) bright green, glabrous.

Distr.: Africa, S Europe, Madeira, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Fairly common, in a variety of habitats: crevices of walls, cliffs, in subtropical and montane zones, 200-1,000 m. *Evol.:* The description of a ssp. *subcordata* (Cav.) Benl. & Poelt and a var. *cupripaleacea* Benl, as well as references to var. *canariensi* Buch indicate that the insular populations have undergone some local evolution. *Syn.:* *Cheilanthes marantae* (L.) Domin.

2. *Notholaena vellea* (Ait.) Desv.

Perennial with tufted leaves, resembling the preceding species, but distinguished by its smaller stature, narrower leaves, and pubescent upper surface.

Distr.: C Asia to E and N Africa, Madeira, Cape Verde Islands, found on all the Canary Islands. *Ecol.:* Dry boulder fields and cliffs, much

more xerophytic than the preceding species, 100-1,000 m. *Syn.: Gymnogramme lanuginosa* R. Br.

Family *ADIANTACEAE*

4. *ADIANTUM* L.

1. Leaf blade entire, reniform to orbicular — 1. *A. reniforme*

1. Leaf 3-4 times compound, the pinnules on slender stalks
   2. Indusium elongate along the margin — 2. *A. capillus-veneris*
   2. Indusium circular or kidney-shaped around indentations of the margin — 3. *A. raddianum*

1. *Adiantum reniforme* L. - «Hierba tostonera», «Ombliguillo»

Perennial from short horizontal rhizome, densely clothed by the old leaf stalks; petioles to 20 cm long, the leaf blades simple, about 4 × 5 cm, kidney-shaped, the veins fanning out with progressive forks from the petiole to the margin; indusia along the margin on the underside of the leaf, broadly kidney-shaped.

Distr.: Madeira, Cape Verde Islands, Lanzarote, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Common on walls, cliffs, especially in shaded places, near sea level up to 900 m. *Evol.:* Highly distinctive endemic of the Macaronesian islands, the var. *pusillum* Bolle is perhaps a local variety with small leaves.

Fig. 2

2. *Adiantum capillus-veneris* L. - «Culantrillo de Pozo».

Perennial from creeping rhizome covered by brown scales; leaves fairly close together, to 50 cm high, usually smaller, with deep blackish brown petioles, the leaf segments on alternate black stalks, the main rachis somewhat zigzag between segments; pinnules broadly rounded, with wedge-shaped base, somewhat lobed, delicate and light green; indusia pale, elongate, inserted along the margin.

Distr.: In many parts of the world, especially subtropical, Azores, Madeira, found on all of the Canary Islands. *Ecol.:* Water courses, springs, wet walls and other shaded, damp habitats, especially in the montane region and the upper subtropical zones, very common.

3. *Adiantum raddianum* Presl.

Similar to the preceding, distinguished by its more narrowly cuneate leaf segments, and the rounded, shield-like indusia which are attached in the shallow notches of the pinnules.

Distr.: Recently discovered on Gran Canaria. *Ecol.:* Extremely rare, but perhaps to be discovered elsewhere in the Canaries, in the sprinkle of waterfalls, on damp cliffs, in shaded places, montane zone.

Family *PTERIDACEAE*

5. *PTERIS* L.

1. Leaves pinnate, the pinnae very finely serrulate or with revolute margins — 1. *P. vittata*

1. Leaves bipinnate or tripinnate
   2. Leaves bipinnate or tripinnate, the pinnules finely serrate in the upper half, sori along the basal 2/3 of the margins — 2. *P. arguta*
   2. Leaves tripinnate, the pinnales entire, lanceolate, sori along the whole margin — 3. *P. multifida*

1. *Pteris vittata* L.

Leaves from the tips of short stout rhizome, clothed with rootlets and scales; leaf lanceolate in outline 40-80 cm long, broadest near the middle, with about 20-30 pairs of linear-lanceolate pinnae, with cordate bases; sori linear along the revolute margins.

Distr.: E and N Africa, S Europe, Cape Verde Islands, Madeira, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Scarce, wet rock walls and water courses, near sea level to 500 m. *Syn.: P. longifolia* auct. Can., non L.

2. *Pteris arguta* Ait.

Leaves from tips of creeping rhizome, more than 1 m high, the petiole up to 50 cm long, brown; leaf blade with the basal pair of pinnae usually forked near the base, each division dissected into pinnules;

pinnules curved forward, acute, serrate in the upper half, the margin folded over the sorus in the lower half or 2/3, the sori not quite to the base of the pinnules.

Distr.: A Macaronesian fern known from Azores, Madeira, the Tangier region of Morocco, and Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Laurel forest, in moist soil, 400-1,000 m, not common.

Fig. 3

3. *Pteris multifida* Poir.

Leaves tripinnate, the basal pinnae quadripinnate, leaves more than 1 m long, the pinnules lanceolate, with revolute margins covering the sori.

Distr.: A cultivated fern of subtropical origin, found occasionally escaped on walls, e. g. on Tenerife; not native.

Family *HYPOLEPIDACEAE*

6. *PTERIDIUM* Scop.

Pteridium aquilinum (L.) Kuhn - «Helecho hembra».

Leaves arising singly from underground rhizome, petioles, with black or dark brown base, otherwise green, somewhat pubescent; leaf blade broadly triangular in outline, sparingly pubescent on rachis and pinnules, tripinnatifid, the sori along the margins of the pinnules, continuous around the incisions.

Distr.: Probably the most widely distributed vascular plant, world-wide, Azores, Madeira, Lanzarote, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.* Abundant in the montane zone, 300-1,200 m, where it grows in clearings of laurel forest, in open heaths and pine woodlands, and with *Rubus* along roadsides. *Syn.: Pteris aquilina* L.

Family *GYMNOGRAMMACEAE*

7. *ANOGRAMMA* Link.

Anogramma leptophylla (L.) Link.

Annual, the leaves tufted on a very short stem, sterile leaves very short with few wedge-shaped pinnules, fertile leaves 3-15 cm, the petiole black, the blade broadly lanceolate in outline, bipinnate, the pinnules somewhat lobed, sori on the underside confluent at maturity, lacking an indusium.

Distr.: Widely distributed, from New Zealand and S America to W and S Europe, N and E Africa, Asia, Azores, Madeira, Lanzarote, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Wet places, moss near rivulets, springs, in the montane zone, occasionally subtropical 100-1,300 m.

Family *DICKSONIACEAE*

8. *CULCITA* Presl.

Culcita macrocarpa Presl.

Perennial from sturdy rhizome, occasionally reported to stand upright, with a crown of triangular fronds, the petiole to 50 cm, with long, narrow brown scales at the base; sterile leaves glossy, tri-to quadripinnatifid, to 40 cm long, the pinnules somewhat asymmetrically developed, toothed; fertile leaves smaller, quadripinnatifid, the pinnules with large reniform sori underneath, the margin revolute over the indusium.

Distr.: Azores, Madeira, N Portugal and S Spain, Tenerife. *Ecol.:* Much more restricted in the Canaries than in the other island groups, known only from a few localities in the laurel forest of E Tenerife, about 700-1,000 m. *Syn.: Dicksonia culcita* L'Herit. *Evol.:* Although a member of a family of tree ferns, this plant is an ordinary forest herb; reports of its reaching 1 m height need further confirmation.

Fig. 4

Family *DAVALLIACEAE*

9. *DAVALLIA* Sm.

Davallia canariensis (L.) Sm.

Leaves spaced along stout, fleshy, creeping rhizomes covered with brown scales, often epiphytic on tree trunks; leaves 10-60 cm long, including the glabrous petiole, the blade triangular in outline, quadripinnatifid, the pinnules dissected into divisions 1-2 mm wide, some of them bearing yellowish pockets containing the sori.

Distr.: Atlantic Spain and Portugal, Madeira, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Very common, 100-1,000 m, epiphytic on laurels, *Erica, Pinus canariensis* and other trees, also on cliffs, becoming summer-deciduous in the subtropical zone.

Fig. 5

10. *NEPHROLEPIS* Schott

Nephrolepis cf. *biserrata* L.

Leaves to 125 cm long, tufted on short stems, the latter producing long, thin stolons which propagate the plant; petiole and rachis with crisp, linear scales or hairs, the frond lanceolate, simply pinnate, the pinnae serrate, broadly rounded at the base, the upper part of the base forming triangular lobe; sori in two rows, covered by a reniform indusium which attaches in its sinus.

Distr.: A tropical fern, introduced from America, found in cultivation, and occasionally escaped, on Tenerife. *Ecol.:* In walls of plantations and near dwellings, rare. *Syn.:* The taxonomy of the «Boston» ferns is not clear; this may be the same plant reported from Madeira as *N. cordifolia* (L.) Presl.

Family *HYMENOPHYLLACEAE*

11. *HYMENOPHYLLUM* Sm.

1. Valves of the indusium dentate; leaf blade flat — 1. *H. tunbridgense*

1. Valves of the indusium entire; leaf blade deflexed — 2. *H. wilsonii*

1 *Hymenophyllum tunbridgense* (L.) Sm.

Very small fern, the leaves spaced along a filiform creeping rhizome, 3-4.5 cm high, bluish green and somewhat glossy, bipinnatifid, thin, with narrow pinnules, the veins black, forked; indusium of two round, fringed or dentate valves.

Distr.: Widely distributed, temperate S Hemisphere, W Europe, Azores, Madeira, Gran Canaria, Tenerife. *Ecol.:* Rare, seldom collected because of its small size and resemblanec to mosses in which it grows; reported to grow on the bases of *Erica* trunks in laurel forest region.

2. *Hymenophyllum wilsonii* Hook.

Similar to the preceding, but with narrower, olive-green leaves, tending to fold back, hence appearing bent over; indusium elongate, of 2 entire valves.

Distr.: Widely distributed like the preceding, Azores, Madeira, collected once in the Canaries; to be confirmed. *Ecol.:* More common on Madeira, where it grows in moss in laurel forest.

12. *TRICHOMANES* L.

Trichomanes speciosum Willd.

Leaves from wiry, creeping rhizomes clothed with black felt; the fronds 15-25 cm long, petiole with narrow wing; leaf blade long-triangular in outline, dark green, much dissected into segments 1-2 mm wide; sori in cylindrical pockets, on older fronds with a long persistent bristle in each pocket.

Distr.: Widely distributed in warm-temperate and subtropical regions, Asia, S America, W Europe, W Africa, Azores, Madeira, Gran Canaria, Tenerife, Palma. *Ecol.:* In deep shade of laurel forests, on mossy banks, occasionally on bases of tree trunks, not common. *Syn.: Vandenboschia radicans* (Sw.) Copeland.

Family *ASPLENIACEAE*

13. *ASPLENIUM* L.

1. Leaves simple, deeply cordate, with 3-5 palmate lobes — 1. *A. hemionitis*

1. Leaves compound
   2. Leaf consisting of a few dichotomously forked divisions — 2. *A. septentrionale*
   2. Leaf with distinct midrib and many pinnate divisions
      3. Leaves once pinnate
         4. Petiole black, the dark pigment extending to about the first pinnae, midrib green — 3. *A. marinum*
         4. Petiole and midrib (rachis) black
            5. Leaf segments dark green, narrow, divided to about the middle or upper 1/3 into acute lobes — 4. *A. aethiopicum*
            5. Leaf segments ovate, bright green, the margin shallowly dentate to almost entire
               6. Pinnae mostly more than twice as long as wide, each with a single sorus on the underside — 5. *A. monanthes*
               6. Pinnae less than twice as long as wide with several sori on the underside — 6. *A. trichomanes*
      3. Leaves bipinnatifid, or even more complex, at least the lower pinnae in turn dissected
         7. Leaves lanceolate in outline, the lowest pinnae shorter than the median ones
            8. Larger pinnae completely dissected into pinnules well past their mid point
               9. Pinnules in turn deeply incised, making the frond tripinnate — 9. *A. terorense*
               9. Pinnules somewhat lobed or toothed, the frond bipinnate — 8. *A. billotii*
8. The larger pinnae divided into pinnules only in their basal portion — 7. *A. obovatum*

7.	Leaves triangular in outline, the lower pinnae longest	
10.	Tips of the pinnae and main leaf tip long drawn out into a serrate point 1.5 mm wide	10. *A. onopteris*
10.	Tips of the pinnae triangular, not long pointed	11. *A. adiantum-nigrum*

1. *Asplenium hemionitis* L. - «Hierba candil», «Pie de Gallo».

Leaves clustered on a short stem, 9-30 cm long, the blade simple, deeply cordate at the base, palmately lobed with 3, sometimes 5 pointed lobes; sori linear, at an angle to the midvein, parallel.

Distr.: NW Africa, Portugal, Azores, Madeira, Cape Verde Islands, found on all of the Canary Islands. *Ecol.:* Fairly common in shaded places in the montane zone, 400-1,000 m, especially in laurel forest. *Syn.: A. palmatum* Lam.

Fig. 6

2. *Asplenium septentrionale* (L.) Hoffm.

Leaves 5-10 cm, from short creeping rhizome; petiole reddish brown at the base, becoming green; leaf segments linear, 2-4 in a dichotomous arrangement; sori linear.

Distr.: N Hemisphere, Madeira, reported from Tenerife and Palma. *Ecol.:* Extremely rare and inconspicuous, in crevices of cliffs, at high elevation.

3. *Asplenium marinum* L.

Leaves 6-15 cm on short stem, petioles dark brown to black, suddenly becoming green near the blade; pinnules ovate, crenate, contracted into a short stalk at the base; sori linear-elliptic, 2-4 on the underside of each of the pinnae.

Distr.: W Europe, W Mediterranean, Azores, Madeira, Cape Verde Islands, Gran Canaria, Tenerife, Palma, Hierro. *Ecol.:* Rare, on rocks near the sea, apparently dependent upon salt spray or salty air currents.

4. *Asplenium aethiopicum* (Burm.) Becher ssp. canariense (Willd.).

Perennial from short thick rhizome, the leaves clustered, 7-30 cm long, the petiole and rachis somewhat hairy, blackish; pinnae dark green, narrowly wedge-shaped, divided into acute lobes, characteristically folded or rolled up when dry; sori linear.

Distr.: Widely distributed, the subspecies only on Madeira, Cape Verde Islands, Tenerife, Palma, Hierro. *Ecol.:* Shaded but fairly dry rocks in heath and laurel forest areas, rather scarce, 400-1,100 m.

5. *Asplenium monanthes* L.

Tufted perennial from short rhizome, the leaves mostly less than 20 cm long, lanceolate in outline, with subopposite or alternate pinnae; petiole and midrib glossy black, pinnae fresh green, the longer ones 7-10 mm long, 3-5 mm wide, with a single sorus on the back.

Distr.: Tropical and subtropical regions of the world, Azores, Madeira, Palma. *Ecol.:* Local, but not rare, in laurel forest, about 400-1,100 m. usually on soil banks among moss.

6. *Asplenium trichomanes* L.

Similar to the preceding, but with several sori per pinna, and more rounded, ovate pinnae.

Distr.: Widely distributed all over the world, Azores, Madeira, Cape Verde Islands, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Laurel forest belt, in shaded damp soil, banks and cliffs, common but not numerous.

7. *Asplenium obovatum* Viv.

Small perennial, leaves tufted, 7-15 cm, broadest about the middle; pinnae with a few basal pinnules, otherwise merely incised and toothed, the teeth short, mucronate; sori rather short, oval, tending to merge.

Distr.: S Europe, Azores, Madeira, Gran Canaria. *Ecol.:* Rare, only in a few localities of the montane zone, 800-1,200 m; these specimens may represent dwarfed forms of the following. *Evol.:* The entire complex of *A. obovatum, A. billotii,* and *A. terorense* is in need of cytotaxonomic analysis to determine the number of taxa present. *Syn.: A. laceolatum* auct.

8. *Asplenium billotii* Schulz.

Perennial, more robust than the preceding, the pinnae divided beyond their middle into pinnules, which are acutely toothed.

Distr.: W Europe, Azores, Madeira, Gran Canaria. *Ecol.:* In several places along the N coast and S portion, 700-1,400 m. *Evol.:* This is the more common form of the obovatum complex; it appears to blend or hybridize with the following species.

Fig. 7

9. *Asplenium terorense* Kunkel.

Perennial, the leaves to 40 cm long, tripinnate, the pinnules sharply toothed; similar to the preceding species.

Distr.: Endemic of Gran Canaria. *Ecol.:* Limited to a small region of the N coast, 800-1,100 m, in fairly dry rocks, shaded. *Evol.:* The most robust and dissected member of the *obovatum* complex, in need of cytotaxonomic analysis.

10. *Asplenium onopteris* L. - «Doradilla negra».

Perennial with stout creeping rhizome, covered by old roots and petioles; fronds to 50 cm long, the petiole and lower rachis deep brown to black, leaf blade triangular in outline to about 25 cm long, 20 cm wide, the upper surface dark green and very glossy; pinnae dissected into serrate, narrow pinnules, long drawn-out into linear tips; sori short linear, 4-8 per pinnule.

Distr.: W and S Europe, Azores, Madeira, known from all of the Canary Islands. *Ecol.:* One of the most common woodland ferns, 300-1,400 m, in laurel forest, pine woodland, tree heaths, and shaded cliffs. *Evol.:* Closely related and often confused with the following species. *Syn.: A. adiantum-nigrum* L. ssp. *onopteris* (L.) Heufler.

11. *Asplenium adiantum-nigrum* L.

Very similar to the preceding, from which it differs by its duller upper leaf surface, more broadly triangular fronds without long linear tips.

Distr.: Much of the N Hemisphere, S Africa, Azores, Madeira, Cape Verde Islands, Fuerteventura, Gran Canaria, perhaps other islands. *Ecol.:* In similar habitants with the preceding species, but apparently

rare. *Evol.:* In Europe, this plant is generally tetraploid, while *onopteris* is diploid; in the Canaries these relationships await further study.

14. *CETERACH* DC.

1. Leaves 3-20 cm, sori about 2 mm long; scales on the underside of the pinnae with entire margins (microscope) ..... 2. *C. officinarum*

1. Leaves 10-40 cm, sori up to 7 mm long; scales on the underside of the pinnae with fimbriate margins ..... 1. *C. aureum*

1. *Ceterach aureum* (Cav.) Buch. - «Doradilla de Canarias».

Robust perennial with tufted leaves, the short petiole, rachis, and lower leaf surface densely covered by pale brown scales; leaves pinnatifid, with alternate, broad lobes 1-4 cm long, rounded at the tips; sori in 2 rows, somewhat obscured by the scaly cover.

Distr.: Madeira, Cape Verde Islands, Lanzarote, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Shaded cliffs and soil, 350-1,200 m, not very common; sometimes sold in markets for medicinal uses.

Fig. 8

2. *Ceterach officinarum* DC.

Small perennial, similar to the preceding, distinguished by its smaller stature, short semicircular pinnae, and entire scales.

Distr.: Europe, W Asia, N Africa, Madeira, reported from Gran Canaria, Tenerife, Palma. *Ecol.:* Extremely rare, the specimens perhaps representing dwarfed forms of the preceding species, hence *C. officinarum* perhaps not to be included in the flora; reports all deal with cliff plants from high altitude (900-2,100 m).

15. *PHYLLITIS* Hill.

Phillitis scolopendrium (L.) Newm.

Leaves tufted on short rhizome, 10-40 cm long, the blades entire, lanceolate, with cordate base.

Distr.: N Hemisphere, Azores, Madeira, reported from Tenerife. *Ecol.:* In garden wall, never actually seen in the field, but reported by peasants as growing in laurel forest. Probably to be deleted from the flora.

Family *ATHYRIACEAE*

16. *CYSTOPTERIS* Bernh.

Cystopteris fragilis (L.) Bernh. spp. diaphana (Bory).

Leaves crowded along creeping rhizome, 15-40 cm high, delicate, broadly lanceolate in outline, the subopposite pinnae divided into serrate pinnules; sori formed under cone-shaped indusia which burst and shrivel at maturity.

Distr.: The species is widely distributed in temperate and subtropical regions of the world, the subspecies in Morocco, Azores, Madeira, Cape Verde Islands, Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Springs and damp, shaded places, fairly common, 400-2,200 m. *Evol.:* A variable fern in size and shape of the pinnules and other features, some approaching the typical form of the species. *Syn.: Cystopteris fragilis* (L.) Bernh. var. *canariensis* (Willd.) Christ, *Cystopteris diaphana* (Bory) Blasdell.

17. *ATHYRIUM* Roth.

1. Frond lanceolate in outline, the petiole much shorter than the blade, greenish or pale — 1. *A. filix-femina*

1. Frond triangular in outline, the petiole almost as long as the blade, black towards the base — 2. *A. umbrosum*

1. *Athyrium filix-femina* (L.) Roth.

Leaves crowded at the tip of a short upright stem, somewhat scaly along petiole and rachis; lower pinnae shorter than median ones, pinnules deeply incised, with sharp teeth; sori elongate, indusia attached along the veinlets. Plant 40-70 cm high.

Distr.: N Hemisphere, Azores, Madeira, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Scarce, shaded damp soil in forest. *Evol.:* Several varieties occur, none of them endemic to the islands.

2. *Athyrium umbrosum* (Ait.) Presl.

Leaves near the tip of creeping rhizome, more than 1 m high, the petiole not scaly, usually dark; leaf blade long-triangular in outline, tripinnatifid, bluntly toothed pinnules with short elongate sori on the underside; indusium lateral.

Distr.: Azores, Madeira, Cape Verde Islands, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Characteristic species of laurel forests, on moist soil, often in great masses, 400-1,100 m. *Syn.:* Probably not specifically distinct from *A. axillare* Willd., also placed in the genus *Diplazium*, e. g. *Diplazium caudatum* (Cav.) Jermy, which may be the oldest available epithet.

Fig. 9

Family *THELYPTERIDACEAE*

18. *CYCLOSORUS* Link.

Cyclosorus dentatus (Forsk.) Ching.

Leaves tufted near the tip of a stout, scaly rhizome, 30-80 cm high, lanceolate in outline, the lower pinnae much shorter than the median ones; fertile fronds longer than the sterile ones; sori in 2 rows on each pinnule, covered by a circular pubescent indusium attached in its center.

Distr.: Tropical and subtropical Africa and America, Azores, Madeira, Cape Verde Islands, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.:* Damp, open places, sometimes rather weedy, mainly in the montane and upper subtropical zones, not common. *Syn.: Aspidium molle* (Jacq.) Swartz, *Bryopteris dentata* (Forsk.) Christens., *D. parasitica* Auct., *Lastrea dentata* Romariz.

Family *ASPIDIACEAE*

19. *POLYSTICHUM* Roth.

Polystichum setiferum (Forsk.) Woyn.

Leaves tufted on a thick rhizome, 25-125 cm high; petiole grooved, with very broad brown scales at the base, grading into narrower hair-like scales along the rachis; leaves generally lanceolate in outline, the

pinnae completely divided into diamond-shaped, stalked pinnules; each pinnule with a basal lobe pointing forward, the margin and tip spinulose; sori in 2 rows along the back of each pinnule, covered by a circular indusium.

Distr.: W and Central Europe, Azores, Madeira, Tenerife, Gomera, Palma. *Ecol.:* Found only in laurel forest, in moist soil in deep shade, 500-1,100 m. *Syn.: P. angulare* (Kit. ex Willd.) Presl., *P. aculeatum* auct. Can. (the real *P. aculeatum* (L.) Roth does not appear to occur in the Atlantic Islands).

20. *DRYOPTERIS* Adans.

1. Fronds tripinnate, the pinnules in turn deeply incised, and with narrowed base; pinnules sharply toothed — 1. *D. dilatata*

1. Fronds tripinnatifid, the pinnules not quite divided, sessile, the margin with a few small teeth on the forward corner — 2. *D. oligodonta*

1. *Dryopteris dilatata* (Hoffm.) A. Gray ssp. maderensis (Milde).

Leaves forming a crown at the tip of the stout rhizome; petiole with scales near the base; leaf blade triangular in outline, the basal pinnae with the longest segment at the base pointing downward; pinnules with soft but sharply pointed teeth; sori in 2 rows on the back of each pinnule, indusium round, glandular,

Distr.: The species throughout the N Hemisphere, the ssp. on Madeira, Gran Canaria, Tenerife. *Ecol.:* In laurel forest, remarkably scarce. *Syn.: Dryopteris spinulosa* auct., non Watt.

2. *Dryopteris oligodonta* (Desv.) Pichi-Serm.

Leaves in crown at tip of erect rhizome; leaves 45-120 cm long, the petiole with large pointed scales; leaf blade elongate-triangular, the basal pinnae with short basal segment pointing downward, with longer segments toward the middle; the leaves bipinnate, the divisions in turn deeply divided into more or less square pinnules with a few teeth along the upper margin; sori in 2 rows on the back, the indusium glabrous or glandular.

Distr.: Gran Canaria, Tenerife, Gomera, Palma, Hierro. *Ecol.:* Very common in laurel forests, also occasionally in pine woodland and heaths, 400-1,400 m. *Evol.:* A member of the very diverse macrospecies *D. filix-mas,* but apparently not found outside the Canaries. Material from the Cape Verde Islands and Madeira is related *(D. macaronesica* Romariz); the Canarian material varies in leaf shape and glands on the indusium, which has given the impression that another species exists in this group *(D. aitoniana).* Further study is recommended. *Syn.: D. aitoniana* Pichi-Serm., *D. elongata* Chev., *D. filix-mas* auct. Can., *Aspidium canariense* A. Br., *A. elongatum* Webb & Berth.

Fig. 10

Family *BLECHNACEAE*

21. *BLECHNUM* L.

Blechnum spicant (L.) Roth.

Leaves clustered on stout rhizome, the sterile leaves 10-30 cm, the fertile ones up to 35 cm; petioles short, dark brown to black, fronds pinnate, the pinnae with entire margins, the sterile ones about 5 mm wide, the fertile ones narrow and revolute; sori in rows along the midrib of the fertile pinnae.

Distr.: N Hemisphere, Azores, Madeira, Tenerife, Gomera. *Ecol.:* Very restricted, on mossy banks in tree heath and scrubby laurel forest along the damp crests of mountains at 700-1,000 m.

22. *WOODWARDIA* Sm.

Woodwardia radicans (L.) Sm.

Large crowns of leaves from thick upright rhizomes, the fronds arching, up to 250 cm long, sometimes footing near the tip, where young plantlet may be formed; pinnae divided almost to the midrib into acute, very finely serrulate pinnules; sori about 3 mm long, in chain-like rows.

Distr.: W Mediterranean region, E Africa, Asia, Azores, Madeira, Gran Canaria, Tenerife, Gomera, Palma. *Ecol.: Abundant* in dense laurel forest, without question the most spectacular fern of the islands; 350-1,200 m.

Family *POLYPODIACEAE*

23. *POLYPODIUM* L.

Polypodium australe Fee. - «Polipodio».

Fronds spaced along creeping rhizome, the latter often more than 1 cm thick, clothed with brown scales 5-10 mm long; leaves 10-55 cm long, broadly ovate in outline; simply pinnate, the pinnae up to 15 cm long and 15 mm wide, coarsely serrate with 2 rows of round sori on the back; indusium absent.

Distr.: S and W Europe, Azores, Madeira, known from all of the Canary Islands. *Ecol.:* In stone walls, cliffs, banks, and epiphytic on laurel trees, fairly common, 300-1,100 m. *Evol.:* The Canarian material differs in several respects from European plants; further study is needed. A report of *P. interjectum* from Gran Canaria must await further clarification. *Syn.: Polypodium vulgare* L. var. *serratum* Milde.

LAMINA XX

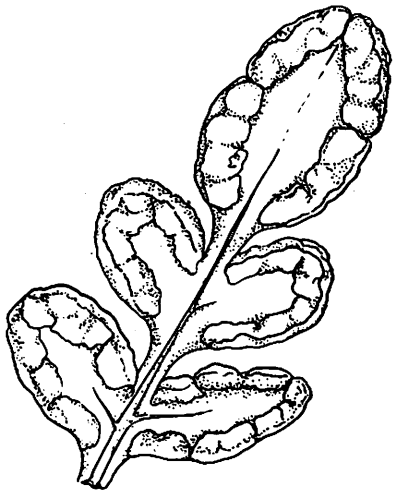

Fig. 1. Cheilanthes pulchella

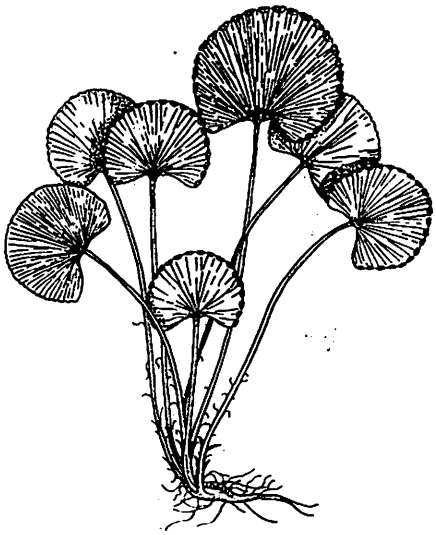

Fig. 2. Adiantum reniforme

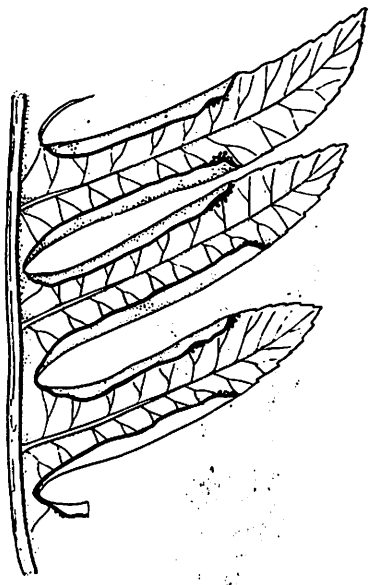

Fig. 3. Pteris arguta

Fig. 4. Culcita macrocarpa

LAMINA XXI

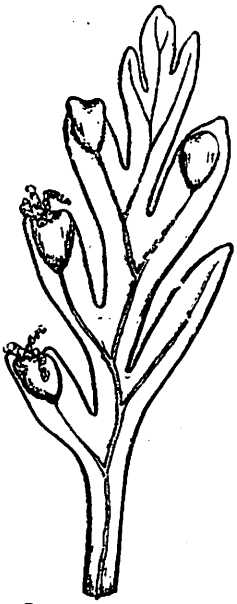

Fig. 5. Davallia canariensis

Fig. 6. Asplenium hemionitis

Fig. 7. Asplenium billotii

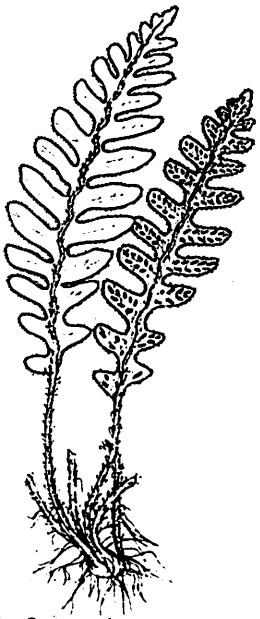

Fig.8. Ceterach aureum

LAMINA XXII

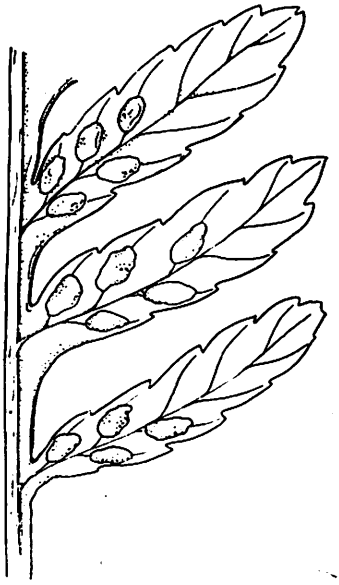

Fig. 9. Athyrium umbrosum

Fig. 10. Dryopteris oligodonta