

A REVISION OF THE GENUS ECHIUM IN MACARONESIA

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(Recibido el 26 de mayo de 1972)

Resumen. En este trabajo se revisan las especies del género *Echium* L. de Macaronesia, o sea, de las Islas Canarias, Madeira, Azores y Cabo Verde, incluyéndose una clave para la determinación de las 28 especies reconocidas para estas islas, 27 de las cuales son endémicas. Se da para cada especie endémica un mapa de distribución, y se incluyen ilustraciones de la corola de todas las especies de las Islas Canarias, tomadas de ejemplares vivos. Se describe una nueva especie para las Islas Canarias (*E. sventenii* Bramwell), y se proponen las nuevas combinaciones siguientes: *E. wildpretii* subsp. *trichosiphon* (Svent.) Bramwell; *E. triste* subsp. *nivariense* (Svent.) Bramwell; *E. strictum* subsp. *gomeræ* (Pitard) Bramwell; *E. strictum* subsp. *exasperatum* (Webb) Bramwell; *E. stenosphon* subsp. *lindbergii* (Pettersson) Bramwell. Se discuten las relaciones existentes entre las 8 secciones del género *Echium* en que se agrupan las especies estudiadas. Se incluye una discusión acerca de la relación entre los tipos de indumento y los tipos principales de vegetación de las islas, preferentemente de Tenerife. Se ilustran los caracteres del indumento con microfotografías obtenidas por medio de microscopio electrónico de barrido.

Summary. In this paper the species of *Echium* L. found on the islands of Macaronesia ie. the Canary Islands, Madeira, the Azores and the Cape Verde Islands are revised. A key to the species is given and each species is described. Full synonymy is cited. 28 species are recognised from Macaronesia, all but one being endemic to the region. These species are grouped into 8 sections. Distribution maps are given for each endemic species and the corollas of all the Canary Islands species have been illustrated from living specimens. One new species has been described from the Canary Islands (*E. sventenii* Bramwell) and the following new combinations made: *E. triste* subsp. *nivariense* (Svent.) Bramwell; *E. wildpretii* subsp. *trichosiphon* (Svent.) Bramwell; *E. strictum* subsp. *gomeræ* (Pitard) Bramwell; *E. strictum* subsp. *exasperatum* (Webb) Bramwell; *E. stenosphon* subsp. *lindbergii* (Pettersson) Bramwell. The relationships between the sections of *Echium* described from the islands are discussed and the relationships between indumentum types and the major ecological/vegetation zones of the islands has been studied in detail with particular reference to the island of Tenerife. Characteristic indumentum are illustrated by means of Scanning Electron micrographs.

INTRODUCTION

Echium is generally considered to be a taxonomically «difficult» genus because of the extreme variation and wide distribution of some of the taxa, and the Macaronesian members of the genus are no exception although there may be additional factors contributing to these difficulties.

The problems in the Macaronesian species are due to two main factors, the first being the evolution of local, very restricted taxa, apparently in response to the diversity of climatic conditions and the numerous available habitats found particularly in the Canary Islands. In this case satisfactory taxonomic treatment is possible only when variation can be studied in the field and correlated with habitat conditions and distribution.

The presence of narrow endemics which are morphologically similar to other more widespread (or in some cases simply better known) species tend to confuse the taxonomist's view of the limits of these species, especially if only older collections and literature records are relied upon, and this creates problems of identification and accurate mapping of distribution.

In addition to the inherent problems within the genus the situation has been further complicated by the early introduction of a number of species from the Canary Islands and Madeira into European gardens by collectors such as MASSON in 1777-1778 and BROUSSONET in 1801. Unfortunately, the introduced species freely hybridised in the gardens, seed and plants seem to have been readily exchanged and many of the hybrids were retained for their showy inflorescences and ability to flower freely over long periods. Consequently, a number of «new species» were described by botanists such as DE CANDOLLE (1813), LEHMANN (1818, 1821-1824) and JACQUIN (1844) which cannot accurately be related to any species found in the field.

Lack of herbarium material from Macaronesia has been a major problem to taxonomists for many years and large areas of some of the islands still remain to be explored botanically, especially in the Cape Verde Archipelago and the western Canary Islands. The following revision of the Macaronesian *Echium* species is based mainly on my own collections and field studies in the Canary Islands and includes data from morphological, phytochemical, cytological and scanning electron microscope studies, and from comparative cultivation.

The Cape Verde Island species of *Echium* remain a problem, especially the variable *E. stenosiphon* Webb. Very few specimens are available and none of the species appears to be in cultivation. I have followed CHEVALIER's treatment (1935), but have included some of the data available from

PETTERSSON's study (1960) which was, however, carried out on only a very few specimens collected by LINDBERG and which probably gave a false impression of the variation in this species which can be seen even amongst the few sheets available at Paris (P).

Twenty eight species are recognised in the area studied in this present revision, including one new species and a few new infra-specific taxa which are described for the first time. Twenty seven of these species are endemic to Macaronesia and these are grouped into eight sections.

MATERIAL AND METHODS

An extensive series of field studies carried out in the Canary Islands from October 1968 to August 1969 and in the Spring of 1971 has permitted observations of natural populations throughout the range of most taxa. Data on ecology, habitat, and associated species have been collected along with some 2500 herbarium specimens of *Echium*, including population samples. Sets of these specimens will be deposited in the following herbaria: Department of Botany, University of Reading (RNG); Botany School, University of Cambridge (CGE); Department of Botany, University of Leicester (LTR); Missouri Botanical Garden, St. Louis, Missouri (MO); Departamento de Botánica, Universidad de Sevilla (SEV); Royal Botanic Gardens, Edinburgh (E).

In addition, numerous herbarium specimens from the following herbaria have been studied (abbreviations following LANJOUW & STAFLEU, 1964): British Museum (Nat. Hist.) London (BM); The Botanical Museum and Herbarium, Copenhagen (C); Botany School, University of Cambridge (CGE); Herbarium Universitatis Florentinae (FI); The Herbarium, Royal Botanic Gardens, Kew (K); Private herbarium of G. Kunkel, Las Palmas (Ku); Cátedra de Botánica, Universidad de La Laguna, Tenerife (LAG); The Linnean Society, London (LINN); The Hartley Botanical Laboratories, University of Liverpool (LIVU); Institut Botanique, Université de Montpellier (MPU); Muséum National d'Histoire Naturelle, Paris (P); Jardín de Aclimatación de Plantas de la Orotava, Tenerife (ORT); Department of Botany, University of Reading (RNG); Botanischer Garten und Museum der Universität Zürich (Z).

HISTORICAL SURVEY

The first descriptions of Macaronesian *Echium* species are found in the Supplementum of LINNAEUS FILIUS (1781). Here three new species were described from material collected by F. MASSON in Madeira and the Canary Islands during 1778.

Later, BROUSSONET, in 1801, explored Tenerife and Gran Canaria and consequently a number of species were described by DE CANDOLLE (1813). Several of these have since proved to be garden hybrids but some (*E. simplex* DC., *E. virescens* DC.) are currently recognised as «good» species. POIRET (1808) also described *E. aculeatum* from BROUSSONET's collections. LEHMANN (1818; 1821-1824) produced the first monograph of the family Boraginaceae with a large section devoted to *Echium*. Unfortunately, most of the material used came from botanical gardens and much of it seems to have been of hybrid origin. The monograph was published in two fascicles in 1818 with the title *Plantae e familia Asperifoliarum nuciferae*, and later (1821-4) a second publication *Icones rariorum plantarum e familia Asperifoliarum*, appeared in several parts with illustrations of many of the species. None of LEHMANN's new species is currently recognised though he was the first to provide good descriptions and illustrations of those described earlier.

Probably the most important contribution to the knowledge of Macaronesian *Echium* species was made by WEBB (1844). WEBB based his account on the collections of BROUSSONET (which he acquired by purchasing the herbarium of DESFONTAINES), his own collections made in the islands in the late 1820's, and the extensive collection of DESPREAUX (c. 1835). After his account was published, WEBB obtained the large collection of BOURGEAU made in 1845-1846; later, a second set of specimens was collected by BOURGEAU and PERRAUDIERE (in 1855) and a number of manuscript names credited to WEBB appeared in their exsiccatae. WEBB intended to produce a supplement and a summary of the Canarian flora and left, when he died in 1854, extensive manuscripts which were later revised and published by CHRIST (1888). Many of the unpublished *Echium* names were, however, taken up earlier by BOLLE (1867), and others were ignored or considered to be synonyms of earlier species until the early 1900's when they were used by COINCY (1903) and SPRAGUE & HUTCHINSON (1914). CHRIST was, however, the first to attempt an infrageneric classification of the frutescent Canarian species.

WEBB (1849), also revised the available material from the Cape Verde Islands, and described two new endemic species of *Echium*.

A further important contribution in this field was made by COINCY (1903), a prolific student of the genus *Echium*, who prepared a revision of the Atlantic island species, most of which he grouped in a new section *Pachylepis*. His account of the group contained descriptions of 17 of the species currently recognised from Macaronesia.

In 1914, SPRAGUE & HUTCHINSON published two papers on *Echium* from the Atlantic Islands. The first was a revision of the *E. giganteum* species complex which had been variously treated by students of the Canary Islands since WEBB's day. These two authors recognised five species, four of which are currently treated as distinct species, the fifth being a hybrid, in the group. The second paper treated some of the species of the *E. simplex* group, corrected nomenclature and established the existence of *E. auberianum* Webb & Berth. as a species distinct from *E. wildpretii* Hook. fil. (syn. *E. bourgaeum* Webb).

CHEVALIER (1935) revised the Cape Verde species in his Flora of the islands and added a single new species *E. vulcanorum* Chev. Since then only SVENTENIUS (1960; 1968) has made a significant contribution to the knowledge of Macaronesian *Echium* species with his description of three new local endemics.

EVALUATION OF CHARACTERS OF TAXONOMIC IMPORTANCE

In the following evaluation of characters of taxonomic importance in Macaronesian *Echium*, both analytic and synthetic (DAVIS & HEYWOOD, 1963) characters are considered, as both delimitation of species and grouping of the species into sections have been considerably revised when compared to previous accounts of the group.

Habit and Growth Form.

Growth form is important both at species and section level and is also of major value in evolutionary considerations. There are four main growth forms in Macaronesian *Echium* species:

A Most Macaronesian species are woody shrubs up to about two

metres in height with a typical «candelabra» branching pattern (MEUSEL, 1954). Within this group there are two distinct types:

(1) species in which the main axis produces the first inflorescence (sect. *Gigantea* and *Stricta*) and subsequent inflorescences are produced on lateral branches in the following season, or sometimes later in the same season in *E. strictum* (fig. 1 A & C).

(2) species in which the first inflorescences are formed on lateral branches and the primary axis does not flower until the following season at the earliest (sect. *Virescentia*) (fig. 1, B).

B Three species from the Canary Islands (*E. simplex*, *E. wildpretii* and *E. pininana*) having a very distinctive monocarpic habit, comprise the section *Simplicia*. Plants of these species exist for several years as simple vegetative rosettes on short woody stems and then flower with a single, very large inflorescence, set a vast quantity of seed and die (fig. 1, D & E).

C This group of herbaceous perennial species often have a woody root-stock and are essentially hemicryptophytes. The leaves are arranged in a basal rosette with one to several ascending flowering stems. *E. triste* (fig. 2, H & I), is the only Macaronesian species of the section *Gigantea* with this type of growth form, which is very common amongst European and North African species. *E. auberianum* has a very distinctive type of habit. It was considered by CHRIST (1888) and subsequent authors to be a monocarpic species of section *Simplicia* but field studies have shown that after flowering the plant branches from the root-stock and produces a further rosette which flowers the following year (fig. 2, A-D). The plants seem to survive for a number of years and flower several times by this method and therefore the species has been removed from the section *Simplicia*, from which it also differs in floral characteristics, and placed in a separate section of its own.

D The final group of species are those with an annual or biennial habit (therophytes s. l.). Excluding *E. triste* (group C) there are two endemic species in the Canaries, *E. bonnetii* and *E. pitardii* which are both annuals. *E. plantagineum*, a widespread Mediterranean species, is common in the western Canaries and also on Madeira and the Azores. This species behaves as an annual or biennial and both forms can be grown from seed from a single plant (fig 2, E-G).

If COINCY's infrageneric classification is followed then the annual/biennial species found in Macaronesia would have to be placed in two se-

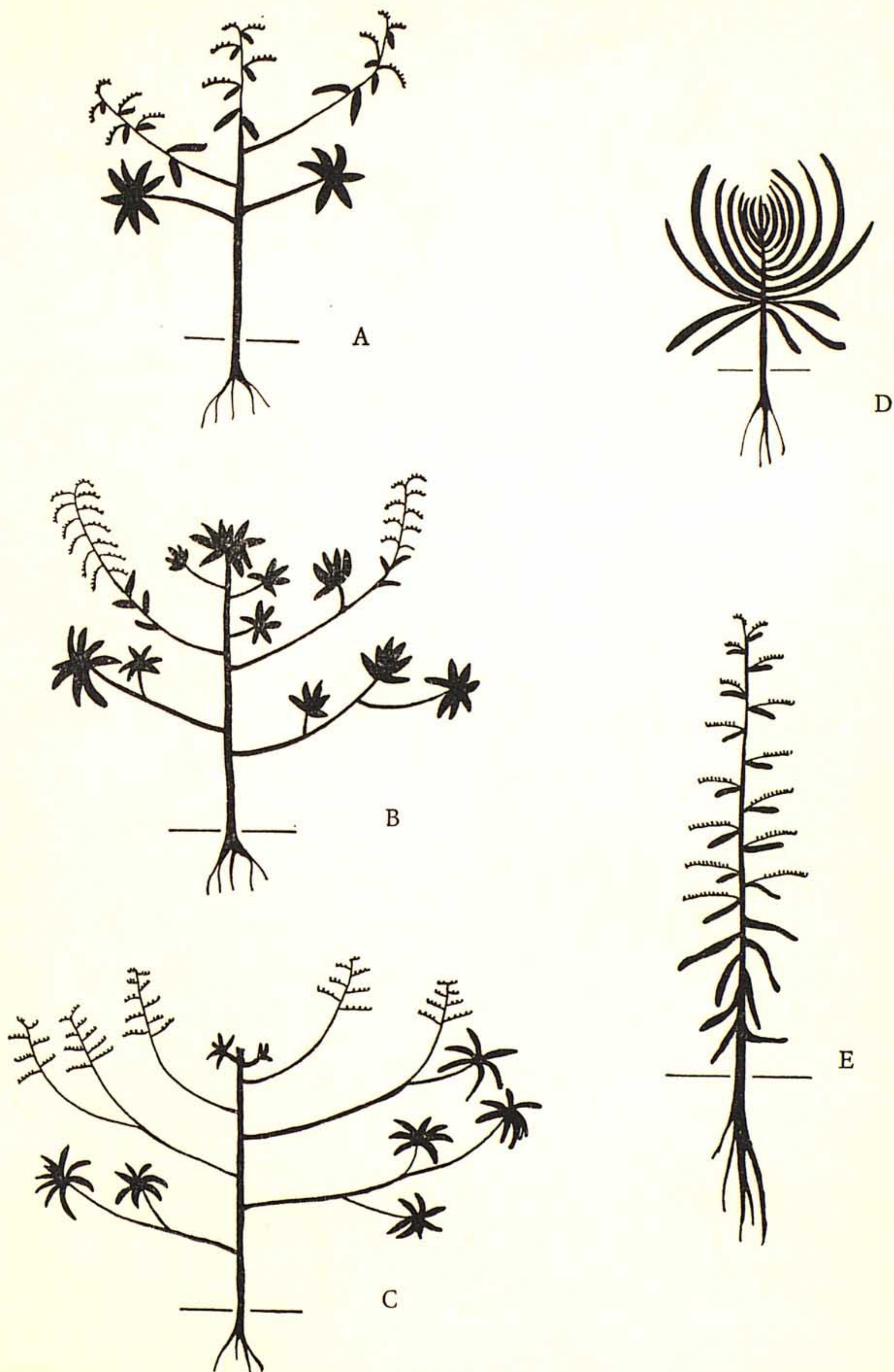


Fig. 1.—A-C. Growth forms of frutescent *Echium* species showing branching patterns and inflorescence types. A. *E. strictum*. B. *E. virescens*. C. *E. giganteum*. D-E. Growth-form of *E. wildpretii* showing the unbranched, monocarpic habit; D. Vegetative rosette; E. Inflorescence.

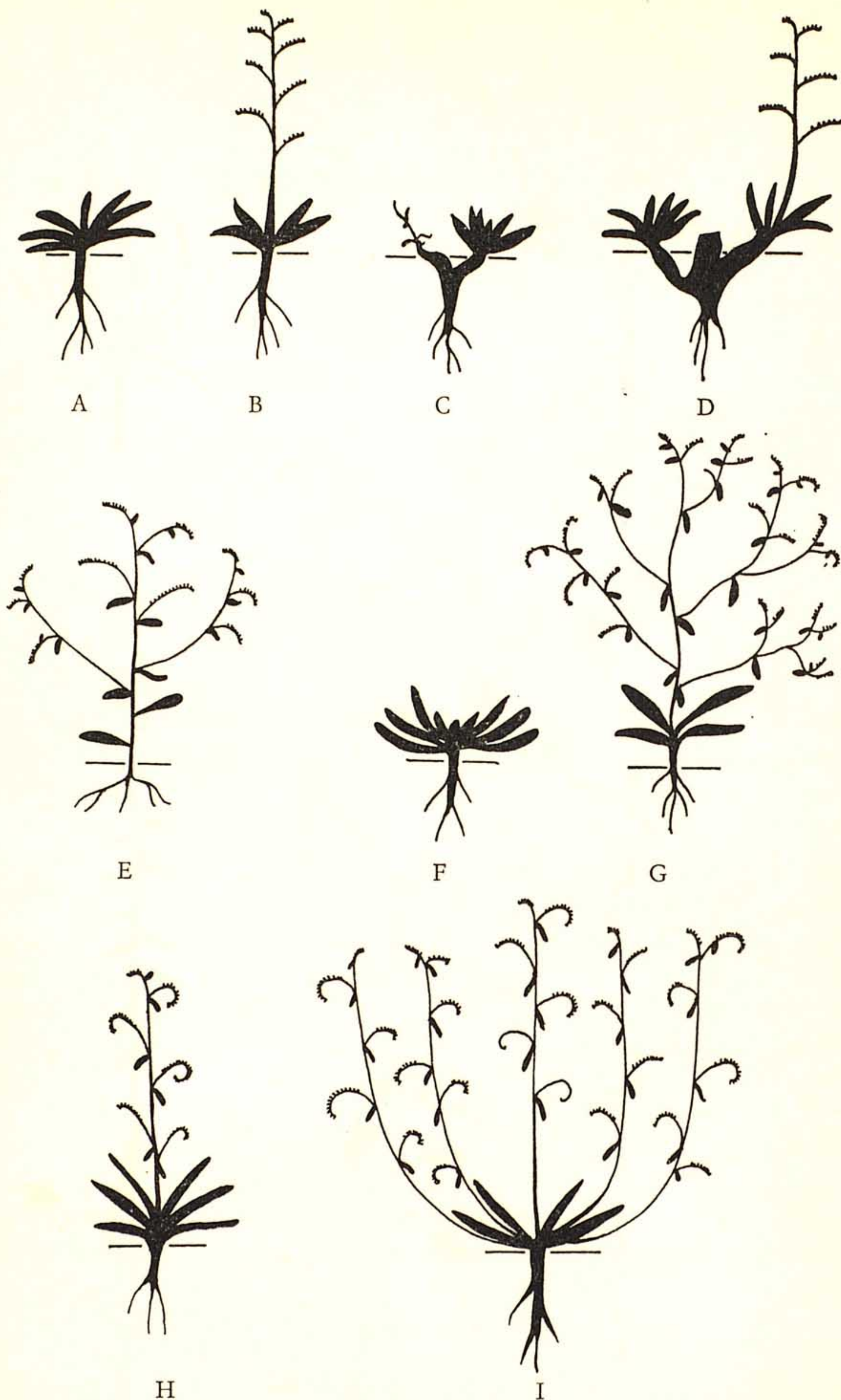


Fig. 2.—Growth-form diagrams of herbaceous species of *Echium* showing annual, biennial and perennial habits. A-D perennial habit of *E. auerianum*. E. *E. plantagineum*, annual form. F-G. *E. plantagineum* biennial form. H. *E. triste*, annual form. I. *E. triste*, biennial form.

parate sections, *Eleutherolepis* and *Gamolepis*, based on the lobing of the annulus at the base of the corolla. These species are so similar morphologically that such a separation does not seem justified.

Leaf-shape.

The leaves of all the species of *Echium* are alternately arranged, simple and exstipulate. In the shrubby species they are usually crowded at the apex of vegetative shoots. The lamina varies in shape from linear to ovate and from 5 to 50 cm. in length. The leaf apex is acute, acuminate or obtuse and the base generally attenuate (in *E. strictum* more or less obtuse to attenuate, in *E. onosmaefolium* sometimes almost parallel to the base). The petiole is usually short and often difficult to distinguish from the attenuate leaf base. The margin is always entire, sometimes ciliate or spinescent and occasionally revolute (e. g. *E. onosmaefolium*). The nerves are often prominent below and the angle of branching, degree of hairiness and presence of spines are useful characters in some groups (*E. giganteum* group, Madeiran species).

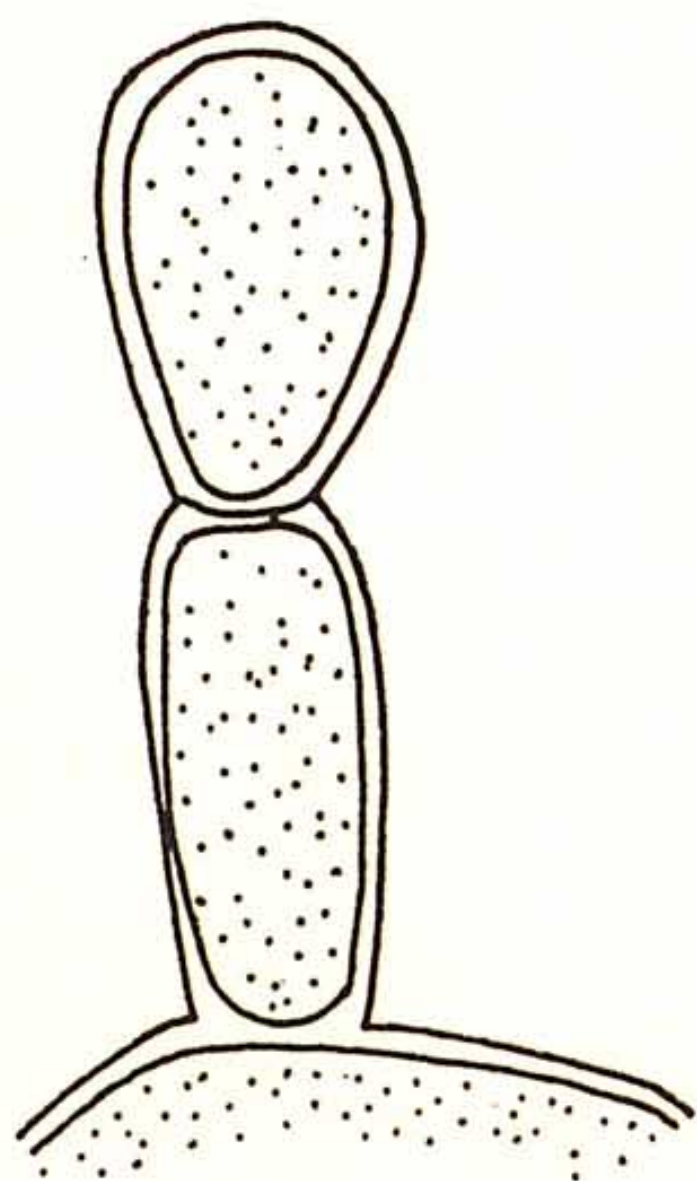
Indumentum Characters.

The structure and distribution of trichomes in the Macaronesian species of *Echium* were recently reviewed by LEMS & HOLZAPFEL (1968). These authors adopted a «phylogenetic point of view» but their final conclusions appear to have been based on several misinterpretations of the ecological and distributional data they accumulated and, because of their preoccupation with indumentum alone, they established a number of rather dubious «evolutionary lines».

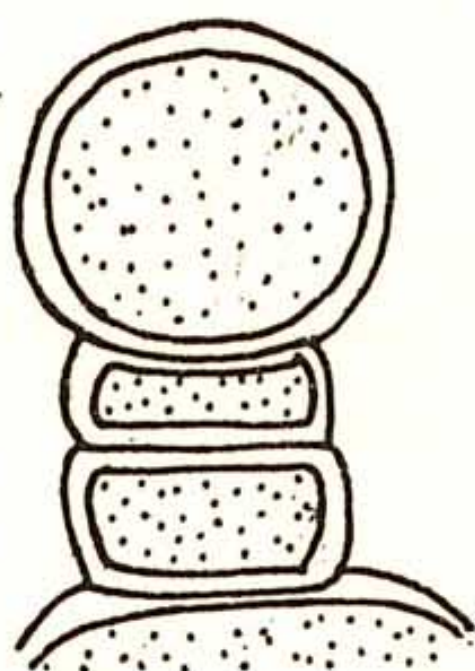
In the present study diversity of trichome types and their distribution in relation to the ecology of the species of the group have been examined in detail both in the field and in the laboratory using light and scanning electron microscopes. The studies have shown strong correlations between rainfall/vegetation zones and the structure and density of the indumentum.

A *Structure of Trichomes.* There are three basic forms of trichomes in Macaronesian *Echium* species, glandular hairs, simple hairs with small bases and large stiff setae with pustular bases.

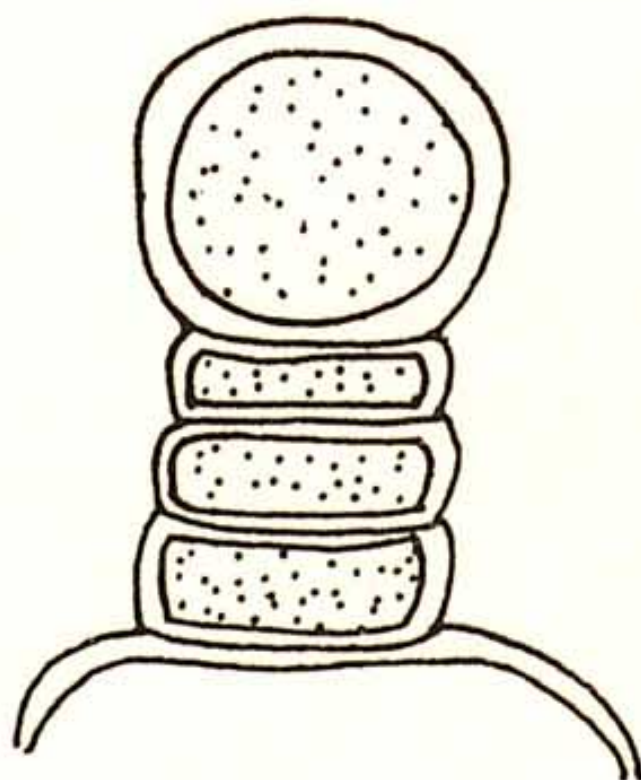
(1) Glandular hairs. This type of hair occurs mainly on the lower surface of the midrib or more rarely over wide areas of the lower surface of the leaf (this situation is most frequently found in cultivated specimens).



A.



B



C

Fig. 3.—Glandular trichomes from the leaves of A. *E. simplex*; B. *E. virescens*;
C. *E. giganteum*.

The glands are stalked with unicellular heads and vary between species. In most species the head is spherical (fig. 3, B-C) and the stalk consists of two or three cells. In a few species the head cell is ovoid or obovoid (*E. simplex*, *E. bonnetii*) and in *E. simplex* only a single stalk cell occurs (fig. 3, A). These glands are formed from the surface of an epidermal cell, the head-cell being formed first (LEMS & HOLZAPFEL, 1968).

(2) Simple trichomes. These are short, stiff hairs without a large pustular base. They are present on the cotyledons of all the *Echium* species studied and persist in the adult stages of the following species, *E. giganteum*, *E. aculeatum*, *E. leucophaeum*, *E. breviflorum*, *E. simplex*, *E. hierrense* and *E. webbii*. In adult plants simple hairs are usually short, often curved and closely appressed to the leaf surface. Though the base of the hair is usually swollen there is generally little or no cell differentiation of the surrounding epidermal cells. Plate 1, A shows this form of trichome in addition to pustular-based forms.

(3) Pustular trichomes. In this type of trichome (nodular bristles of METCALFE & CHALK, 1950) the base of the hairs is surrounded by one or more concentric rings of strongly differentiated cells of the epidermis which contain cystolith-like structures and whose walls are also strongly impregnated with calcareous material. In very large forms some of the cells of the upper palisade layer of the mesophyll are also involved in the pustule structure and may also be calcified. In *Echium* the number of rows of epidermal cells involved in the pustule formation varies from one in species such as *E. callithyrsus* (Plate 1, B) two in *E. strictum* (Plate 1, C), three to four in *E. triste* (Plate 1, D) up to five in *E. gentianoides* (Plate 1, E). The number of rings of cells involved in base formation tends to be constant in any one species though in *E. triste* several forms may occur. Plate 1 shows the range of pustular trichome types.

B *Indumentum Types*. Within the Macaronesian species of *Echium* there are four main types of indumentum and these are closely correlated with ecological conditions. The most frequent types are: (1) the spinous indumentum with stiff spines on the leaf-surface or in many cases confined to the margins and midrib of the leaf (Plate 2, A-C); (2) the appressed to ascending silky indumentum where the surface is covered with a dense layer of simple or small-based appressed hairs (Plate 2, D); (3) a very specialized form of spinous indumentum with large-based trichomes resembling drawing-pins on an otherwise glabrous leaf-surface (Plate 2, E-F); (4) a dense, as-

ending to erect indumentum of long trichomes with small bases found only in subalpine zone species.

The distribution of indumentum type is shown in the following table:

Type 1	Type 2	Type 3	Type 4	
<i>E. aculeatum</i>	<i>E. giganteum</i>	<i>E. handiense</i>	<i>E. gentianoides</i>	<i>E. auberianum</i>
<i>E. brevirame</i>	<i>E. leucophaeum</i>	(<i>E. callithyrsum</i> , <i>E. decaisnei</i>		<i>E. wildpretii</i>
<i>E. onosmaefolium</i>	<i>E. virescens</i>	very variable)		
<i>E. triste</i>	<i>E. webbii</i>	<i>E. simplex</i>		
(<i>E. strictum</i> , very variable)	<i>E. hierrense</i>	<i>E. pininana</i>		
	<i>E. acanthocarpum</i>	<i>E. sventenii</i>		

Indumentum Types in Relation to Climate/Vegetation Zones.

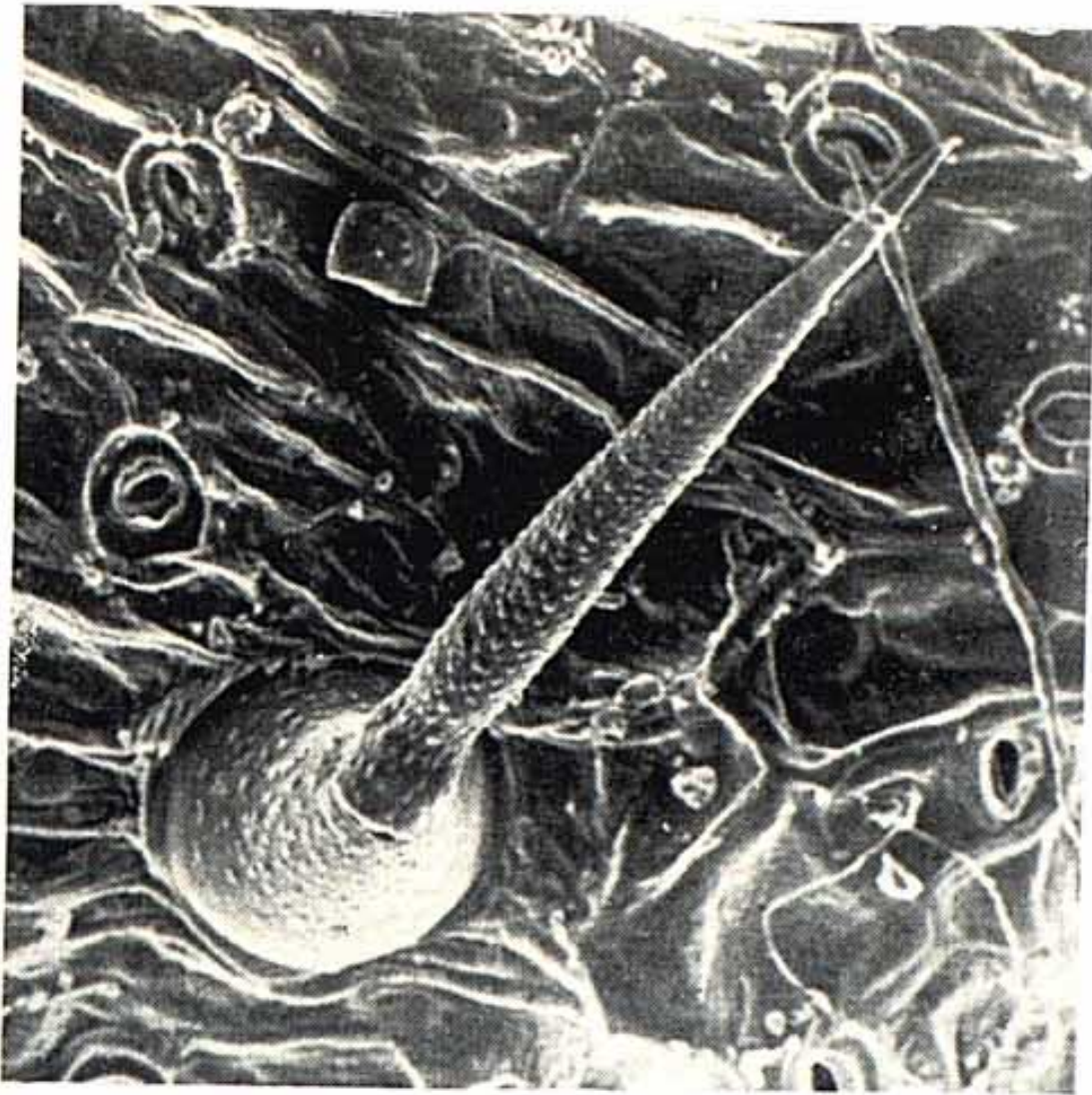
In their discussion of the ecological implications of indumentum diversity LEMS & HOLZAPFEL (1968) came to the conclusion that there was little correlation between altitude and types of indumentum. If the full range of distribution of each species is, however, compared with the distribution of the major climate/vegetation zones of the islands, it can be seen that the occurrence of each of the major types of indumentum is closely related to climate factors. The following table shows the altitudinal range and indumentum type of each species of *Echium* found on the island of Tenerife.

Species										
Vegetation Zone	<i>E. triste</i> ●	<i>E. leucophaeum</i> *	<i>E. sventenii</i> *	<i>E. wildpretii</i> †	<i>E. auberianum</i> †	<i>E. strictum</i> * to ●	<i>E. virescens</i> *	<i>E. giganteum</i> * to ●	<i>E. aculeatum</i> ●	<i>E. simplex</i> *
Subalpine 2000-3000 m.	—	—	—	+	+	—	—	—	—	—
Pine forest 1000-2000 m.	—	—	—	+	—	—	+	—	—	—
Laurel forest 1000-1500 m.	—	—	—	—	—	+	+	+	—	—
Forest transition zone ca. 900 m.	—	+	+	—	—	+	+	+	—	—
Upper xerophytic zone 500-900 m.	—	+	+	—	—	+	+	+	+	—
Lower xerophytic zone 0-500 m.	+	—	—	—	—	+	—	—	+	+

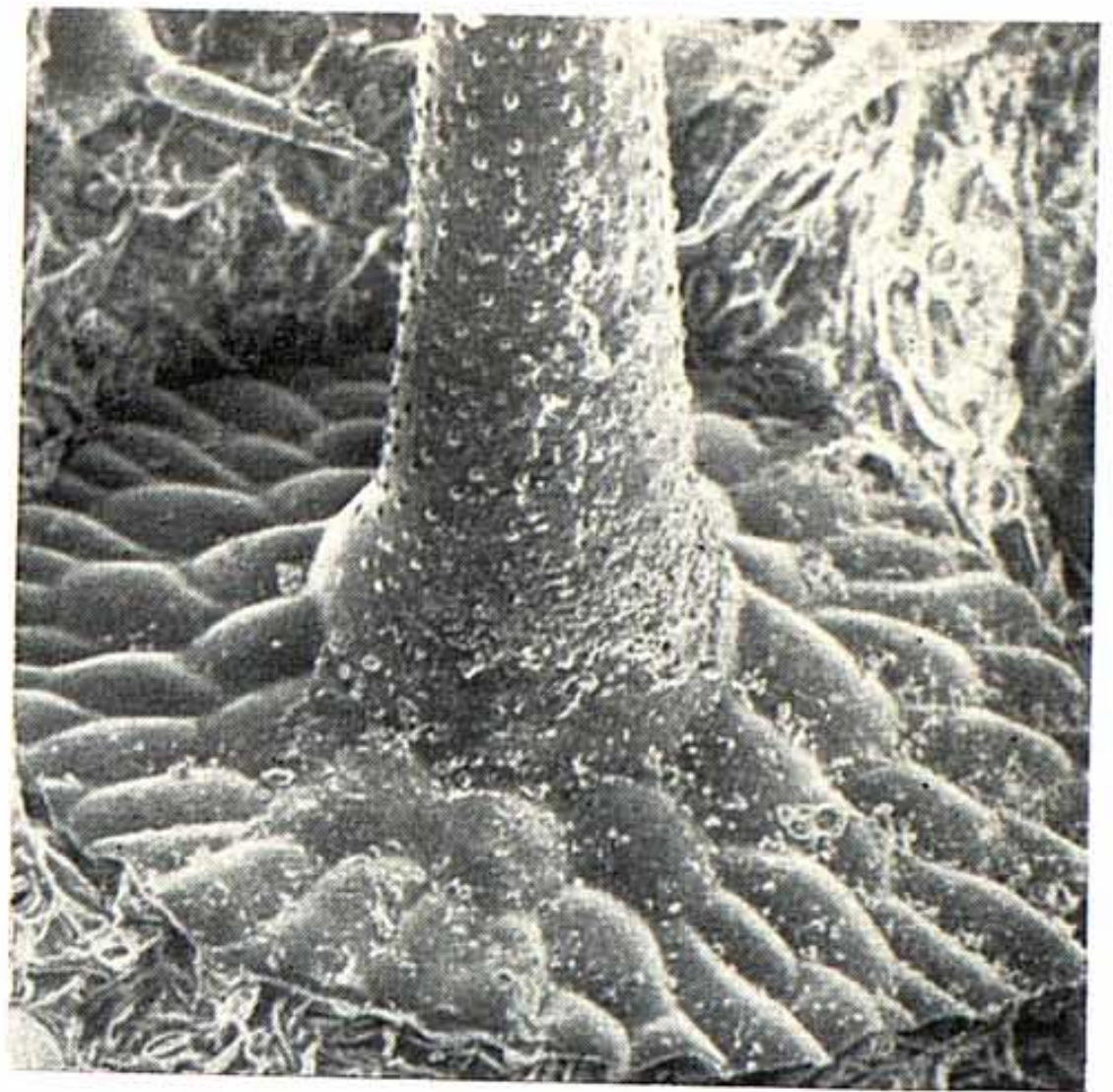
Distribution of *Echium* species in the vegetation zones of Tenerife

● Leaves spiny; * leaves silky with appressed hairs; † leaves with very long, dense indumentum.

PLATE 1.—Scanning-Electron Micrographs of trichome Types in Canary Islands
Echium species:



A. Simple hair (*E. triste*).



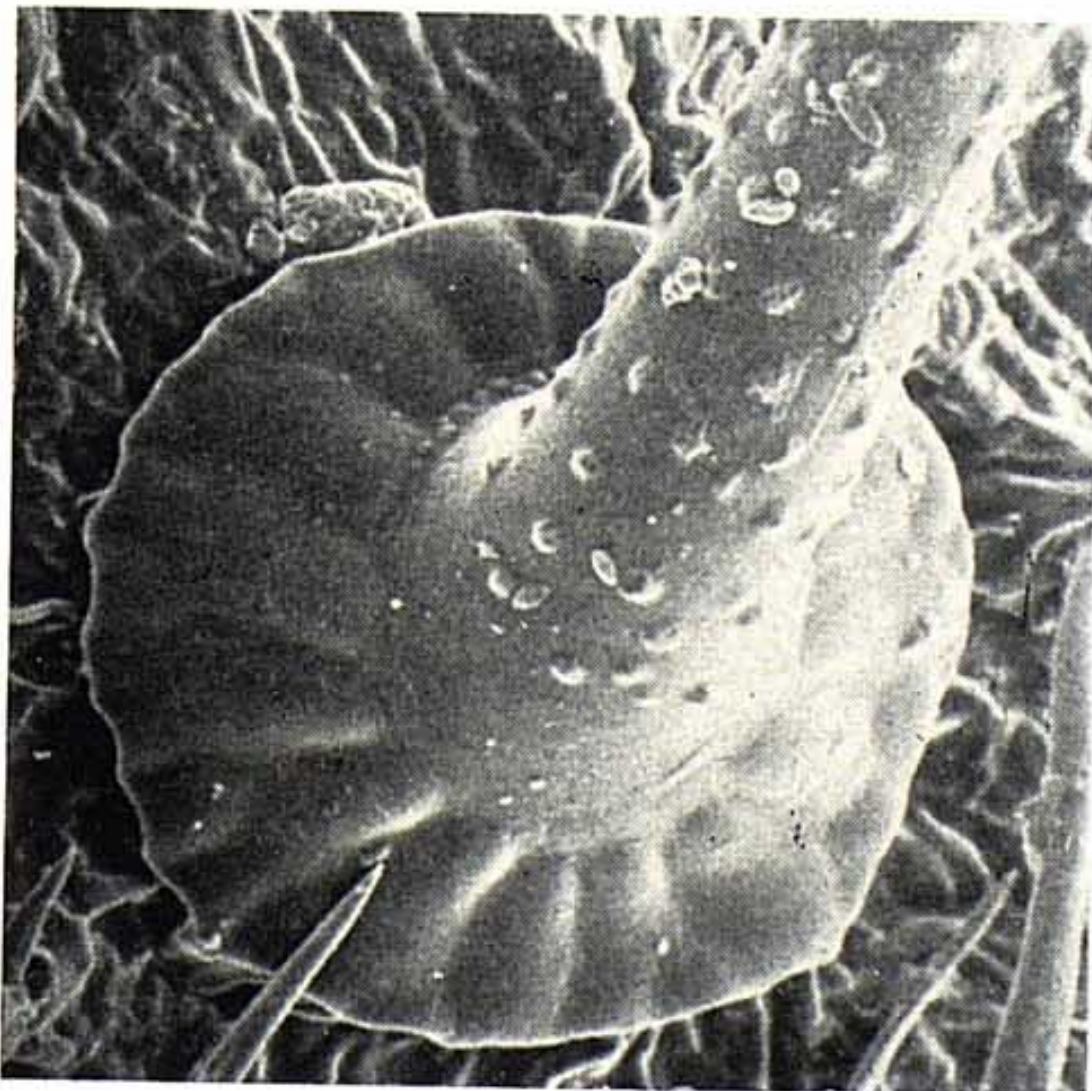
(*E. triste*).
D. Pustular trichome with 3-4 rows of basal cells



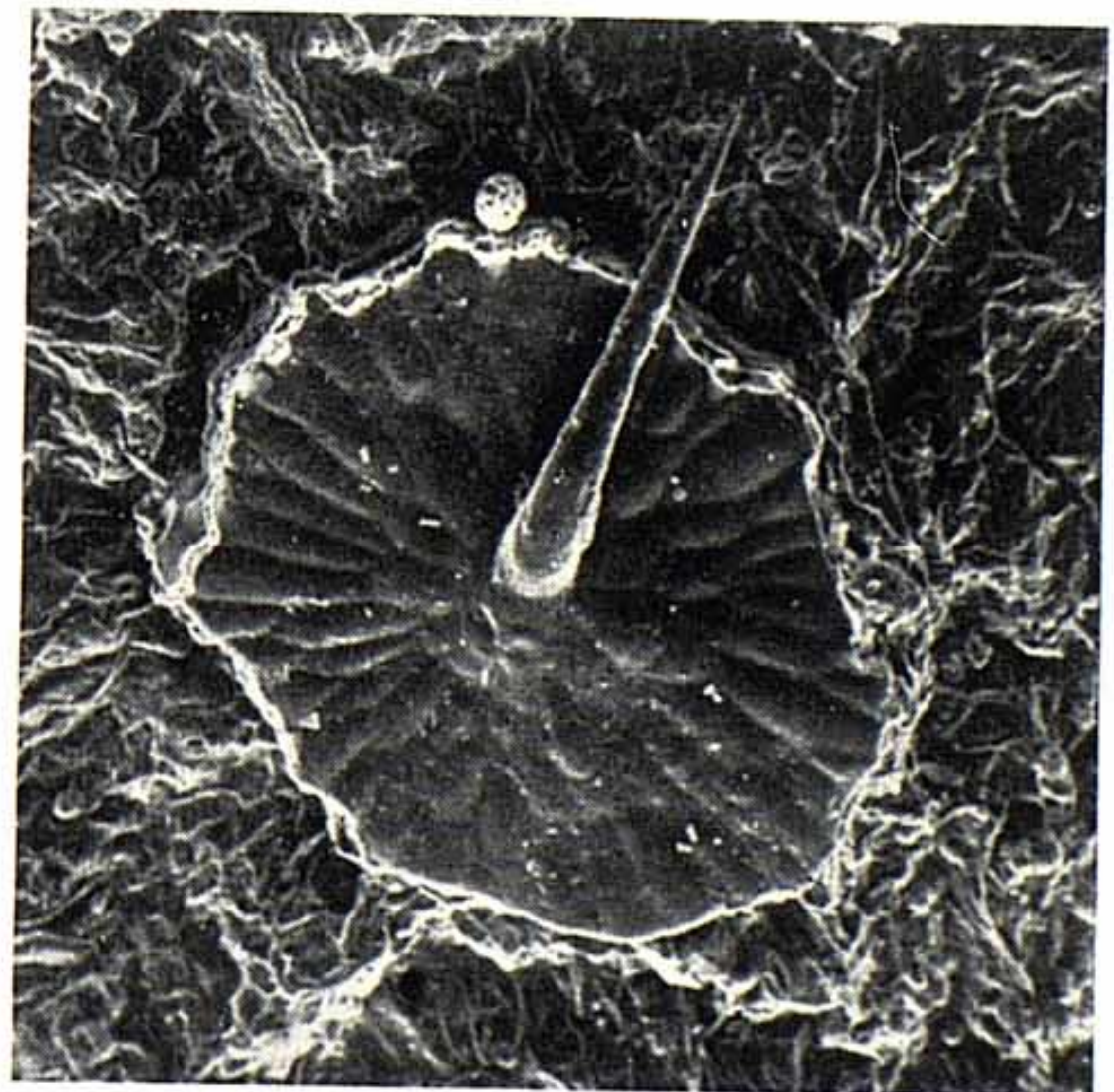
(*E. callithyrsum*).
B. Pustular trichome with single row of basal cells



(*E. gentianoides*).
E. Pustular trichome with 4-5 rows of basal cells



(*E. strictum*).
C. Pustular trichome with 2 rows of basal cells

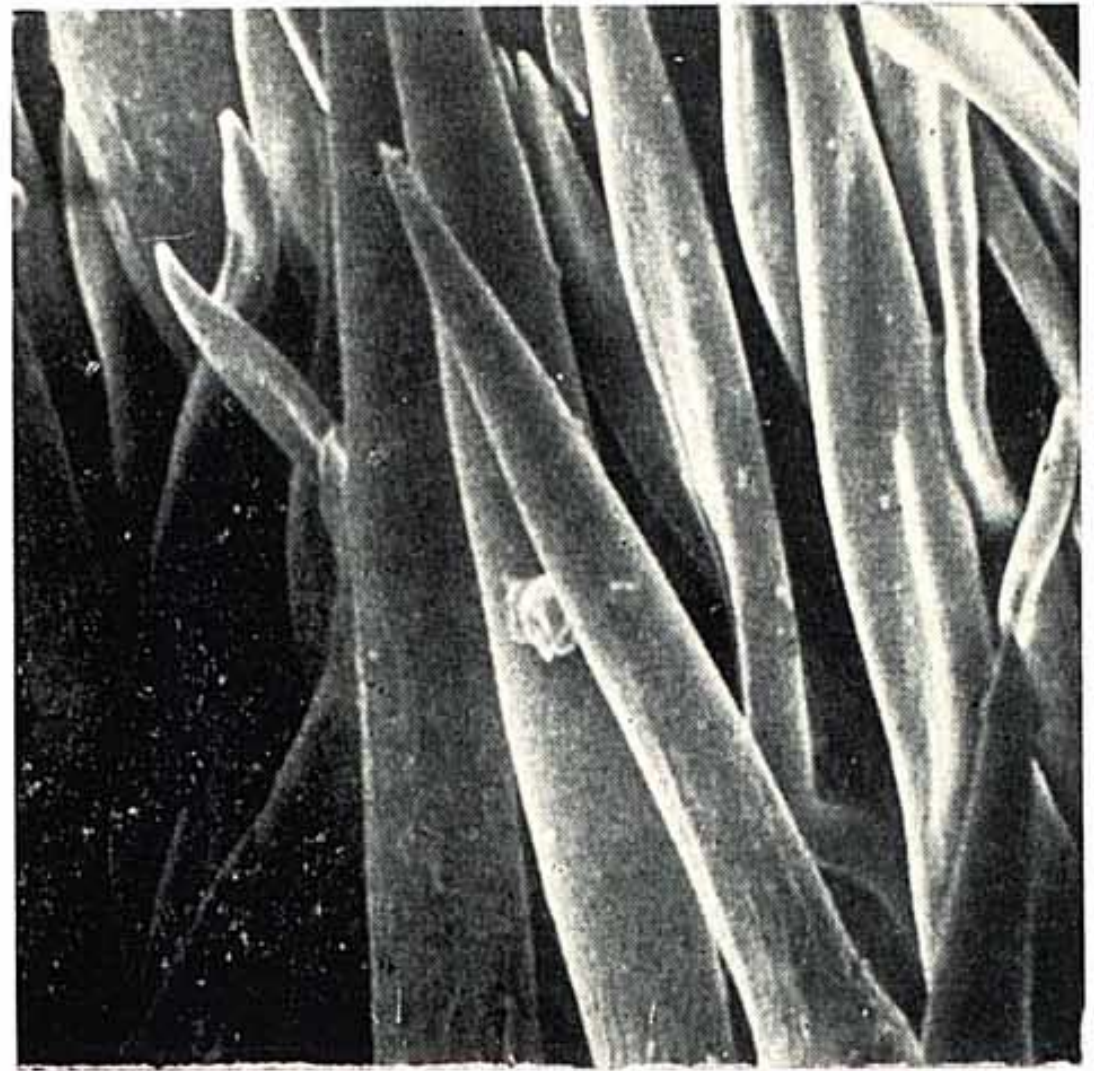


(*E. decaisnei*).
F. Pustular trichome with 3 row of basal cells

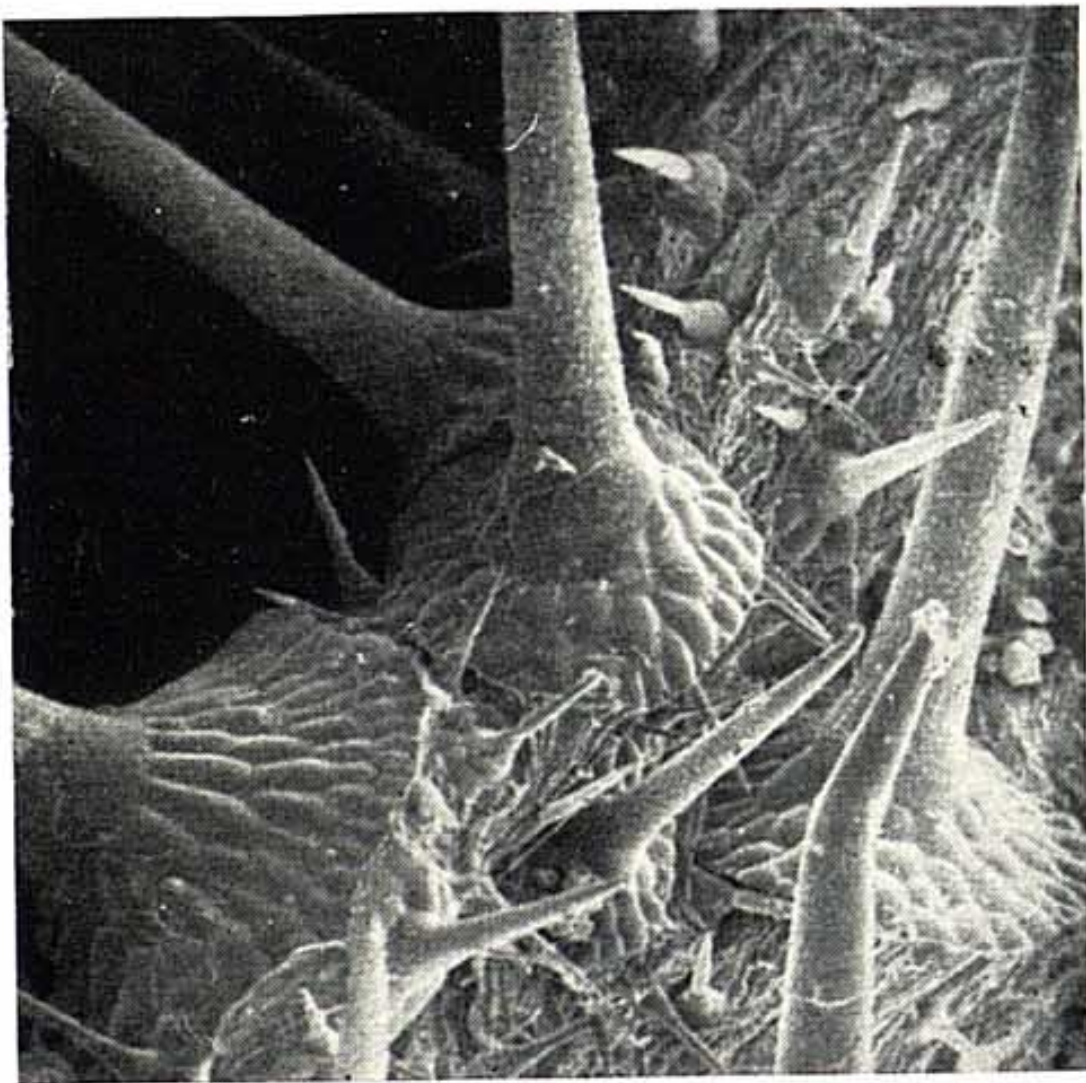
PLATE 2.—Scanning-Electron Micrographs of indumentum Types in Canary Islands
Echium species:



A. Spinous indumentum (*E. brevirame*).



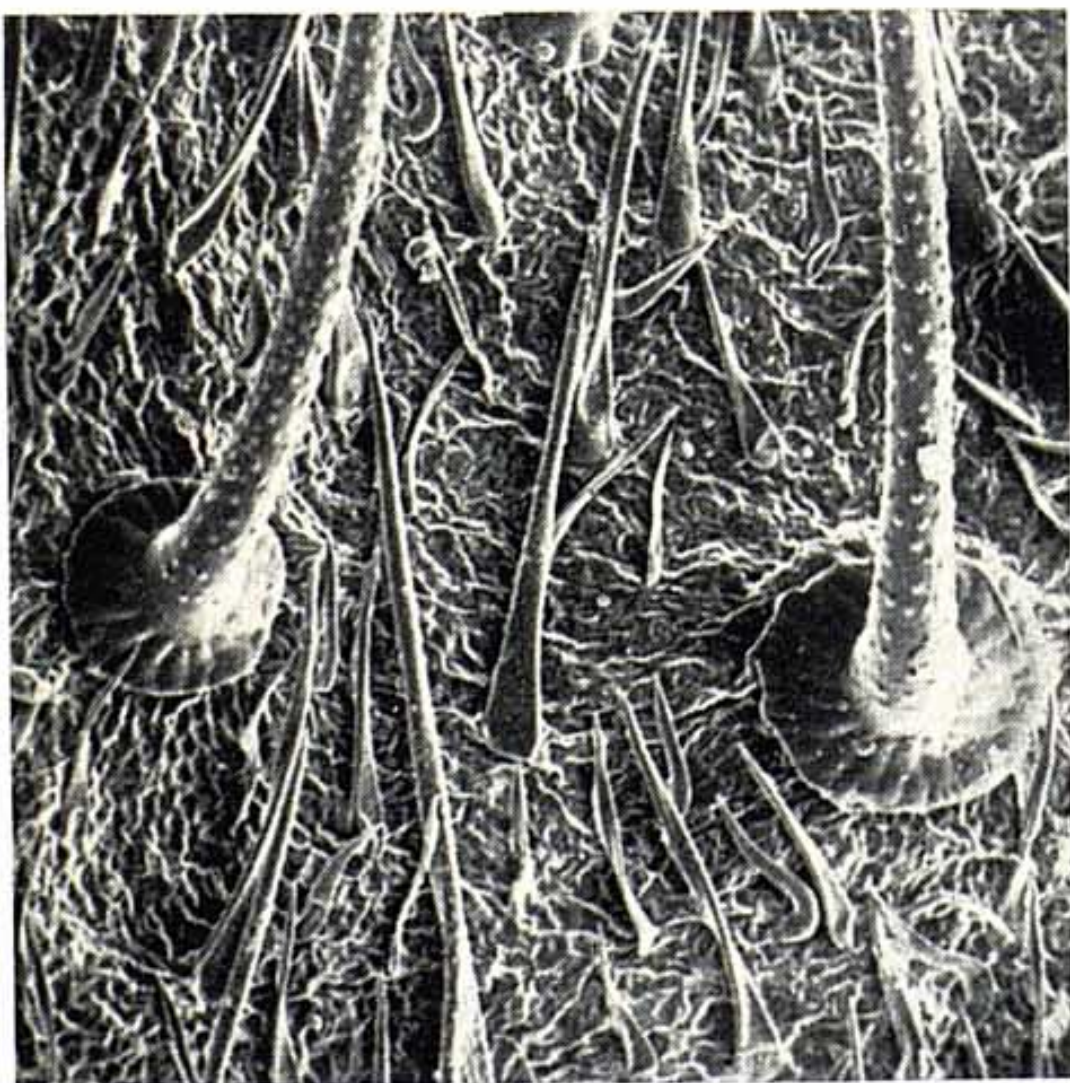
D. Appressed silky indumentum (*E. virescens*).



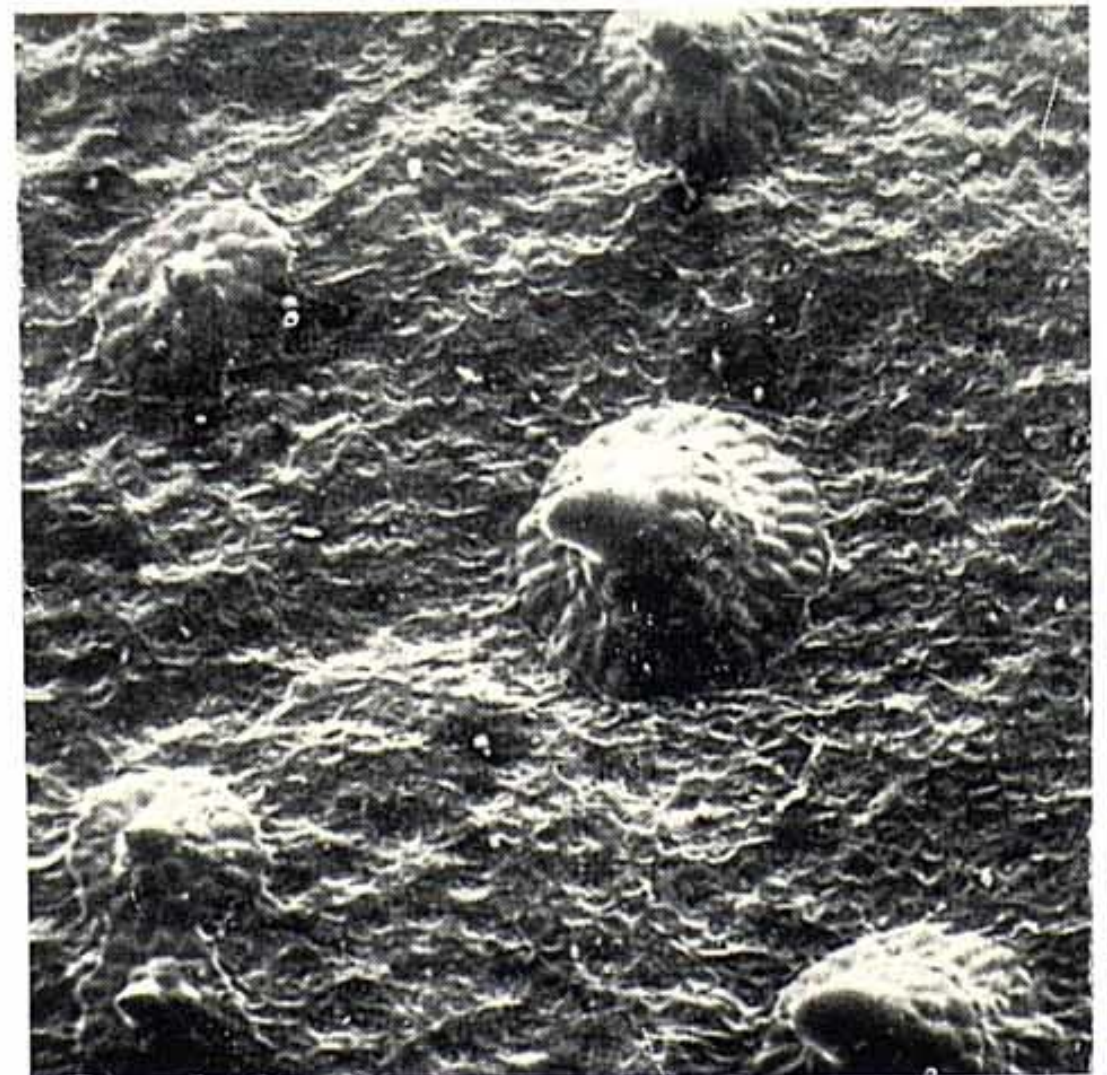
B. Spinous indumentum (*E. triste*).



E. Specialized spinous indumentum (*E. gentianoides*)



C. Appressed spinous indumentum (*E. strictum*).



F. Specialized spinous indumentum (*E. decaisnei*).

Wide ranging species such as *E. strictum* have a very variable indumentum but there are several trends which are immediately obvious: (1) spines are usually found in the xerophytic zone at low altitudes and are extremely rare in forest species; (2) forest species usually have a silky, appressed to ascending indumentum and this form is also common in species occurring in transition areas between the forest and xerophytic zones; (3) long, erect hairs are confined to the subalpine zone.

There are some exceptions to the general rule, for example *E. simplex* which is a sea-cliff species of very low altitudes and has an appressed silky indumentum. This species grows, however, in very humid north coast habitats where the relative humidity at most times of the year is very similar to that of the forest zone.

The effect of environment on the indumentum has led to the development of very similar types in species which, on the basis of overall morphological features, belong to different sections, for example the silky indumentum of *E. leucophaeum* and *E. virescens*. In view of this it is doubtful whether indumentum characters can be weighted to such a degree as LEMS & HOLZAPFEL did in establishing their «evolutionary lines». These authors did not consider other characters such as habit and floral structure to be of evolutionary importance in this group. In fact, the obvious effects of habitat on the indumentum renders it more or less useless and certainly of secondary importance to more consistent features such as habit and floral morphology in considerations of the evolutionary and indeed, the phenetic relationships of the Macaronesian *Echium* species.

The Calyx.

The calyx is usually 5-partite with linear to ovate, acute to obtuse segments which are, in most cases, divided almost to the base. The segments are often unequal, particularly in *E. strictum* and in the *E. giganteum* group, but the degree of asymmetry is variable even in the flowers of a single inflorescence and is therefore of little value as a diagnostic character. The segments may be glabrous, scabrid, hispid or hirsute. In the case of scabrid segments there is usually a greater concentration of trichomes along the central vein of the segment. The margins are entire and occasionally ciliate. The calyx is persistent and strongly accrescent in fruit acting as a wing to assist dispersal. Within the *E. giganteum* group *E. aculeatum* is easily separable as the calyx is more or less equal to the corolla whereas in the remaining species it is much shorter.

The Corolla.

The corolla margin is usually distinctly 5-lobed though in some species of the *E. giganteum* group and in *E. sventenii* the posterior lobes may be more or less completely united to give the appearance of a 4-lobed corolla. The outer surface is usually hairy to some extent. At the base of the corolla is a ring of tissue, the annulus, which was given a great deal of taxonomic weight in the infra-generic classification of the genus proposed by COINCY (1903). COINCY's system was a considerable oversimplification with a great deal of overlap of annulus-types between his groups and in this revision the classification of CHRIST (1888) is preferred for the Macaronesian members of the genus in view of its more 'natural' basis of overall similarity in general morphology.

Flower colour together with lateral compression of the corolla and the degree of development of corolla-lobes, are important characters in the delimitation of species in the Macaronesia and are also valuable as key characters. Corollas of Canarian species are illustrated in fig. 4 to 9.

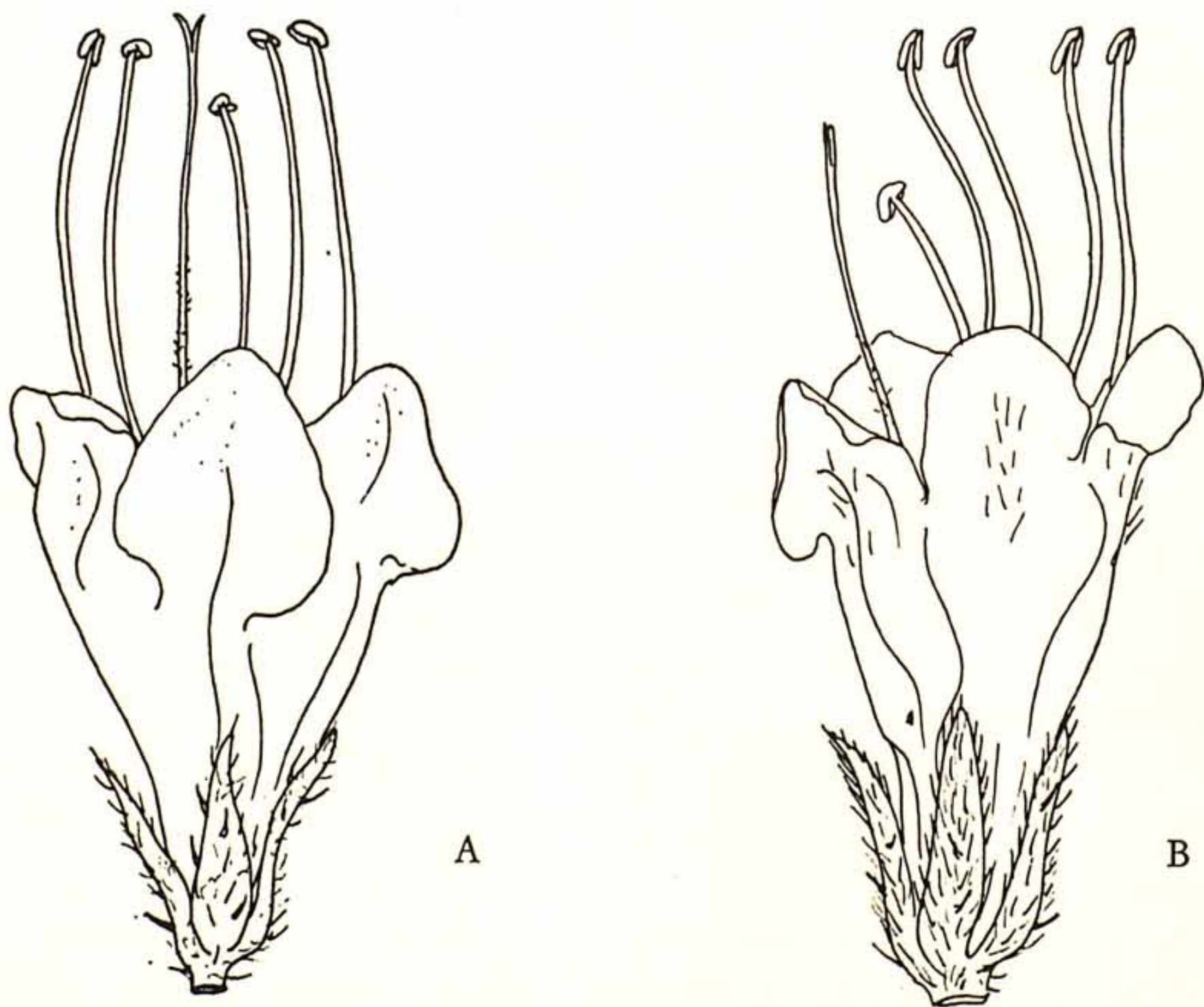


Fig. 4.—Corolla of *E. hierrense* (A) and *E. handiense* (B).

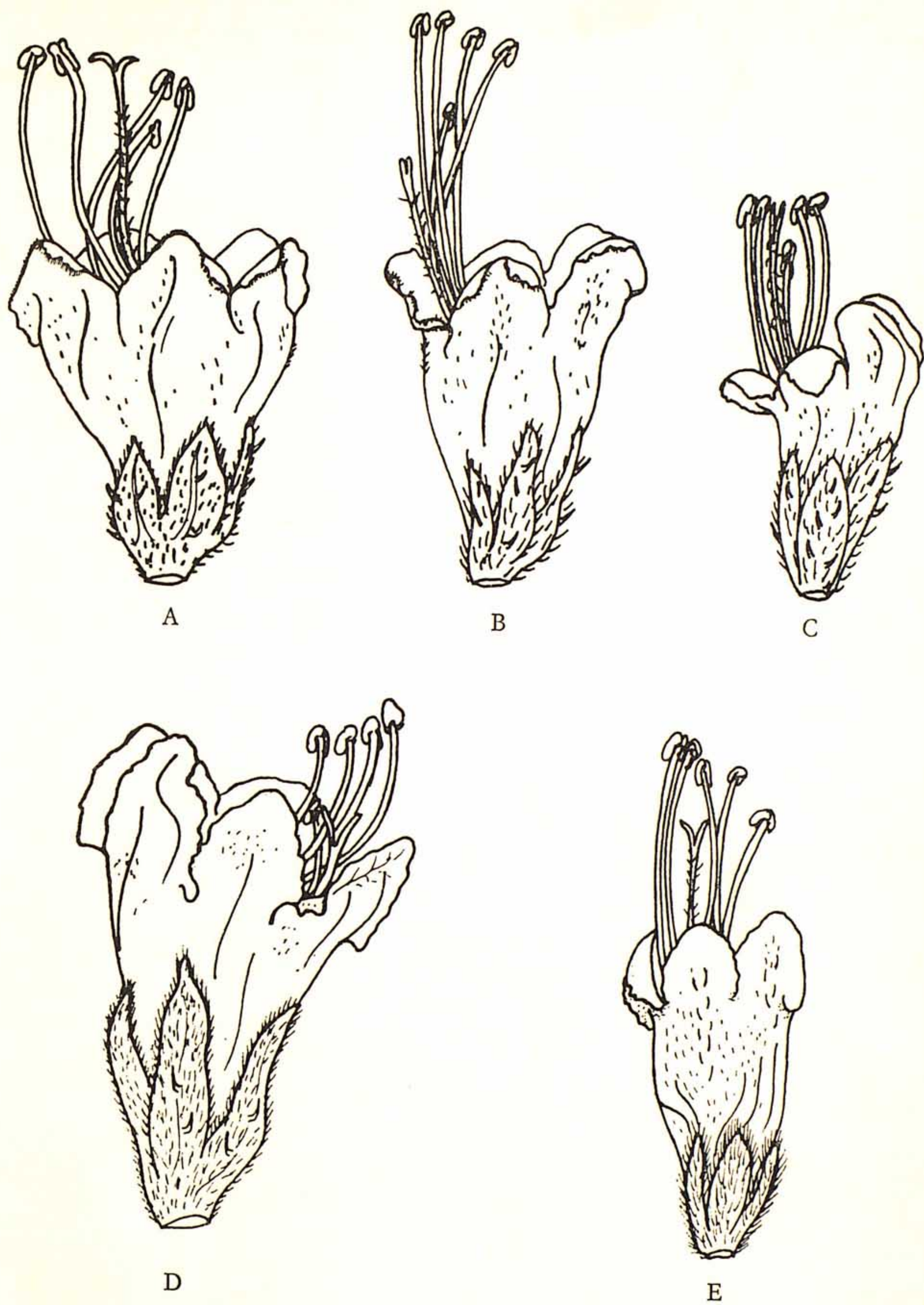
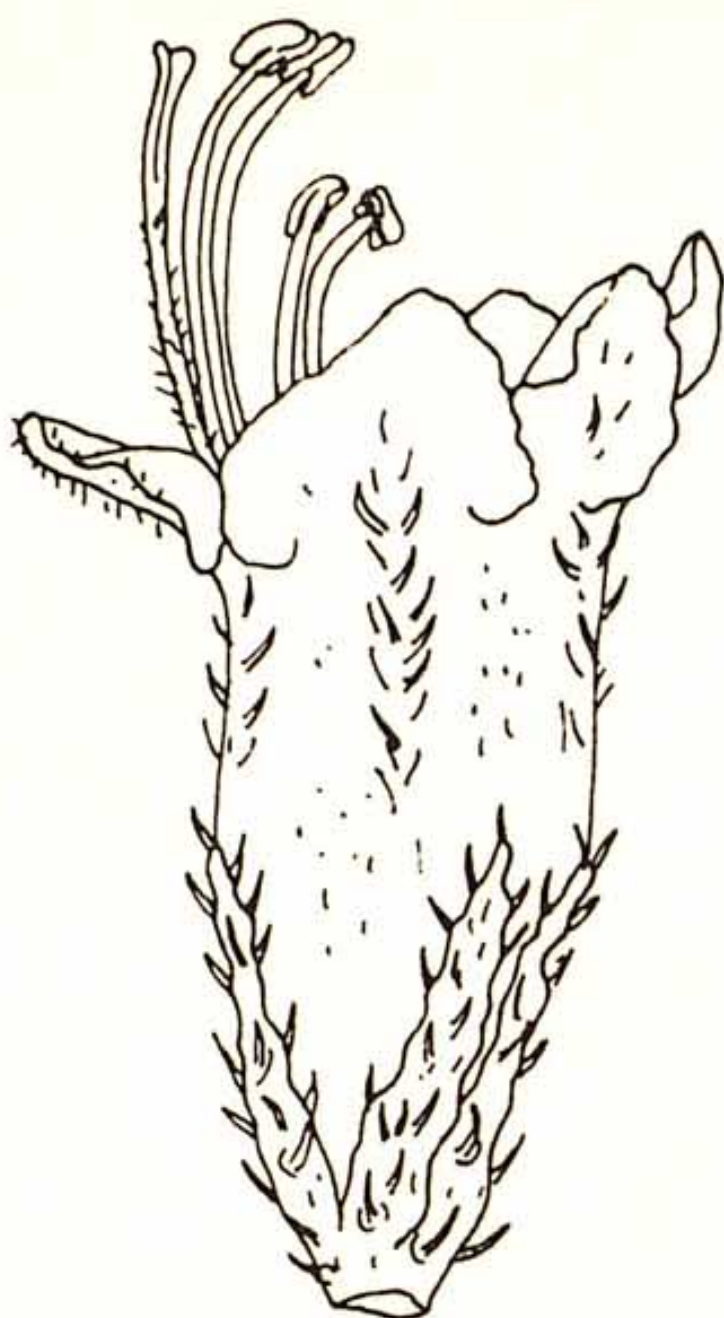
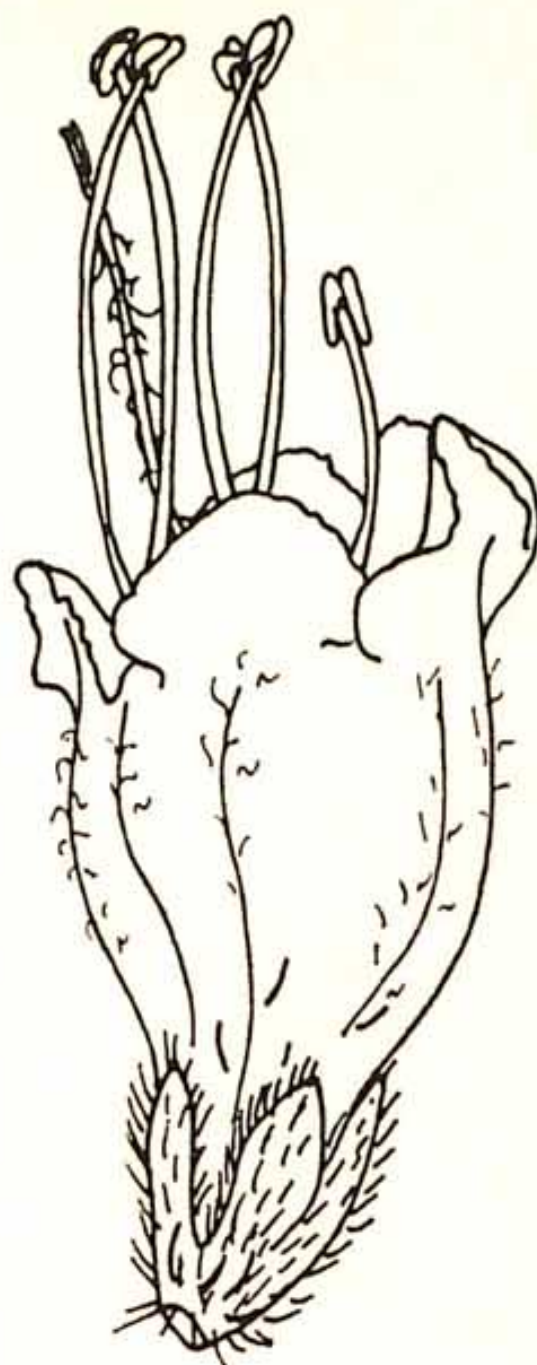


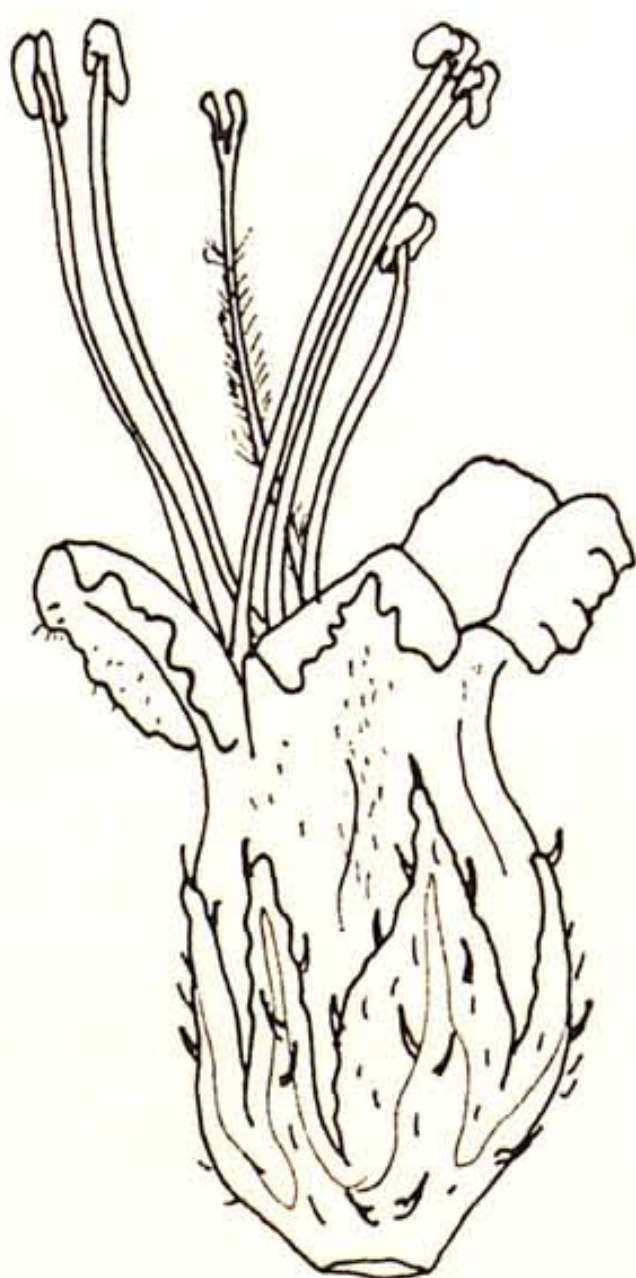
Fig. 5.—A. *E. virescens*; B. *E. virescens* var. *angustissimum*; C. *E. sventenii*; D. *E. acanthocarpum*; E. *E. webbii* (All $\times 5$).



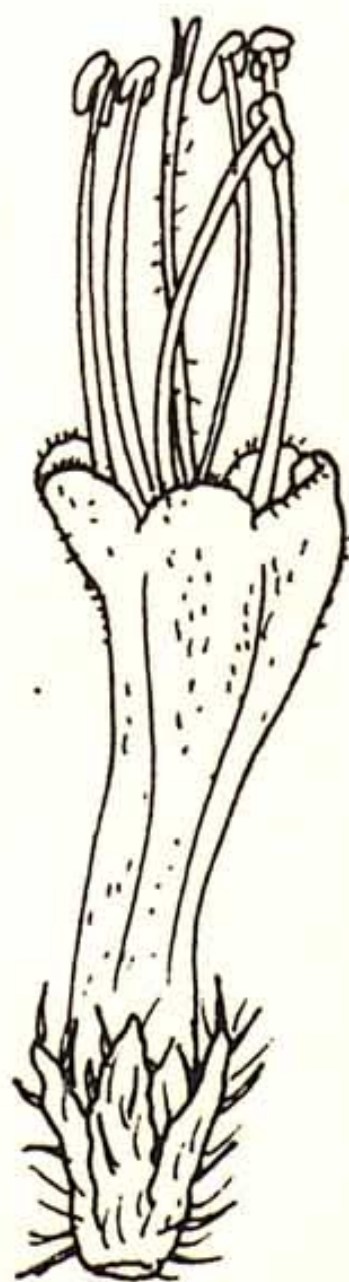
A



B



C



D

Fig. 6.—A. *E. onosmaefolium*; B. *E. callithyrsus*; C. *E. strictum*; D. *E. triste* (All $\times 5$).

The Androecium.

COINCY placed much emphasis, in species delimitation, on the level of insertion of the stamens in the corolla and in some cases this is characteristic of the species (*E. strictum*, *E. virescens*), but in most cases it is a very variable character with some individuals having the stamens inserted all at the same level somewhere between the base and the middle of the corolla but other individuals of the same population having them inserted at different levels, the posterior pair generally at a higher level than the other three.

The Gynoecium.

The gynoecium in *Echium* consists of a deeply four-lobed ovary with a simple, gynobasic style which is usually bifid at the tip. The fruits (nutlets) are very distinctive in some species (*E. acanthocarpum*, *E. simplex*) and usually have well developed surface sculpturing and spines or papillae.

RELATIONSHIPS BETWEEN THE MACARONESIAN SPECIES

The frutescent Macaronesian species form a natural group which can be subdivided into seven sections, two of which are monotypic.

The sections *Gigantea*, *Stricta* and *Decaisnea*, which tend to occupy the most xerophytic habitats in the Canary Islands, are also found in the Cape Verde Archipelago which is the driest, southernmost part of Macaronesia. The section *Virescentia*, on the other hand, tends to occupy moist, forest habitats in the Canary Islands and also occurs on the more oceanic, humid island of Madeira.

Relationships of the section Gigantea.

The section *Gigantea* is a complex one which has its greatest development in the western Canary Islands especially on Tenerife where three species occur. These species (*E. leucophaeum*, *E. aculeatum*, *E. giganteum*), though basically similar morphologically, are allopatric and can be readily distinguished. *E. aculeatum* is the most widespread species and is also found on Hierro and La Palma. A further Canarian species *E. brevirame* is endemic to La Palma.

The species of this group are best considered as vicarious taxa which have probably arisen by fragmentation of a single ancestral species. The only

inter-archipelago vicariant in the group is *E. vulcanorum* from the island of Fogo in the Cape Verde.

E. triste is a very variable species which ranges in habit from a biennial to a short-lived perennial with a very woody stock. It is adapted to extreme xeric conditions but its corolla structure places it taxonomically near to the *E. giganteum* complex.

Relationships of the section Simplicia.

This section, made up of three monocarpic species, was considered by LEMS & HOLZAPFEL (1968), on the basis of leaf indumentum, to be polyphyletic. Studies on floral morphology, habit and flavonoid pigments, however, support the opposite view that the section is monophyletic and probably «advanced» phylogenetically. The species *E. auerianum* which was included in this section by CHRIST (1888), SPRAGUE & HUTCHINSON (1914) and LEMS (1960) is not monocarpic and has a very distinct floral structure and in this treatment has, therefore, been removed to a separate section of its own.

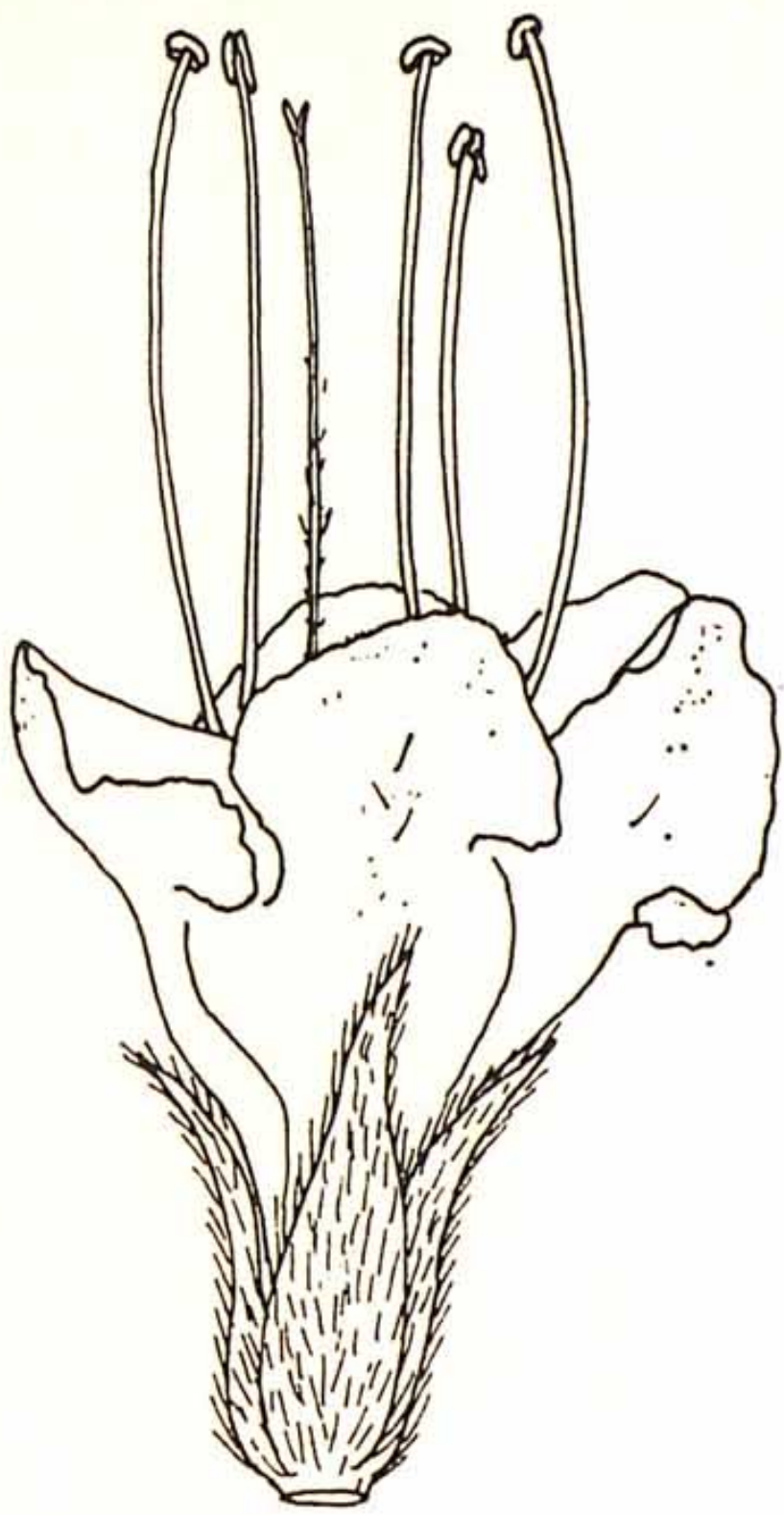
The three species remaining in the section, *E. wildpretii*, *E. simplex* and *E. pininana*, are morphologically very similar but are separable on characters of leaf-width and indumentum, and on differences in flower-colour and width of the corolla-tube. The three species are ecologically very distinct and the leaf-indumentum differences are closely correlated with habitat.

All three species occur on two adjacent islands, Tenerife and La Palma and *E. wildpretii* is found in the sub-alpine zone of both islands.

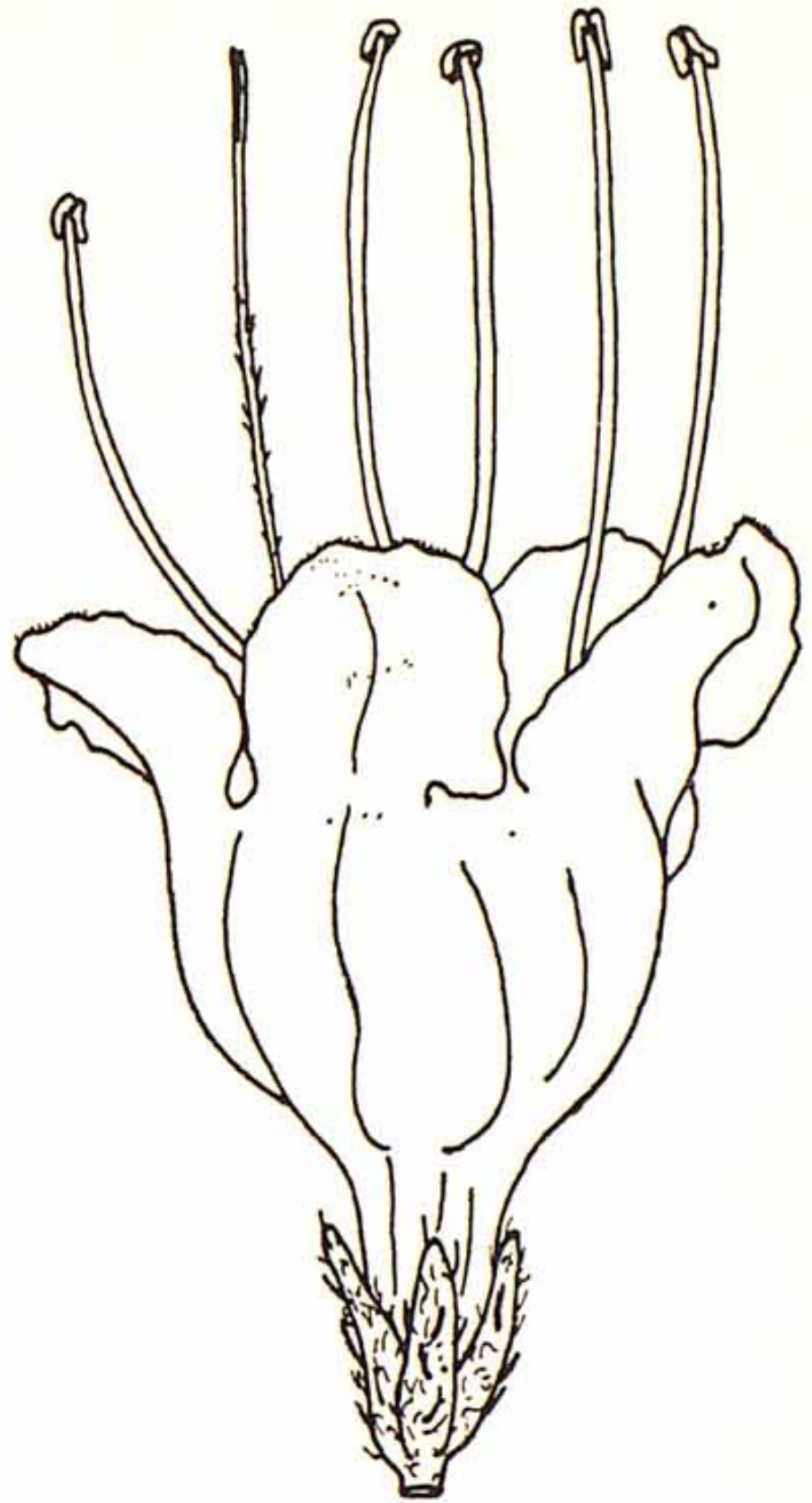
Relationships of the section Virescentia.

Virescentia is the largest of the sections in the Macaronesia and is also the most widespread with species on all the Canary Islands except Lanzarote and on the islands of Madeira and Porto Santo.

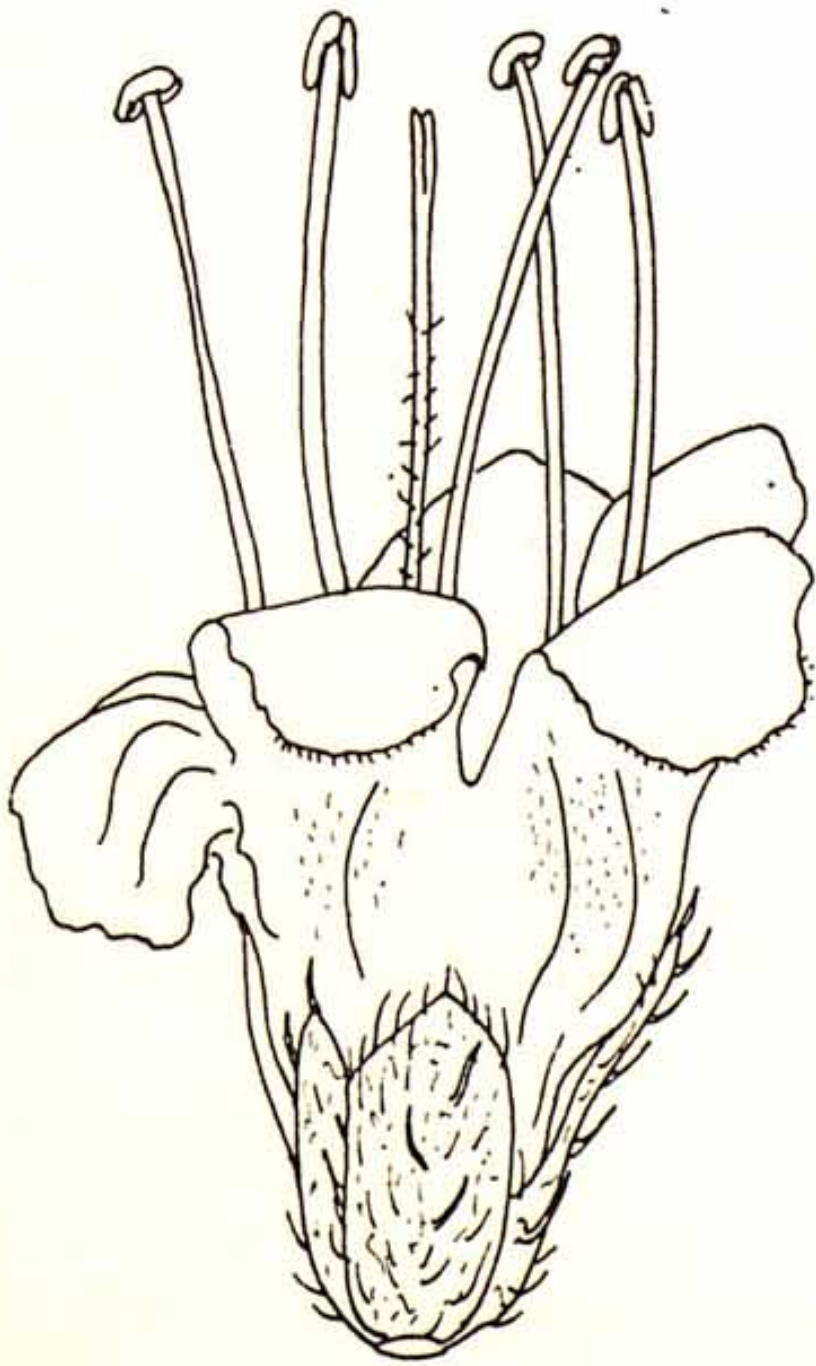
The greatest development is in the western Canaries where each island has its own morphologically similar, forest-cliff vicariant. Tenerife has two endemic species, one widespread (*E. virescens*) and one very restricted (*E. sventenii*). The eastern Canaries have three species, *E. onosmifolium*, a very distinct whitish to pale pink-flowered species from the dry southern slopes of Gran Canaria and the vicarious pair, *E. callithyrsum*, a very rare ravine plant from Gran Canaria, and *E. handiense* known only from the Jandia cliffs of southern Fuerteventura.



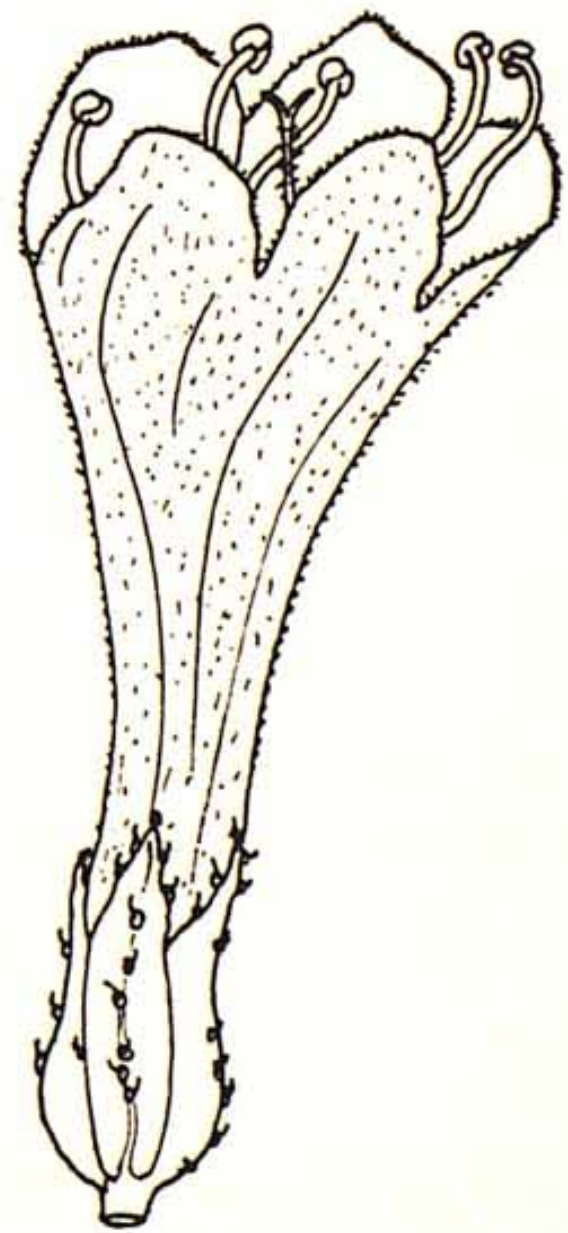
A



B



C



D

Fig. 7.—A. *E. wildpretii*; B. *E. pininana*; C. *E. simplex*; D. *E. gentianoides*.

The Madeiran archipelago species are morphologically and ecologically similar to the western Canaries species except for the extreme development of the corolla annulus into ten distinct lobes. *E. candicans* of Madeira has sometimes been united with *E. virescens* of Tenerife (*Index Kewensis*, 1893; DE CANDOLLE, 1846) as a single species but in fact the two can be separated on a number of characters. *E. nervosum* of Madeira and Porto Santo is found on coastal cliffs in areas of high humidity and in this feature it resembles *E. hierrense*.

Relationships of the Section Stricta.

This section contains two species, one which is widespread in the Canaries (*E. strictum*) and the other in the Cape Verde Islands (*E. stenosphon*).

Both species are very variable and a number of subspecies are recognised. *E. strictum* is the most widely distributed species of the subgenus occurring on five of the Canary Islands from near sea-level to the lower edges of the forest zone at about 1500 m.

Relationships of the Section Auberiana.

E. auberianum is the only species of this section. It is a subalpine species which grows in cinder and volcanic debris at about 2100 m. on Tenerife. Its relationships with the other sections are rather obscure and in many ways it seems to bridge the gap between the herbaceous and woody groups of *Echium*. The entire annulus, the presence of several different types of trichome in the indumentum and the very woody rootstock show affinities with the Macaronesian shrubs but in the absence of a true woody stem, the more or less included stamens and blue funnel-shaped corolla, it resembles some of the Mediterranean herbaceous species such as *E. vulgare*. The species occupies a geologically very recent habitat and may represent a transition from the older, more «primitive» woody shrubs of Macaronesia to the younger, more «advanced» herbaceous species of the Iberio-North African region.

Relationships of the Section Decaisnea.

This section is distinguished from the section *Gigantea* by the even lobing of the corolla which is not laterally compressed. There are two species in the section *E. dicaisnei* from the Canaries (Gran Canaria, Lanzarote and Fuerteventura) and *E. hypertropicum* from the Cape Verde Islands. Both species

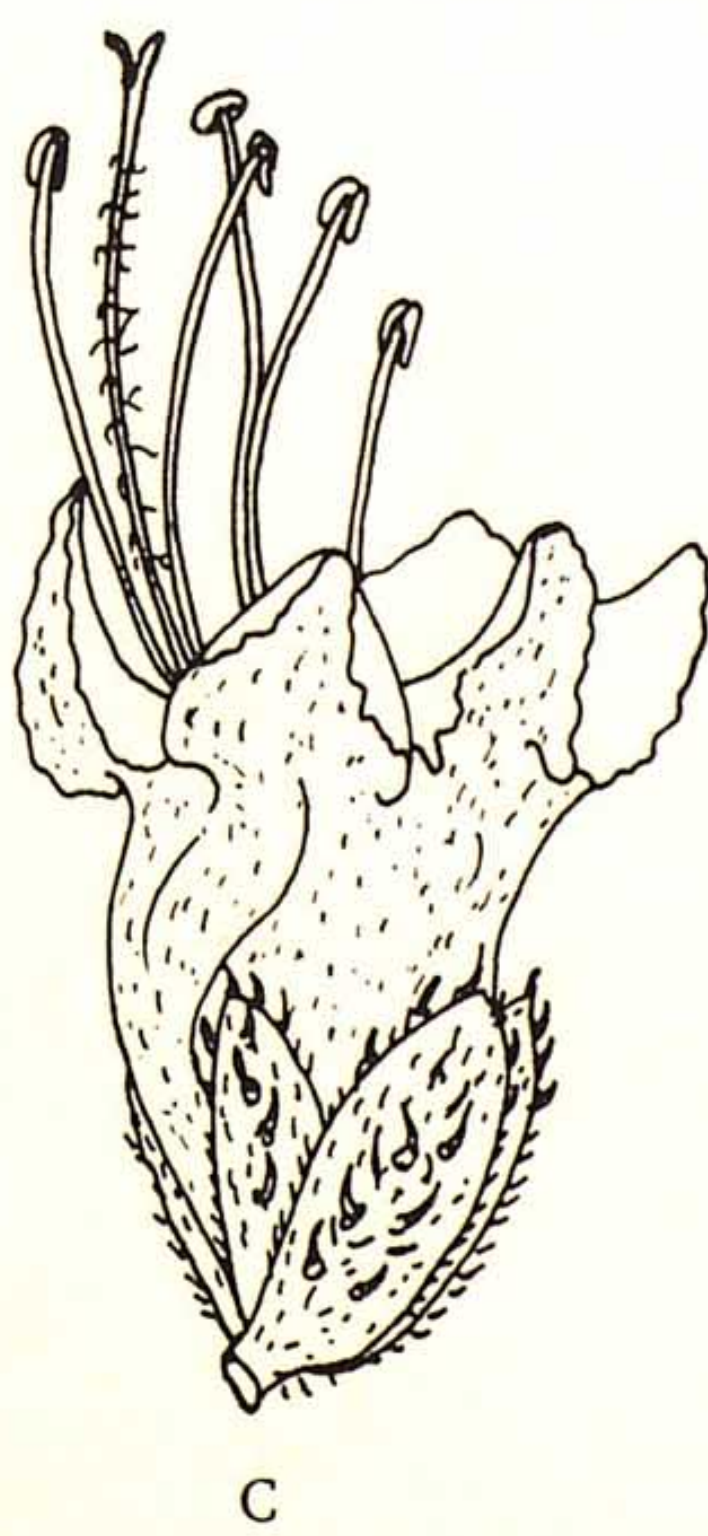
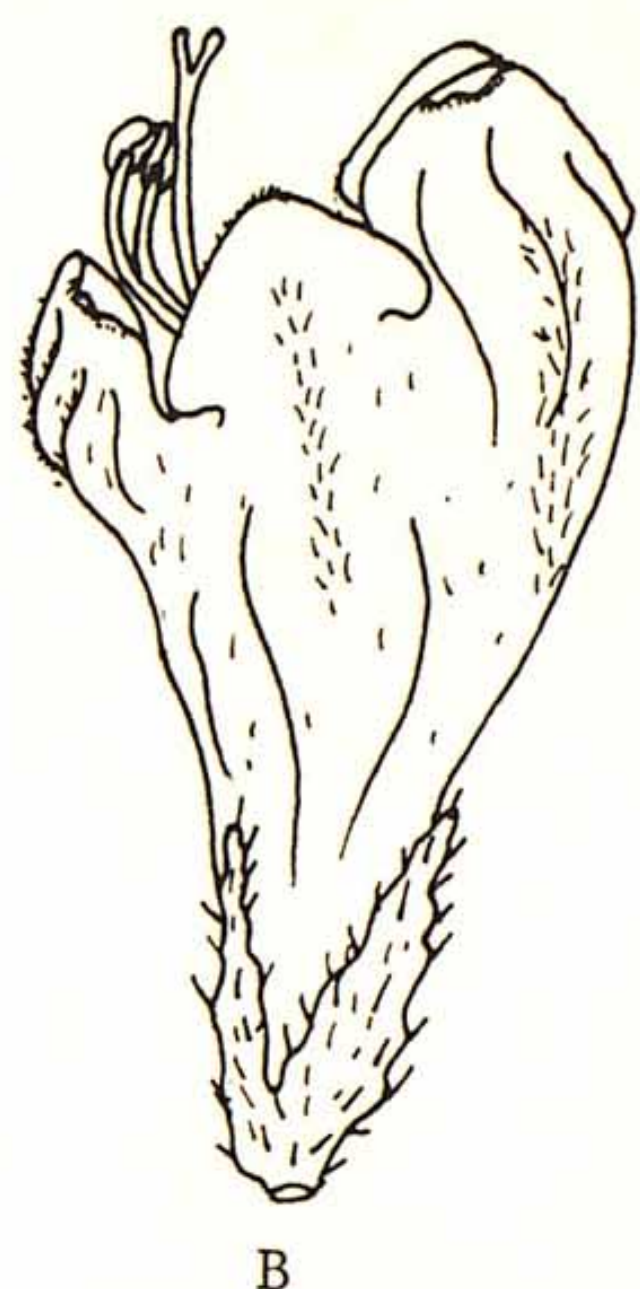
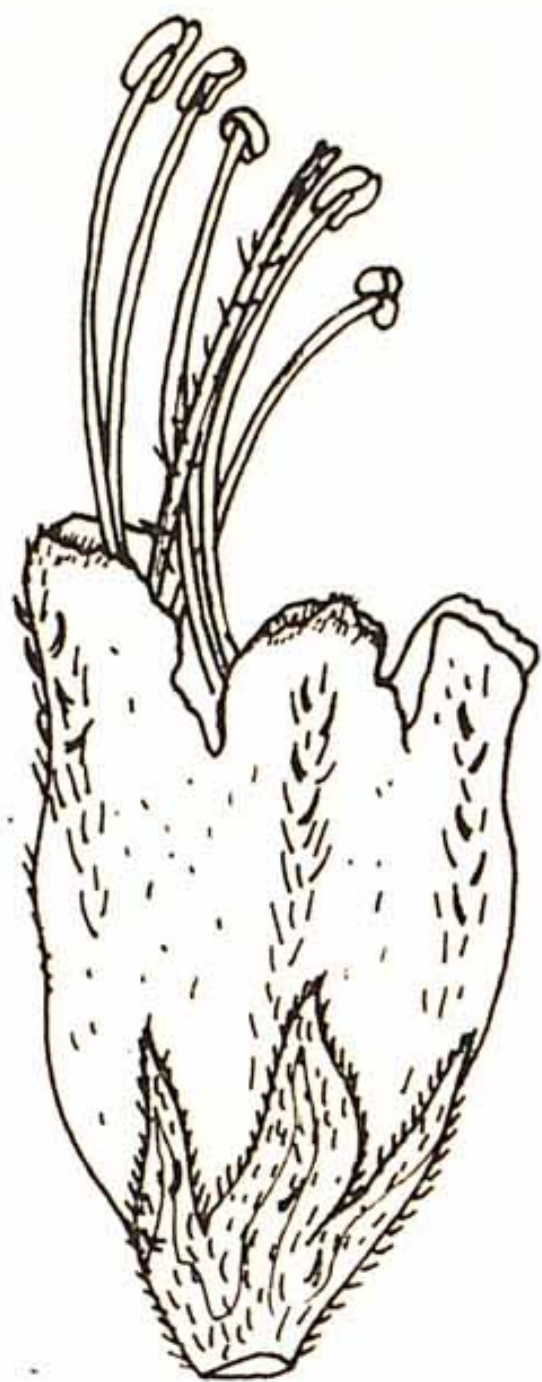
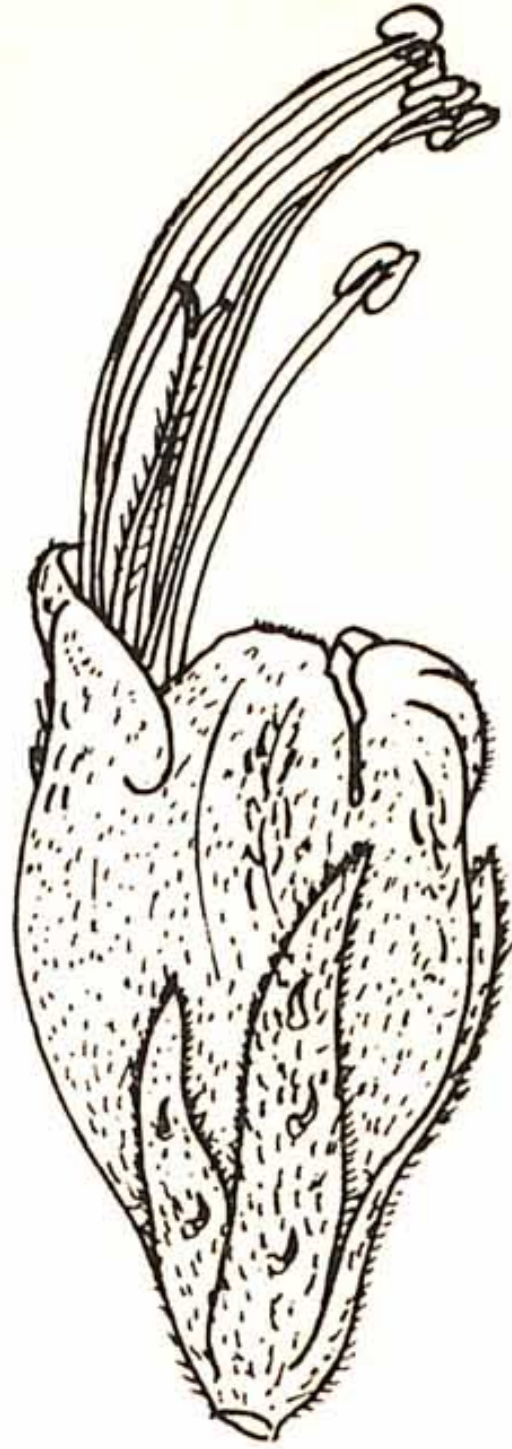


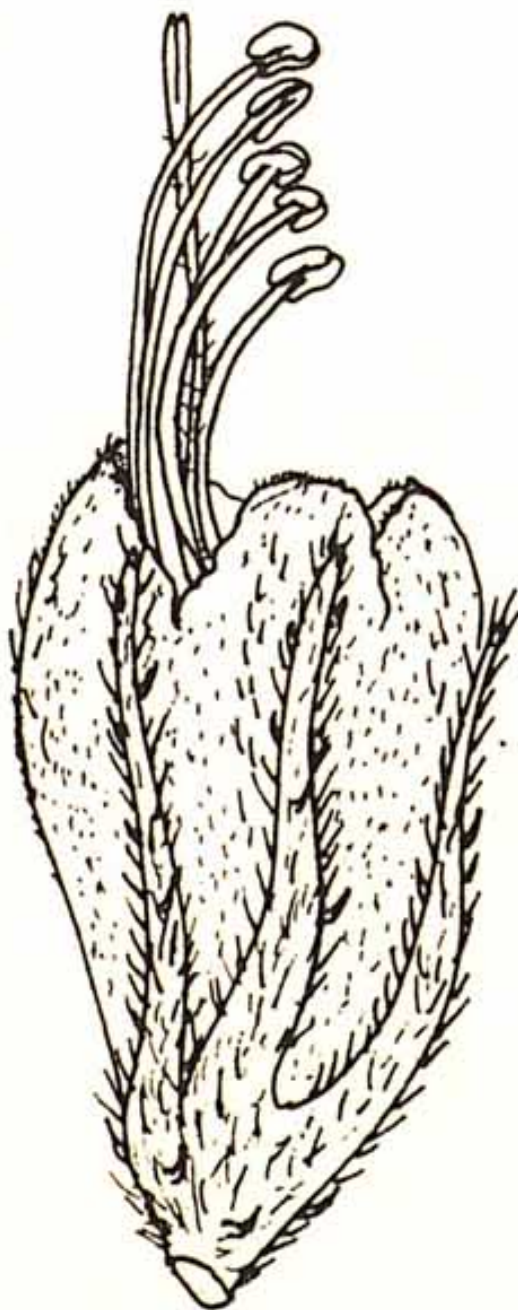
Fig. 8.—A. *E. plantagineum*; B. *E. bonnetii*; C. *E. decaisnei*; D. *E. auberianum* (All $\times 5$).



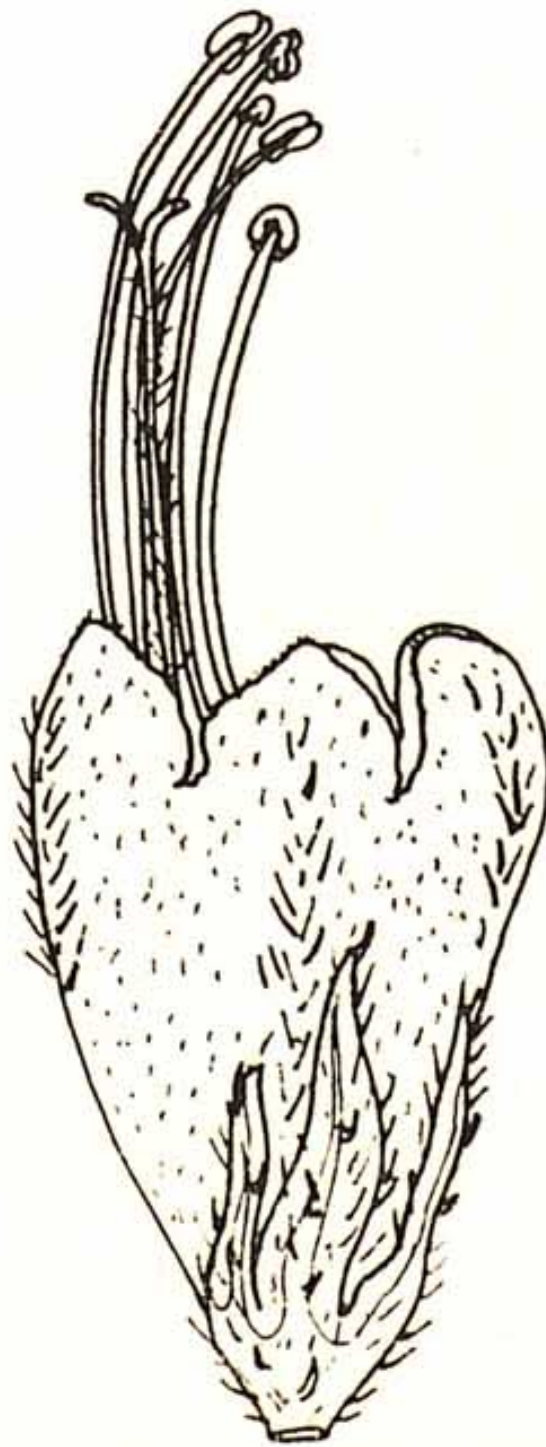
A



B



C



D

Fig. 9.—A. *E. giganteum*; B. *E. brevirame*; C. *E. aculeatum*; D. *E. leucophaeum*.
(All $\times 5$).

are adapted to xerophytic habitats having thick, almost leathery leaves and a dense habit.

Relationships of the Section Gentianoidea.

The only species, *E. gentianoides*, is a rare chasmophyte found on high mountain cliffs in the central region of La Palma. The floral morphology is unique amongst the Macaronesian species as the calyx is divided for only about half its length and has a distinct tube. The indumentum of flat discs with a very short central spur represents an extreme development of the pustular trichome and perhaps reflects the taxonomically isolated position of this species.

ECHIUM L., *Sp. Pl.*: 139 (1753).

Annual, biennial or perennial hispid herbs or shrubs, with an indumentum of tubercle-based setae and often an underlayer of short, stiff, appressed or patent hairs. Inflorescence thyrsoïd with lateral helicoid cymes often much enlarging in fruit. Calyx 5-lobed, usually accrescent. Corolla broadly to narrowly infundibuliform, with a tapering tube and usually oblique, open throat, usually more or less hairy outside. Corolla-tube usually with an annulus of 5-10 distinct scales or lobes or an undulate, entire, somewhat fleshy, collar-like membrane at the base. Stamens 5, often unequal, included or variously exserted from the corolla. Style exserted; stigma bifid or occasionally capitate. Nutlets 4, more or less triquetrous at the base, usually rugose.

Type. *E. italicum* L., *Sp. Pl.*: 139 (1753).

KEY TO THE SPECIES OF *ECHIUM* IN MACARONESIA

- | | | |
|----|---|------------------------|
| 1a | Annual to perennial herbs | 2 |
| 1b | Branched or unbranched shrubs | 6 |
| 2a | Corolla pale pink; leaves linear | 8. <i>triste</i> |
| 2b | Corolla blue; leaves lanceolate to ovate | 3 |
| 3a | Indumentum of long, yellow setae; perennial herb with woody stock | 25. <i>auberianum</i> |
| 3b | Indumentum of short, stiff, whitish setae; annual to biennial herbs | 4 |
| 4a | Corolla 22-30 mm.; cauline leaves and bracts sessile | 3. <i>plantagineum</i> |
| 4b | Corolla 9-20 mm.; cauline leaves petiolate | 5 |

- 5a Leaves ovate, very densely hairy; annulus of 5 distinct lobes **2. pitardii**
- 5b Leaves lanceolate, hispid; annulus an entire ring **1. bonnetii**
- 6a Unbranched, monocarpic shrubs with dense leaf-rosette 7
- 6b Branched shrubs 9
- 7a Leaves linear-lanceolate; corolla red (turning blue on drying) **12. wildpretii**
- 7b Leaves broadly lanceolate; corolla blue or white 8
- 8a Corolla white; leaf-rosettes more or less sessile (Tenerife) **10. simplex**
- 8b Corolla pale blue; leaf-rosette with woody stemp up 20 cm. (La Palma) **11. pininana**
- 9a Calyx lobes $\pm$ equalling tube; indumentum of upper leaf-surface of flat discs, lower surface $\pm$ glabrous (La Palma) **28. gentianoides**
- 9b Calyx segmented almost to base; indumentum of setae or hairs, more or less similar on both surfaces 10
- 10a Corolla laterally compressed, white; lobes markedly unequal 11
- 10b Corolla not laterally compressed, usually pink or blue (if white, then with pronounced blue stripes); lobes $\pm$ equal 15
- 11a Leaves linear to narrowly oblanceolate, the margins and lower midrib densely spiny; style scarcely bifid at tip (up to 1 mm.) 12
- 11b Leaves lanceolate, margins with a few or no spines; style distinctly bifid (1.5 mm. or more) 13
- 12a Calyx segments as long as corolla tube **5. aculeatum**
- 12b Calyx segments up to half as long as corolla tube **6. brevirame**
- 13a Leaves densely white-sericeous with long, pustular-based setae; corolla lobes only slightly unequal (Cape Verde Islands) **9. vulcanorum**
- 13b Leaves greyish-green with indumentum of short, simple hairs with a few pustular-based setae; dorsal corolla lobe longer than laterals (Canary Islands) 14
- 14a Inflorescence conical, without basal branches; leaves 1.5-3.5 cm. wide **4. giganteum**
- 14b Inflorescence a flattish dome usually with several basal branches; leaves less than 1.5 cm. wide **7. leucophaeum**
- 15a Inflorescence lax, with a few lateral cymes and long internodes; leaves ovate-lanceolate to ovate 16
- 15b Inflorescence dense, with many lateral cymes and very short internodes; leaves linear to lanceolate 17
- 16a Corolla 5-6 mm.; leaves scabrous to hispid with stiff, small setae (Canary Islands) **23. strictum**
- 16b Corolla 12-18 mm.; leaves very rough with stiff, very large setae (Cape Verde Islands) **24. stenosphon**
- 17a Inflorescence conical, very broad at base; corolla white with blue stripes or pinkish 18
- 17b Inflorescence cylindrical, scarcely broadening at base; corolla pink, blue or pink with blue stripes 19

- 18a Leaves broadly lanceolate; calyx densely hispid; corolla pinkish (Cape Verde Islands) **27. hypertropicum**
- 18b Leaves narrowly lanceolate; calyx subglabrous, occasionally with a few setae; corolla white with blue stripes (Canary Islands) **26. decaisnei**
- 19a Upper leaf-surface with indumentum of dense, large setae; lower surface usually with simple hairs 20
- 19b Leaf indumentum $\pm$ similar on both surfaces, usually simple, silky hairs or small setae 21
- 20a Leaf-margins revolute; corolla very pale pink-whitish (very rarely blue) **20. onosmifolium**
- 20b Leaf-margins not revolute; corolla deep blue **21. callithyrsum**
- 21a Hairs on veins of lower leaf-surface 1.5-2 mm. long; rosette leaves abruptly tapering to long, acuminate apex (Madeira) **18. candicans**
- 21b Hairs on veins of lower leaf-surface less than 1.3 mm. (usually less than 1 mm.) long; leaves evenly tapering to acute apex 22
- 22a Calyx-segments rounded at apex; corolla blue with white stripes; annulus distinctly 10-lobed (Madeira) **19. nervosum**
- 22b Calyx-segments acute or obtuse; corolla pinkish or blue, never with white stripes; annulus a $\pm$ entire fleshy ring 23
- 23a Leaves broadly lanceolate to elliptical; corolla deep blue (Fuerteventura) **22. handiense**
- 23b Leaves linear to lanceolate; corolla pink or blue 24
- 24a Leaves linear; corolla pale pink appearing 4-lobed (2 ventral lobes $\pm$ united), (Tenerife) **14. sventenii**
- 24b Leaves lanceolate; corolla pink or blue, 5-lobed 25
- 25a Nutlets very ornate, with long (2-3 mm.) projections; leaves up to 30 cm. long, 5-10 cm. wide (Gomera) **16. acanthocarpum**
- 25b Nutlets papillate or shortly echinulate; leaves up to 15 (-20) cm. long, less than 2.5 cm. wide 26
- 26a Calyx segments lanceolate; longest leaves 5-8 cm. long; thyse 10 (-15) cm. long (Hierro) **17. hierrense**
- 26b Calyx segments linear to linear-lanceolate; longest leaves more than 8 cm. long; thyse 10-30 cm. long 27
- 27a Lateral cymes bifid; corolla pink to pale blue (Tenerife) **13. virescens**
- 27b Lateral cymes simple; corolla blue (La Palma) **15. webbii**

Sect. 1. ECHIUM.

Annual to biennial herbs with or without a basal rosette of leaves. Corolla deep blue. At least 3 stamens included within the corolla-tube.

1. **E. bonnetii** Coincy, *Bull. Herb. Boiss., sér. 2, 2*: 748 (1901).
E. arenarium auct. Canar., non Guss. (1825).

Annual up to 25 cm. Basal rosette of up to 5 narrowly oblanceolate to ovate leaves. Rosette leaves 4-9 cm., acute, densely hispid, occasionally absent. Cauline leaves reduced above to linear bracts. Inflorescence simple or with 1-2 branches. Flowers distinctly pedicellate. Calyx 3-5 mm. at anthesis, up to 10 mm. in fruit; lobes linear, acute, hispid. Corolla blue, 8-15 mm. narrowly infundibuliform; upper lobes longer than the lower, pubescent; annulus a more or less continuous ring. Lower pair of stamens strongly exerted. Style exerted, lightly pubescent. Nutlets grey to black, rugose.

Type. «Tenerife, Volcan de Güimar, April. 1855», *H. de la Perraudière* (P!).

This species generally occurs in very dry, xerophytic scrub and on fine cinder cones in association with annual grasses and ephemeral herbs.

Key to the varieties of E. bonnetii.

Plants up to 15 cm. tall; basal rosette usually present; corolla lightly pubescent

(α) var. **bonnetii**

Plants up to 25 cm. tall; basal rosette usually absent; corolla very densely pubescent

(β) var. **fuerteventurae**

(α) var. **bonnetii**.

Distribution. Canary Islands: Tenerife, Gran Canaria, Fuerteventura.

Representative Specimens. **Canary Islands: Tenerife:** Volcán de Güimar, IV.1855, *Perraudière* (P); *ibid.*, III.1905, *Pitard* 262 (P); *ibid.*, 20.III.1933, *Asplund* 442 (K); *ibid.*, 1.V.1969, *Bramwell* 2238 (RNG); Valle Seco de Adeje, 10.III.1969, *Bramwell* 944 (RNG); Punta de Teno, 17.IV.1933, *Asplund* 821 (K); *ibid.*, 13.II.1969, *Bramwell* 671 (RNG); *ibid.*, 16.III.1969, *Bramwell* 982 (LTR, RNG, SEV); *ibid.*, 5.IV.1971, *Bramwell & Humphries* 3279 (BM, PNG); Slopes above Teno Bajo, 20.VI.1969, *Bramwell* 1737 (RNG).

(β) var. **fuerteventurae** (Lems & Holzap.) *Bramwell, Cuad. Bot. Canar.* 12: 4 (1971).

E. fuerteventurae Lems & Holzap., *Bull. Torrey Bot. Club* 95: 52 (1968).

Annual up to 25 cm. Basal rosette usually absent. Calyx lobes up to 6 mm., acute or obtuse. Corolla 12-17 mm.; lobes densely pubescent.

Type. «Volcan north of La Oliva, Fuerteventura», *Lems* 7061 (US). I have seen an isotype deposited in the Kew Herbarium (K!).

Distribution. Canary Islands: Fuerteventura; northern and central areas.

Representative Specimens. **Canary Islands: Fuerteventura:** Volcán de La Oliva, III.1966, *Lems* 7061 (K); *ibid.*, 13.V.1969, *Bramwell* 1540 (LTR, RNG); Betancuria, Barranco de la Pressa, 10.V.1969, *Bramwell* 1619 (RNG).

E. bonettii var. *fuerteventurae* is found in very dry rocky areas, on cinder cones and amongst coarse lavas at about 200-300 m.

In coastal regions near sea-level a very short-stemmed, succulent-leaved form of *E. bonnetii* sometimes occurs. This habit is not maintained in cultivation and plants revert to the typical habit with non-succulent leaves. LEMS & HOLZAPFEL (1968) referred this form to var. *pachycaulon* but as a phenecotype it can only be recognised at the rank of forma if at all.

2. *E. pitardii* A. Chev., *Fl. Cap. Vert*: 183 (1935).

E. lancerottense Lems & Holzap., *Bull. Torrey Bot. Club* 95: 50 (1968).

Annual up to 25 cm. Stem simple or branched at the base, erect, very densely hispid. Basal leaves ovate, petiolate, 4-6 x 3 cm., very densely pubescent, subacute. Cauline leaves like the basal but reduced to sessile bracts. Inflorescence lax, with up to 6 branches. Calyx 4-7 mm. at anthesis; lobes acute with bluish tips, hispid. Corolla purplish blue, 10-13 (-25) mm.; lobes subequal, densely pubescent especially distally; annulus of 5 separate fleshy lobes. Stamens all included or rarely the lower pair slightly exserted. Style exserted, pubescent. Nutlets black, rugose.

Type. «Lanzarote; Riscos Famara, 1905», *Pitard* 268 (P!).

This species is abundant in fields, at roadsides and as a rock-ledge plant in the Famara and Haría regions of Lanzarote.

Key to the varieties of E. pitardii.

Corolla 10-13 mm. long
Corolla 15-25 mm. long

(α) var. *pitardii*
(β) var. *macrantha*

(α) var. **pitardii**

Representative specimens. **Canary Islands: Lanzarote:** Haría valley, 17. I.1858, *Lowe* (K); *ibid.*, 14.V.1902, *Murray* (K); Los Valles, 8.III.1859, *Lowe* (K); Famara, 25.V.1892, *Murray* (BM, K); Peñitas de Chache, 15.V. 1969, *Bramwell* 1648 (RNG); Lanzarote, 1829, *Webb* (BM).

(β) var. **macrantha** (Lems & Holzap.) *Bramwell*, *Cuad. Bot. Canar.* 12: 4 (1971).

E. lancerottense Lems & Holzap. var. *macrantha* Lems & Holzap., *Bull. Torrey Bot. Club* 95: 52 (1968).

Like the typical variety, but with several flowering stems and very large, robust corollas up to 25 mm.

Type. «Lanzarote, Mirador del Río», *Lems* 6760 (US, n.v.).

Distribution. Canary Islands: Lanzarote: sporadic in the extreme north.

Representative specimens. **Canary Islands: Lanzarote:** Mirador del Río, 15.V.1969, *Bramwell* 1628 (RNG).

This large flowered variety occurs in the extreme northern area of Lanzarote between the village of Ye and the north coast. It is usually found in more extreme conditions than the typical variety in dry, windswept areas.

3. ***E. plantagineum* L.**, *Mantissa Alt.* 202 (1771).

E. lycopsis auct., non L.

Erect annual to biennial herb with one to many flowering stems. Basal leaves 5-16 x 1-2 cm., ovate to oblanceolate, with distinct lateral veins and appressed setae; cauline leaves oblong to lanceolate, the uppermost cordate to truncate at the base. Inflorescence usually branched. Calyx 7-12 mm. at anthesis, up to 17 mm. in fruit. Corolla 18-30 mm., infundibuliform, purplish blue, with hairs restricted to the veins and margins; annulus of 10 distinct lobes. Lower pair of stamens exserted; upper three included. Style included, lightly pubescent. Nutlets black, rugose.

Type. For typification see GIBBS (1971: 58).

Distribution. Canary Islands: Gran Canaria, Tenerife, La Palma, Hie-

ro, Gomera. Madeira. Azores. Widespread weed species probably introduced into Macaronesia.

Representative specimens. **Canary Islands: Tenerife:** Agua García, 7. XI.1968, *Bramwell* 359 (RNG); El Bailadero de San Andrés, 7.II.1969, *Bramwell* 652 (RNG); Buenavista, 13.II.1969, *Bramwell* 672 (LTR, RNG, SEV). **Gran Canaria:** Santa Lucía de Tirajana, 27.III.1969, *Bramwell* 1075 (RNG); Rincón de Tenteniguada, 26.III.1971, *Bramwell & Humphries* 3125 (BM, RNG). **La Palma:** Caldera de Taburiente, IX.1965, *Bramwell* 181 (LIVU); Pinar de Fuencaliente, 8.VI.1969, *Bramwell* 1859 (RNG). **Gomera:** Chorros de Epina, VIII.1964, *Bramwell & Winterhalder* 71 (LIVU); Barranco de la Laja, 25.VI.1969, *Bramwell* 1967 (RNG); Degollada de la Villa, 6.IV.1971, *Bramwell & Humphries* 3359 (BM, RNG).

Madeira Archipelago: Madeira: Funchal, undated, *Vogel* (K); *ibid.*, 3000 ft., 22.V.1913, *Sprague & Hutchinson* (K); Curral, VII.1852, *MacGillivray* 57 (K).

Azores: St. Michaels: 1865, *Godman* (K); *ibid.*, 1847, *Hunt* 2751 (K).

E. plantagineum is the only non-endemic species of the genus *Echium* found in the Atlantic Islands. It is widespread in cultivated ground and at roadsides from sea-level to almost 2000 m. in the western and central Canaries and also seems to be fairly abundant in the Azores and on the island of Madeira.

Sect. 2. GIGANTEA (Christ ex Spr. & Hutch.) *Bramwell, stat. nov.*

Echium 3 *Gigantea* Christ, *Bot. Jahrb.* 9: 128 (1888), *nom. illeg.*

Echium series *Gigantea* Christ sec. Spr. & Hutch. *Bull. Misc. Inf. Kew.* 1914: 265 (1914).

Branched shrubs. Inflorescence conical to convex. Corolla white to pale pink, laterally compressed, the dorsal lobe exceeding the others.

Type. *E. giganteum* L. fil.

4. *E. giganteum* L. fil., *Suppl.*: 131 (1781).

E. rupestre Salisb., *Prodr.*: 114 (1796).

E. giganteum fma. *genuina* Coincy, *Bull. Herb. Boiss., sér. 2, 4*: 271 (1903).

Shrub up to 2.5 m.; stems whitish, densely tomentose. Leaves 6-20 (-25) x 1.5-3.5 cm., lanceolate to oblanceolate, hispid to hirsute, sometimes with small

spinules on the margins and lower midrib, attenuate into a pronounced petiole; apex acute or obtuse, rarely acuminate. Inflorescence a broadly based, conical thyrse c. 10-15 cm.; lateral cymes usually simple, flowers pedicellate. Calyx 5-7 mm., segments linear-lanceolate, acute, much shorter than the corolla, hispid, occasionally with a few spinules along the mid-vein. Corolla white 10-20 mm., laterally compressed, the anterior lobe much longer than the others; outer surface pubescent especially on the veins; annulus a continuous, fleshy ring occasionally with 10 pronounced lobes, pubescent at the base. Stamens exserted. Style exserted, sparsely hairy, shortly bifid at tip. Nutlets c. 2.5 mm., greyish or black, echinulate. $2n = 16$ (BORGÉN, 1970).

Type. «N. coast of Tenerife in steep places 1778», *Masson* (BM!).

Distribution. Canary Islands: Tenerife-Orotava, N. coast from El Burgado to Realejos and Los Silos.

Representative specimens. **Canary Islands: Tenerife:** La Florida, 1889, *Christ* (Z); Las Arenas, Orotava, V.1889, *Christ* (Z); Ladera de Santa Ursula 300 m., I.1923, *Burchard* 180 (CGE, Z); *ibid.*, 26.VII.1867, *Lowe* (K); *ibid.*, 28.II.1930, *Maude* (BM); Puerto de Orotava, 19.II.1901, *Pérez* (BM, K); *ibid.*, 24.V.1901, *Pérez & Murray* (K); *ibid.*, 5.XI.1857, *Lowe* 98 (BM); Orotava Valley, 30.XII.1857, *Lowe* (BM, K); *ibid.*, 13.III.1933, *Asplund* 276 (K); *ibid.*, San Antonio, 11.XII.1857, *Lowe* (BM, K); *ibid.*, Mirador de Humboldt, VIII.1965, *Bramwell* 46 (LIVU); *ibid.*, 9.I.1969, *Bramwell* 499 (LTR, RNG, SEV); Villa Orotava, 20.X.1968, *Bramwell* 255 (LTR, RNG, SEV); above Puerto de la Cruz, 3.II.1935, *Chaytor* (K); Orotava, in hort., 31.III.1908, *Rikli & Schröter* (Z); Barranco de Los Silos, 19.III.1855, *Bourgeau* 1441 (C); *ibid.*, 1.II.1921, *Borgesen* 291 (C, K); Icod el Alto, I.1896, *Collet* (K); El Durasno, 26.V.1914, *Sprague & Hutchinson* 98 (K); El Burgado, 13.II.1845, *Bourgeau* 896 (BM, CGE, K); Icod de Los Vinos, 19.III.1933, *Tethewy* 152 (K); Barranco Gotera above San Juan de la Rambla, 14.I.1969, *Bramwell* 526 (LTR, RNG, SEV); San José, 300 m., 2.I.1969, *Bramwell* 479 (LTR, RNG, SEV); San Juan de la Rambla, sea-cliffs, 22.I.1969, *Bramwell* 549 (LTR, RNG); Playa de San Marcos, 24.I.1969, *Bramwell* 591 (LTR, RNG, SEV); Barranco de Ruiz, 200 m., 17.II.1969, *Bramwell* 719 (LTR, RNG, SEV).

E. giganteum is a species of fairly wide ecological amplitude growing at 5 m. above sea-level at San Juan de la Rambla up to 700 m. in the *Erica arborea* heath at Icod el Alto. It is found on steep, shady slopes and in ravines

in a number of different community types (*Cistus* maquis, *Erica* heath, succulent *Euphorbia* scrub).

Several varieties and forms of *E. giganteum* have been described in the literature. These are considered here to refer to other species of the *E. giganteum* complex. Within *E. giganteum* s. s. there is some variation in leaf-width, in the development of spinules on the leaf-margins and on the calyx veins. This variation is correlated with exposure and dryness of the habitat but does not blur the boundaries between this species and its nearest relatives. The diagnostic characters used to separate these species (*E. giganteum*, *E. brevirame*, *E. leucophaeum*, *E. aculeatum*): calyx-length, shape of inflorescence, development of large spines, length of style-arms, etc., remain constant in cultivation.

This species is often grown as a garden shrub in the Canaries.

5. ***E. aculeatum*** Poir., *Encycl. Méth. Bot.* 8: 664 (1808).

E. giganteum fma. *aculeata* Coincy, *Bull. Herb. Boiss.* 4: 273 (1903).

E. giganteum var. *aculeatum* Bornmüller, *Bot. Jahrb.* 33: 465 (1904).

E. aculeatum var. *genuinum* Bornmüller, l. c. (1904).

[*E. armatum* Chr. Sm., *in sched.*]

Shrub up to 1 m., densely branched, compact; stems rough, whitish, hispid. Leaves up to 15 x 0.3-0.5 cm., linear, rarely linear-lanceolate, shortly petiolate; both surfaces densely hispid; margins and midrib densely covered with large-based spines; apex acute. Inflorescence thyrsoïd, dense, broadly conical, rounded at the apex; lateral cymes simple or very rarely bifid; peduncles spiny, flowers subsessile. Calyx 10-15 mm.; segments linear, 0.6-1.2 mm. broad, acute, equal to or exceeding the corolla-tube, spinulose on midvein. Corolla white (very rarely blue), 10-15 mm.; the lateral lobes shorter than the others, the outer surface lightly pubescent to hispid; annulus a continuous, fleshy, subglabrous ring. Stamens twice as long as corolla, glabrous. Style exserted, hairy above the middle, bifid at tip. Nutlets brownish, echinulate-rugose. $2n = 16$ (LARSEN, 1960).

Type. *E. aculeatum* was described by POIRET from specimens collected by BROUSSONET in the Canary Islands in 1801. The holotype should be in the herbarium of DESFONTAINES at the Museum National d'Histoire Naturelle, Paris (P) but I have been unable to trace it. I have, however, seen a specimen to BROUSSONET's collection «M. Broussonet, Canaries 1801» in the

herbarium at the British Museum (BM) which can probably be considered as a duplicate of the type specimen.

Distribution. Canary Islands: Tenerife, Gomera, Hierro.

Representative specimens. **Canary Islands: Tenerife:** Buenavista, 25.V. 1879, *Hillebrand* (Z); *ibid.*, 23.VI.1901, *Bornmüller* 2656 (Z); *ibid.*, 1.II. 1921, *Borgesen* 330 (C); *ibid.*, 19.III.1855, *Bourgeau* 1431 (C, K); *ibid.*, II.1932, *Maude* (BM); *ibid.*, 15.III.1933, *Asplund* 322 (K); *ibid.*, III.1888, *Ball* (Z); inter Buenavista et Garachico, I.1905, *Pitard* 1609 (P); Punta de Teno, I.1905, *Pitard* 1608 (P); *ibid.*, 17.III.1969, *Bramwell* 975 (RNG, SEV); Barranco del Infierno de Adeje, 1882, *Hillebrand* (Z); *ibid.*, 22.X. 1965, *Kaae* (C); *ibid.*, 25.VI.1855, *Perraudière* (P); *ibid.*, IX.1965, *Bramwell* 924 (LTR, RNG, SEV); Valle de Santiago de Teide, V.1923, *Burchard* 119 (CGE, Z); *ibid.*, 29.III.1960, *Larsen* (C); *ibid.*, 12.I.1969, *Bramwell* 510 (RNG, SEV); El Palmar, 2.I.1921, *Borgesen* 330 (C); Montaña de Tanco, undated, *Webb* (BM, CGE, K); Teno Alto, 27.III.1933, *Asplund* 579 (K); Tamaimo, Hoya de Malpais, 5.III.1969, *Bramwell* 872 (LTR, RNG, SEV); Cumbres de Masca, 25.IV.1969, *Bramwell* 1383 (LTR, RNG, SEV); Valle de Masca, 27.X.1968, *Bramwell* 288 (RNG); *ibid.*, IX.1965, *Bramwell* 29 (LIVU); Cult. ex Valle de Masca, 29.III.1960, *Larsen* 189 (C); Tenerife s. l., *Smith* (C). **Gomera:** Barranco de la Villa, San Sebastián, 4.III. 1888, *Kuntze* (K); *ibid.*, 24.V.1894, *Murray* (K); *ibid.*, 14.IV.1901, *Bornmüller* 2656 (Z); *ibid.*, 24.V.1957, *Larsen* (C); *ibid.*, III.1905, *Pitard* (P); Hermigua, 20.IV.1861, *Lowe* (BM, Z); Valle Gran Rey, VIII.1965, *Bramwell* 18 (LIVU); Roque de Agando, 27.VI.1969, *Bramwell* 2014 (RNG, SEV); Tagamiche, 27.VI.1969, *Bramwell* 2016 (LTR, RNG, SEV); Barranco de la Laja, 25.VI.1969, *Bramwell* 1968 (RNG); Valle de Argaga, 1.VII. 1969, *Bramwell* 2054 (RNG, SEV); La Fortaleza de Chipude, 2.VII.1969, *Bramwell* 2079 (LTR, RNG, SEV); Degollada de San Sebastián, 8.IV.1971, *Bramwell & Humphries* 3362 (BM, RNG). **Hierro:** Punta de Salmar, 9.IV. 1971, *Bramwell* 3344 (BM, RNG).

E. aculeatum is a shrub of the *Euphorbia* community (Crassi-Euphorbietea macaronesica) which occurs on dry slopes in the xerophytic zone in the Canary Islands. This species is found between 10 and 400 m. on northern slopes and up to 1000 m. in the south. On Tenerife it is most frequent in the west and south west from Buenavista to Adeje and Arona. On the island of La Gomera, *E. aculeatum* is abundant in the coastal region of the north and

east from Valle Hermoso to Playa de Santiago and also in the south west at Valle Gran Rey and Argaga.

E. aculeatum is variable in habit, leaf-width and degree of armature of the leaf-margins. On Tenerife the leaves are narrower and more spiny in drier places and there is a general N - S trend from broader, less spiny leaves to narrower spiny ones. Where plants occur in dry exposed places they form dense compact shrubs up to 60-70 cm. in height. In sheltered areas and deep ravines such as the Barranco del Infierno de Adeje in the south of Tenerife the species can become subarborescent, up to two metres tall with a stout woody stem. The diagnostic characters such as leaf-shape, presence of spines and length of the calyx show a small amount of variation which does not obscure species boundaries within this group (*E. brevirame*, *E. leucophaeum*, *E. giganteum*, *E. aculeatum*).

6. *E. brevirame* Sprague & Hutchinson, *Bull. Misc. Inf. Kew* 1914: 121 (1914).

E. aculeatum Poiret var. *leucophaeum* Bornmüller, *Bot. Jahrb.* 33: 465 (1904), *quoad stirpe palmensem*.

E. giganteum L. fil. fma. *inermis angustifolia* Coincy, *Bull. Herb. Boiss., sér. 2, 4*: 273 (1903).

E. leucophaeum Webb sensu Lems, *Sarracenia* 5: 16 (1960), *pro parte, excl. typo*.

Shrub 40-80 cm.; stems short, up to 15 cm., rough, with dense, whitish indumentum. Leaves 5-15 x 0.5-0.8 cm., narrowly oblanceolate to linear, subsessile; with a dense indumentum of very short, stiff, simple hairs; margins and lower midrib somewhat spinescent; apex obtuse to apiculate. Inflorescence a short, broad-based, conical thyse 5-12 cm. long, lateral cymes usually simple; peduncles 20-30 mm. Flowers distinctly pedicellate; pedicels up to 3.5 mm. Calyx 3-6 mm.; segments lanceolate, hispid, spinulose on central veins, accrescent in fruit. Corolla white, 10-12 mm., laterally compressed, sparsely hairy on outer surface; anterior lobe 2-3 mm., exceeding the lateral lobes; annulus subentire slightly hairy at base. Stamens exerted; filaments glabrous, whitish. Style exerted, spinulose, scarcely (0.3-0.5 mm.) bifid at the apex. Nutlets black, roughly chinulate.

Type. «La Palma eastern region; norther face of the Barranco Carmen, 31.V.1913», *Sprague & Hutchinson* 162 (K!).

Distribution. Canary Islands: *E. brevirame* is endemic to the island of La Palma.

Representative specimens. **Canary Islands: La Palma:** Barranco del Carmen, 31.V.1913, *Sprague & Hutchinson* 162 (K); *ibid.*, 26.IV.1901, *Bornmüller* 2658 (Z); *ibid.*, 8.VI.1969, *Bramwell* 1862 (LTR, RNG, SEV); Barranco del Río, 9.VI.1892, *Murray* (K); *ibid.*, 10.VI.1892, *Murray* (K); *ibid.*, V. 1880, *Hillebrand* (Z); Los Llanos de Aridane, VI.1892, *Murray* (BM); Santa Cruz de la Palma, 29.V.1957, *Larsen* (C); Puntallana, 8.VI.1969, *Bramwell* 1863 (RNG, SEV); Fuencaliente, Volcán de San Antonio, 9.VI.1969, *Bramwell* 1864 (CGE, LTR, RNG, SEV); Barranco de las Angustias, IX.1965, *Bramwell* 130 (LIVU); *ibid.*, 10.VI.1969, *Bramwell* 1896 (LTR, RNG); between Fuencaliente and the south coast, 15.IV.1971, *Bramwell & Humphries* 3419 (BM, RNG).

This species occurs in the xerophytic zone of La Palma between sea level and about 600-700 m. Large populations are located at Fuencaliente between the town and the coast, between Los Llanos and Tazacorte and in the lower reaches of the valleys north of Santa Cruz. The species is very variable in habit with a tall race in the upper xerophytic zone and a distinct low-growing coastal ecotype in the cinder rubble and volcanic sand below Fuencaliente and Volcán de San Antonio. This ecotype seems to be a phenotypic variant as plants raised from seed collected in the field do not have the dwarf, compact habit of their parents.

E. brevirame has, in the past, often been confused with *E. leucophaeum* (BORNMÜLLER, 1904; LEMS, 1960) or with *E. aculeatum* (PITARD & PROUST, 1908) but is a distinct species recognisable by the form of its inflorescence, the length-ratio of calyx/corolla, the obtuse leaves, very short indumentum-hairs, and the short style-arms.

7. *E. leucophaeum* Webb ex Spr. & Hutch., *Bull. Misc. Inf. Kew* 1914: 119 (1914).

E. aculeatum var. *leucophaeum* (Webb) Christ, *Bot. Jahrb.* 9: 128 (1888).

E. giganteum var. *leucophaeum* (Webb) Bornmüller, *Bot. Jahrb.* 33: 466 (1903).

E. giganteum fma. *inermis angustifolia* Coincy, *Bull. Herb. Boiss., sér. 2, 4*: 273 (1903), *pro parte*.

[*E. aculeatum* fma. *inermis* Lowe, *in sched.*]

[*E. leucophaeum* Webb in Bourg., *Pl. Canar. Exsicc.* 466 (1846); 1438 (1855), *in sched.*]

Shrub, 1-2 m.; stem and branches whitish; bark papery. Leaves 7-12 x 0.5-0.7 cm., linear-lanceolate, shortly petiolate to sessile, apex usually obtuse; indumentum of stiff, simple, appressed hairs; spinules usually absent. Inflorescence short, convex and thyrse occasionally branched at base, scarcely raised above subtending leaf rosette; lateral cymes simple or a rarely bifid; peduncle c. 5 mm. Flowers sessile, about 13 mm. long. Calyx up to 5 mm. shorter than corolla; segments linear-lanceolate, subacute, densely hispid, with a few spinules on the mid-vein, slightly accrescent in fruit. Corolla white, 10-12 mm.; anterior lobe up to 2 mm. longer than laterals; outer surface glabrous to slightly pubescent; annulus an undulating fleshy ring, slightly pubescent. Stamens exserted; filaments pinkish. Style hairy, bifid at tip to about 1 mm. Nutlets blackish, about 3-4 mm., echinulate. $2n = 16$ (BRAMWELL et al., 1971).

Type. «Teneriffa in rupibus Baxamar, maio 1846». *Bourgeau* 466 (K!).

Distribution. Canary Islands: Tenerife, Sierra de Anaga.

Representative specimens. **Canary Islands: Tenerife:** in rup. siccis reg. inferioris, III.1845, *Bourgeau* 53 (BM, CGE, K); in rupestribus Convallium Baxamar et Bufadero, 6.III.1855, *Bourgeau* 1438 (C, K, Z); in rupibus Baxamar, V.1846, *Bourgeau* 466 (BM, CGE, K); Bco. de San Andrés, 5.V.1899, *Murray* (K); ibid., 2.XII.1968, *Bramwell* 425 (LTR, RNG, SEV); Anaga, 26.III.1855, *Perraudière*, s. n., (K, P); Las Mercedes, 600 m., 11.VI.1900, *Bornmüller* 1012 (Z); prope Tegueste, 400 m., 17.VI.1900, *Bornmüller* 1011 (Z); in convallis Anagae, undated, *Bolle* (Z); Valle Seco, III.1852, *Bolle* (Z); El Bailadero above San Andrés, 3.I.1969, *Bramwell* 498 (LTR, RNG, SEV); Cumbres de Taganana, 700 m., 7.II.1969, *Bramwell* 642 (LTR, RNG, SEV); Cumbre de Igueste, 600 m., 1.III.1969, *Bramwell* 824 (LTR, RNG, SEV).

E. leucophaeum seems to be confined to the upper xerophytic zone and *Erica arborea* heath of the Sierra de Anaga, the extreme north-east promontory of Tenerife. It occurs between 300 and 700 m. and is locally frequent particularly in the upper part of the Valle de San Andrés. Records of this species from La Palma seem all to be referable to *E. brevirame* Spr. & Hutch.

The ecological range of this species seems to be limited and there is a little variation even in habit. The compact convex inflorescence borne on a very short peduncle is particularly characteristic of this species.

8. *E. triste* Svent., *Addit. Fl. Canar.* 1: 49 (1960).

Annual, biennial or perennial herb; stems simple or branched at the base, erect, up to 60 cm., greyish, densely hispid. Leaves usually in a basal rosette, 10 x 1 cm., linear to linear-lanceolate, acute, subsessile, with both surfaces covered with large-based pustular spines; midrib prominent below. Inflorescence a lax thyrse; lateral cymes simple, patent. Flowers subsessile. Calyx 6 mm.; segments linear, acute to obtuse, accrescent in fruit, hispid. Corolla 12-15 mm., pinkish, the tube somewhat sigmoid; the anterior lobe longer than the others, rotund-ovate, pubescent; annulus a thick, pubescent ring. Stamens exserted; filaments glabrous, inserted near the base of the corolla-tube. Style exserted, densely hispid-pubescent, bifid at the tip; stigma somewhat globose. Nutlets conical, obtuse. $2n = 16$ (BRAMWELL et al., 1972).

Type. «3 aprilis 1947, Canaria Magna; supra oppidulum Agaete dictum, versus 100 m. supra mare, ubi legi cum flore et fructu». *Sventenius* (ORT!). I must reject KUNKEL's lectotypification of this species (KUNKEL, 1969) by one of his own specimens as being superfluous. KUNKEL considered that the protologue contained no citation of a type specimen and, therefore, that the name was invalidly published (Art. 37, International Code 1961) despite the fact that this is clarified in the preface to SVENTENIUS (1960) (see BRAMWELL 1970).

Key to the infraspecific taxa of E. triste.

- | | |
|--|------------------------------|
| Short-lived robust, perennial herb; corolla 1.2-1.5 cm.; lobes flaired | (a) subsp. triste |
| Annual or biennial; corolla less than 1.1 cm.; lobes scarcely flaired | (b) subsp. nivariense |
| Leaf-margins entire; nutlets greyish-papillate | (α) var. nivariense |
| Leaf-margins crispate-undulate; nutlets scabrous, subcostate on dorsal surface | (β) var. gomeraceum |

(a) subsp. **triste**.

Distribution. Canary Islands: Gran Canaria: Valle de Agaete, Puerto de Mogan, up to 150 m. a. s. l.

Representative specimens. **Canary Islands: Gran Canaria:** Agaete 100 m., 3.IV.1947, *Sventenius* (ORT); Valle de Mogan 50 m., 14.III.1969, *Kunkel* 12664 (C, Herb. Ku.); Puerto de Mogan 100 m., 21.III.1971, *Bramwell & Humphries* 3067 (BM, RNG); cultivated, ex Valle de Agaete (Sunding leg.), X.1970, *Bramwell* (RNG).

(b) subsp. **nivariense** (Svent.) Bramwell, *stat. nov.*

E. triste var. *nivariense* Svent., *Addit. Fl. Canar.* 1: 51 (1960).

Annual or biennial herb up to 1 m. Leaves loosely rosulate at base, up to 15 (-20) cm., densely hispid with simple and pustular trichomes. Inflorescence up to 65 cm. Calyx-segments acute. Corolla shorter than in subsp. *triste*. Nutlets brown with greyish papillae.

Type. «Nivariae Insula; regione australi versus 200 m. alt., inter pagum dictum "Playa San Juan" et oppidum Adexem. Legit cum flore et fructu die 26 Martii 1950». *E. R. Sventenius* (ORT!).

Distribution. Canary Islands: Tenerife, amongs rocks and at the edges of dry fields in the south of the island between San Juan and Adeje, 100-300 m., and in dry rocky areas near Candalaria.

Representative specimens. **Canary Islands: Tenerife:** inter pagum dictum Playa San Juan et oppidum Adexem, 26.III.1950, *Sventenius* (ORT); west of Adeje 350 m., 9.III.1969, *Sventenius* (ORT); Barranco Manchitas west of Adeje 350 m., 9.III.1969, *Bramwell* 908 (CGE, LTR, RNG, SEV); sandy slopes above Playa San Juan 100-200 m., 9.III.1969, *Bramwell* 908a (RNG).

(β) var. **gomeraeum** Svent., *Addit. Fl. Canar.* 1: 51 (1960).

Biennial herb with several axial inflorescences arising from the basal rosette. Leaves with crispate-undulate margins. Corolla-throat oblique; lobes oblong. Nutlets roughly scabrous, subcostate on the dorsal surface.

Type. «Junonia Minor (Insula Gomera); regione australi juxta plagam Argagae, ubi est sat abundanter. Die 10 October 1957 inventa et cum fructu lecta fuit». *E. R. Sventenius* (ORT!).

Distribution. The Gomera variety of subsp. *nivariense* is very rare and is found only in a very small area of the coastal region at Playa de Argaga near Valle Gran Rey on the south-west side of the island.

Representative specimens. **Canary Islands: La Gomera:** juxta plagam Argagae, 10.X.1957, *Sventenius* (ORT); *ibid.*, 25.V.1958, *Sventenius* (ORT); *ibid.*, 21.VII.1969, *Bramwell* 2051 (LTR, RNG, SEV).

E. triste, though herbaceous, is a member of the frutescent group. Indumentum and corolla-characters place it in the section *Gigantea* and it is probably the most adapted to xerophytic conditions of all the Canarian species. It is found in all cases in very dry areas usually in the coastal region. The largest populations are in the south of Tenerife, west of the town of Adeje where it is very common along the edges of fields and roadsides with *Heliotropium erosum*. The Gran Canaria subspecies seems to be most usually perennial, though KUNKEL (1969) also mentions biennial plants from the island. Cultivated material grown from seed collected by SUNDING in 1969 and SVENTENIUS in 1968 behaved as perennial plants in cultivation. The Gomeran plants seem to be biennial and the Tenerife ones annual or biennial, biennials tending to produce both annual and biennial offspring but the annuals generally breed true.

9. *E. vulcanorum* A. Chev., *Fl. Cap Vert*: 183 (1935).

[*E. sericeum* A. Chev., *in sched.*, *nom. nud.*]

Much branched shrub up to 1.5 m. Stem densely tomentose. Leaves 6-10 x 1-1.5 cm., lanceolate, subacute; the surfaces densely hispid to sericeous with long, pustular trichomes; veins more or less prominent below. Inflorescence a short, dense, subconical thyrse up to 18 cm.; lateral cymes simple, shortly pedunculate. Flowers sessile. Calyx-segments linear-lanceolate, 6-7 mm., subacute, densely hispid. Corolla infundibuliform, somewhat laterally compressed, with slightly unequal lobes, white or occasionally bluish, pubescent; annulus subentire, lightly pubescent. Stamens exserted. Style exserted, lightly hispid, shortly bifid with globose stigma. Nutlets brownish, oblong to conical, echinulate.

Type. I have not been able to see the type specimen «A. Chevalier 44871, 23.7.1934, Ile de Fogo, La Caldeira» (P) but an adequate photograph of it is given in CHEVALIER (1935). I have, however, seen a duplicate of this specimen bearing the same collecting number and locality which can be considered an isotype (P!).

Distribution. Cape Verde Islands; endemic to the island of Fogo.

Representative specimens. **Cape Verde Islands: Ilha de Fogo:** Chupadeiro, 25.VII.1934, *Chevalier* 44889 (P); La Caldeira, 23.VIII.1934, *Chevalier* 44871 (P); Chara Furna, 27.VII.1934, *Chevalier* 44928 (P); Monte Mhuco, 24.III.1864, *Lowe* (BM, K); volcanic cone, 16.II.1866, *Lowe* (BM).

E. vulcanorum is a member of the *E. giganteum* group of species and can be considered as a vicariant of *E. giganteum* itself. It occurs between 900 and 2000 m. (CHEVALIER 1935) on dry volcanic rocks. As with *E. stenosiphon* and *E. hypertropicum*, the other Cape Verde Islands species, very little herbarium material is available and apart from CHEVALIER's own collections only a few specimens collected by LOWE (BM, K) have been seen. There is some variation in leaf-width, though, as no ecological data are available, it is impossible to determine whether this is due to variation in age, as in some of the Canarian species, or correlated with habitat conditions.

Sect. 3. SIMPLICIA (Christ ex Spr. & Hutch.) Bramwell, *stat. nov.*

Echium l. *Simplicia* Christ, *Bot. Jahrb.* 9: 126 (1888), *nom. illeg.*

Echium series *Simplicia* Christ sec. Spr. & Hutch. *Bull. Misc. Inf. Kew.* 1914: 265 (1914).

Unbranched monocarpic shrubs with a dense terminal inflorescence.

Type. *E. simplex* DC.

10. *E. simplex* DC., *Cat. Pl. Horti Monsp.*: 108 (1813).

Monocarpic shrub living 4-5 years. Stem short, unbranched, 10-15 cm. Leaves crowded at tip of stem, elliptic-lanceolate, 10-40 x 4-9 cm., densely hispid with simple trichomes; veins prominent beneath; petiole short, up to 3 cm., apex subacuminate. Inflorescence a large, dense, cylindrical thyrse up to 2 m., tapering abruptly at apex; lateral cymes 1 to 3-fid, the peduncles 20-25 mm. Flowers sessile. Calyx c. 6 mm., somewhat accrescent in fruit; segments lanceolate, acute, densely hairy with occasional setae along the midvein. Corolla 9-12 mm., narrowly campanulate, white with faint bluish lines; lobes equal, 1-3 mm., rounded, sparsely pubescent; annulus a thick, fleshy, slightly undulating, pubescent ring. Stamens strongly exserted, the filaments glabrous. Style exserted, hairy below. Nutlets greyish brown, conical, somewhat hispid, with pronounced tubercles. $2n = 16$ (BRAMWELL et al., 1971).

Type. «*E. simplex* DC. hab. in Insula Teneriffa ex Herb. Broussonet» (MPU!).

Distribution. Canary Islands: Tenerife. *E. simplex* is restricted to the coastal region of the north-east of the island between Bajamar and Taganana.

Representative specimens. **Canary Islands: Tenerife:** Taganana, 1801, *Broussonet* (BM); s.l., undated, *Broussonet* (BM); *ibid.*, *Broussonet* (MPU); San Miguel de Geneto, undated, *Berthelot* (Z); cult., in Puerto de Orotava, 1855, *Honnegger* (Z); in convalleis Baxamar, V.1846, *Bourgeau* 467 (BM, CGE, K, P, Z); in rupestribus Baxamar, 5.VI.1855, *Bourgeau* 1435 (BM, C, K, MPU, P, Z); Bajamar, undated, *Lowe* (K); *ibid.*, undated, *Webb* (K); Orotava in hort., VII.1900, *Bornmüller* 999 (Z); basalt cliffs above the town of Bajamar 250 m., 24.V.1969, *Bramwell* 1670 (LTR, RNG); Taganana, Roque de las Animas 120 m., 5.VIII.1969, *Bramwell* 2165 (RNG). **Gran Canaria:** cultivated at Santa Brígida, 29.IV.1894, *Murray* (K).

This species is a chasmophyte found on basalt cliffs between 100 and 400 m. It is very rare and the two largest populations at Bajamar and Roque de las Animas are both small, consisting of about 55 and 30 individuals respectively, and under such circumstances a wide range of variation is not to be expected. Plants of *E. simplex* are monocarpic and exist for four to five years in a vegetative state after which they flower producing a large terminal inflorescence and a large quantity of seed before dying.

11. *E. pininana* Webb & Berth., *Phyt. Canar.* 3: 44 (1846).

E. piniana Pitard & Proust, *Les Iles Canaries, Fl. Archipel.*: 277 (1908).

Monocarpic shrub. Stem up to 75 cm., unbranched, 3-5 cm. in diameter, roughly hispid. Leaves crowded towards apex of stem, lanceolate to broadly lanceolate-ovate, up to 50 x 6-10 cm., acuminate, attenuate to a narrow petiole; veins prominent especially below; young leaves covered with simple hairs, mature leaves with large-based, appressed setae. Inflorescence a long, cylindrical thyrse up to 3.5 m., acute at apex, the axis 1-2 cm. in diameter, sparsely hispid; lateral cymes 1- to 3-fid. Flowers subsessile. Calyx campanulate; segments 4 x 2 mm., ovate, obtuse, ciliate at margin, otherwise glabrous, accrescent in fruit. Corolla blue or rarely white with bluish lines, narrowly infundibuliform, up to 13 mm., lightly pubescent; lobes 2 mm., crenulate to entire; annulus narrow, irregularly lobed with long hairs at base. Stamens well exerted, the filaments glabrous. Style hispid, deeply bifid at tip. Nutlets brownish, about 2 mm., narrow-conical, subspinescent. $2n = 16$ (LITARDIERE, 1943).

Type. «*Echium pininana* sp. nov. Habit. Barlovento ins. Palmae, dedit. P. Barker-Webb» (FI!).

Distribution. Canary Islands: La Palma. *E. pininana* is found only on the eastern side of the island.

Representative specimens. **Canary Islands: La Palma:** Monte de Barlovento, 28.V.1858, *Lowe* 264 (BM, K, P); Barlovento, undated, *Webb* (FI, K, P); Cubo de la Galga 800 m., V.1911, *Burchard* 5 (CGE, Z); mountains above Barranco del Agua, Los Sauces 1000 m., 7.VI.1969, *Bramwell* 1835a (RNG); laurel forest, Los Tiles 800 m., 15.IV.1971, *Bramwell & Humphries* 3401 (RNG).

As in the case of the other two monocarpic rosette species in the Canary Islands (*E. wildpretii* and *E. simplex*), *E. pininana* has a very restricted distribution and very specialized ecological requirements. It grows between 600 and 1000 m. in cloud-zone laurel forests and *Erica arborea* heath and according to SVENTENIUS (*in litt.*) does not form its normal, unbranched inflorescence at lower levels or in exposed situations with high light intensity. It has been recorded from the laurel forests and tall heaths above La Galga between 800 and 1000 m., in the high mountains above Los Sauces 600 to 1000 m. and in the forest above Barlovento 500-700 m.

12. *E. wildpretii* H. W. Pearson ex Hooker fil., *Curtis' Bot. Mag.* t. 7847 (1902).

E. bourgaeum Webb ex Christ, *Bot. Jahrb.* 9: 126 (1888), *in syn.*

E. bourgaeum Webb ex Coincy, *Bull. Herb. Boiss., sér. 2*, 4: 275 (1903).

[*E. bourgaeum* Webb in Bourgeau, *Pl. Canar. Exsicc.* 895 (1845), *in sched.*]

Monocarpic shrub. Stem unbranched, up to 25 cm. in vegetative state, 2-3 cm. in diameter; dark brownish, hispid. Leaves densely crowded at apex of stem, up to 50 cm., linear to oblanceolate, petiolate, acute to acuminate, both surfaces densely covered with long, appressed tuberculate trichomes; veins scarcely visible below. Inflorescence 1.5-3 m., dense, thyrsoïd, narrowly conical, the central axis up to 3 cm. in diameter; lateral cymes numerous, dense, 2- to 3-fid, many flowered. Flowers subsessile. Calyx segments 9-10 mm., ovate or lanceolate, lightly to densely hispid, obtuse to subacute, strongly accrescent in fruit. Corolla red (turning blue on drying), 10-14 mm., broadly infundibuliform; lobes more or less equal, about 3 mm., rounded, subglabrous to densely hispid; annulus a narrow, sparsely hairy, uneven,

fleshy ring. Stamens exserted, glabrous, reddish. Style exserted, hispid, bifid. Nutlets 2 mm., subconical, blackish, rugose. $2n = 16$ (LARSEN, 1960).

Type. Figure 7847 of *Curtis' Botanical Magazine* (1902) which accompanied the original description.

E. wildpretii occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Cañadas and at the upper edge of the pine forests above Vilaflor. In habit, *E. wildpretii* parallels the Afro-alpine *Dendro-Senecio* and *Lobelia* growth form which HEDBERG (1964) suggests is an adaptation to diurnal temperature range, the dense rosette of leaves closing up at night to protect the growing point from frost.

Key to the subspecies of E. wildpretii.

- Inflorescence broadest at middle; calyx and corolla very densely hispid; style deeply bifid
(a) subsp. **wildpretii**
- Inflorescence broadest at middle; calyx and corolla very densely hispid; style deeply bifid
(b) subsp. **trichosiphon**

(a) subsp. **wildpretii.**

Distribution. Canary Islands: Tenerife, subalpine zone above 1800 m.

Representative specimens. **Canary Islands: Tenerife:** ad rup. La Fortaleza de Teyde, 5.IV.1845, *Bourgeau* 895 (FI, P); in rupibus praeruptis Cañadas de Teyde, 4.VII.1855, *Bourgeau* 1436 (BM, C, FI, K, P, Z); supra Güimar, 4.IV.1855, *Perraudière* (K); Agua Agria, Chasna 2000 m., 27.VI.1855, *Perraudière* (P); cultivated at Orotava, 1912, *Pérez* (K, 10 sheets; (FI); Filo de las Cañadas 2000 m., VI.1911, *Burchard* 2 (CGE, Z); *ibid.*, 1.VI.1963, *Landbohjsk* (C); Valle de Ucanca 2000 m., 22.V.1957, *Larsen* (C); Los Azulejos, 23.X.1969, *Hansen* (C); Topo de la Grieta 2100 m., 2.XI.1968, *Bramwell* 329 (RNG); Pinar de Vilaflor 1900 m., 7.V.1969, *Bramwell* 2260 (RNG); La Fortaleza 2200 m., VIII.1965, *Bramwell* 21 (LIVU).

(b) subsp. **trichosiphon** (Svent.) Bramwell, *comb. et stat. nov.*

E. bourgaeum var. *trichosiphon* Svent. in Ceballos & Ortuño, *Veg. Fl. Forest. Canar. Occ.*: 409 (1951).

E. perezii Sprague, *Bull. Misc. Inf. Kew.* 1914: 210 (1914).

E. coeleste Stapf, *Curtis' Bot. Mag.* tab. 8977 (1923).

Similar to the type subspecies in habit but with a broader, ovate inflorescence; calyx and corolla much more densely hairy; corolla lobes broader; stigmatic lobes at least twice as long as in subsp. *wildpretii*.

Por un error de imprenta en el momento de hacer la tirada de *Lagascalia*, vol. 2(1), se ha repetido dos veces la misma línea en la clave de la pág. 78 correspondiente al artículo de D. BRAMWELL, *A revision of the genus Echium in Macaronesia*.

Sustitúyase la citada clave por la siguiente corregida:

Key to the subspecies of E. wildpretii.

Inflorescence evenly tapering to base; calyx and corolla lightly hispid; style briefly bifid
(a) subsp. **wildpretii**

Inflorescence broadest at middle; calyx and corolla very densely hispid; style deeply bifid
(b) subsp. **trichosiphon**

prominent on lower surface; indumentum dense, consisting of simple or rarely tuberculate, greyish white-silvery setae. Inflorescence narrowly spiciform, 10-30 cm.; lateral cymes bifid; peduncles 5-10 mm., elongating in fruit. Flowers subsessile. Calyx 5 mm., hispid; segments linear to linear-lanceolate, accrescent in fruit. Corolla pink or bluish, narrowly infundibuliform, 6-10 mm., lobes rounded, obtuse, 2 mm. in diameter, the mid vein hairy; annulus fleshy, sparsely hairy; margin undulating. Stamens exserted; filaments red-

E. perezii Sprague, *Bull. Misc. Inf. Kew.* 1914: 210 (1914).

E. coeleste Stapf, *Curtis' Bot. Mag.* tab. 8977 (1923).

Similar to the type subspecies in habit but with a broader, ovate inflorescence; calyx and corolla much more densely hairy; corolla lobes broader; stigmatic lobes at least twice as long as in subsp. *wildpretii*.

Type. «El Paso, La Palma», Ceballos & Ortuño (ORT, n.v.).

Distribution. *E. wildpretii* subsp. *trichosiphon* occurs in the high mountains of the Caldera of La Palma on rocky slopes and cliffs in pine forest.

Representative specimens. Cultivated at Kew sub. nom. *E. perezii* 1912-1915 (K, 6 sheets); cult. Orotava, 1913, Pérez (K, 5 sheets).

Sect. 4. *VIRESCENTIA* (Christ ex Spr. & Hutch.) Bramwell, *stat. nov.*

Echium 2. *Virescentia* Christ, *Bot. Jahrb.* 9: 127 (1888), *nom. illeg.*

Echium series *Virescentia* Christ ex Spr. & Hutch., *Bull. Misc. Inf. Kew.* 1914: 265 (1914).

Branched shrubs. Inflorescence cylindrical. Corolla pink or blue, not laterally compressed, the lobes more or less equal.

Type. *E. virescens* DC.

13. *E. virescens* DC., *Cat. Pl. Horti Monsp.*: 107 (1813).

E. candicans sensu DC., *Prodr.* 10: 17 (1846), *pro parte*.

E. virescens var. *candollei* Coincy, *Bull. Herb. Boiss., sér. 2, 4*: 269 (1903).

[*E. bicolor* Webb in Bourg., *Pl. Canar. Exsicc.* 456 (1845), *in sched.*]

Shrub, 1-2 m., with densely hispid stems and papery bark. Leaves lanceolate, 8-12(-20) x 0.3-1.5 cm., attenuate to short petiole; apex acute; veins prominent on lower surface; indumentum dense, consisting of simple or rarely tuberculate, greyish white-silvery setae. Inflorescence narrowly spiciform, 10-30 cm.; lateral cymes bifid; peduncles 5-10 mm., elongating in fruit. Flowers subsessile. Calyx 5 mm., hispid; segments linear to linear-lanceolate, accrescent in fruit. Corolla pink or bluish, narrowly infundibuliform, 6-10 mm., lobes rounded, obtuse, 2 mm. in diameter, the mid vein hairy; annulus fleshy, sparsely hairy; margin undulating. Stamens exserted; filaments red-

dish. Style exserted; apex shortly bifid, pubescent towards base. Nutlets 2-3 mm., angular, rugose. $2n = 16$ (BORGÉN, 1969).

Type. *E. virescens* DC. Hort. Monsp. 12 April 1811 in Herb. Prodrom. (G, photo!).

Distribution. *E. virescens* is fairly common on Tenerife occurring on cliffs and screes in the upper xerophytic zone 400-800 m., the forest 600-1800 m., and the subalpine zones. It is most frequent on cliffs in *Erica arborea* and *Pinus canariensis* forests. SVENTENIUS (*in litt.*) records this species from La Palma but I have not seen any specimens substantiating the record.

Within this species there is some degree of variation in leaf-width and hairiness. Plants from the dry southern slopes of the outer walls of Las Cañadas, from 1900 m. in the pine forests above Vilaflor and Izana to 500 m. at Guía de Isora, tend to have very narrow leaves and short corollas and, on the basis of this, are recognised as var. *angustissimum* Bolle.

Several collections from the south-east of the island (e.g. Perraudière, 24.II.1855, Barranco de Badajoz) have long, silky hairs up to 1.5 mm. on the upper surface of the leaves and in this respect resemble *E. candicans* of Madeira (cf. COINCY 1903, who records *E. candicans* from Tenerife on the basis of PERRAUDIERE's specimens).

Key to the varieties of E. virescens.

Leaves more than 0.8 cm. wide; corolla 8-10 mm.

(a) var. **virescens**

Leaves up to 0.5 cm. wide; corolla 6 mm.

(b) var. **angustissimum**

(a) var. **virescens.**

Distribution. Canary Islands: Tenerife, Sierra Anaga, Montañas de Teno, Güimar, Aguamansa, etc.

Representative specimens. **Canary Islands: Tenerife:** Aguamansa, 27.IV.1894, Murray (K); Aguamansa, Los Organos, 12.VI.1890, Murray (B); *ibid.*, 3.V.1935, Asplund 1068 (K); *ibid.*, 20.IV.1879, Hillebrand (Z); *ibid.*, 1882, Askenasy (Z); *ibid.*, 1100 m., 1.VII.1900, Bornmüller 1006 (P, Z); *ibid.*, 1400 m., 8.V.1969, Bramwell 1478 (LTR, RNG, SEV); Los Realejos, 21.VII.1855, Bourgeau 1441 (C, K); Barranco de Bufadero, 10.II.1855, Bourgeau 1442 (K, MPU, P, Z); *ibid.*, 4.IV.1855, Perraudière (K); *ibid.*, 18.III.1852, Bolle (K); Güimar, in convallis Badajoz, 25.II.1855, Bourgeau 1432

(C, K, Z); *ibid.*, 24.II.1855, *Perraudière* (MPU); Güimar, Barranco del Agua, 8.IV.1855, *Perraudière* (P); Ladera de Güimar, 500 m., 9.III.1969, *Bramwell* 847 (LTR, RNG); Barranco del Infierno, Adeje, V.1846, *Bourgeau* 468 (BM, CGE, K); *ibid.*, 700 m., 10.III.1969, *Bramwell* 925 (LTR, RNG, SEV); Anaga hills, 19.V.1890, *Murray* (BM); *ibid.*, 12.VI.1894, *Murray* (BM); *ibid.*, Cruz de Taborno 700 m., 7.II.1969, *Bramwell* 650 (LTR, RNG); Vilaflor, 16.VI.1899, *Murray* (BM); *ibid.*, 1900 m., 30.IV.1969, *Bramwell* 1407 (LTR, RNG); Ladera de Santa Ursula 700-1200 m., V.1923, *Burchard* 179 (CGE, Z); Anavigno above Arafo, 800 m., III.1909, *Burchard* (K); Tamadaya, 9.III.1855, *Perraudière* (MPU); Buenavista, V.1845, *Bourgeau* 465 (CGE, BM); *region. sylv.*, 1889, *Christ* (Z); *supra* La Florida, *in sylv.*, 1889, *Christ* (Z); Cumbre de Masca 1100 m., 11.II.1969, *Bramwell* 663 (LTR, RNG, SEV); Guía de Isora, Barranco del Fraile 500 m., 23.II.1969, *Bramwell* 769 (LTR, RNG, SEV); below Guía de Isora, on dry cliff, 9.III.1969, *Bramwell* 913 (LTR, RNG); Lomo de Pedro Gil 1600 m., 15.IV.1969, *Bramwell* 1296 (LTR, RNG); entre Palmar et Punta de Teno 500 m., II.1905, *Pitard* 1612 (P); *montibus Teneriffae*, undated, *Webb* (BM).

(b) var. **angustissimum** Bolle ex Christ, *Bot. Jahrb.* 9: 127 (1888).

Like var. *virescens* but with leaves linear-lanceolate, up to 0.5 cm. wide, the upper surface with pustular trichomes. Corolla shorter (0.6 cm.).

Type. «Barranco del Cuevo prés Chasna sur les flancs du Pic de Tenerife, 1856», C. Bolle (Z).

Distribution. Canary Islands: Tenerife, sporadic, south slopes from the subalpine down to about 500 m.

Representative specimens. **Canary Islands: Tenerife:** Barranco del Cuevo prés Chasna, 1856, *Bolle* (Z); Vilaflor, 15.VI.1899, *Murray* (K); Cumbres de Pedro Gil 2000 m., 30.V.1969, *Bramwell* 1712 (LTR, RNG, SEV); Barranco de Erjos 600 m., 3.IV.1971, *Bramwell & Humphries* 3202 (BM, RNG); Barranco de Tamadaya, 3.IV.1969, *Bramwell & Humphries* 3213 (BM, RNG).

14. *E. sventenii* Bramwell sp. nov.

Ex affinitate *E. virescens* DC. sed habitu altiore ramosissimo; foliis linearibus vel linear-lanceolatis, dense hirsutis, argenteis, margine revolutis;

corolla breve, dilute subrosea, subquadrilobata, lobis duobus dorsalibus conjunctis apice excepto, differt.

Holotypus. «Ex insula Tenerife, regione austro-occidentali in convallis dicto "Barranco Seco" prope oppidum Adexe versus 350 m. supra Mare», 1.VI.1969, D. Bramwell 1718, in Herb. Univ. Radingensis (RNG) conservatus.

Shrub 1.3 m., branching near the base; branches tortuous ascending; bark papery, greyish, hispid. Leaves linear to linear-lanceolate, 6-10 x 0.6-1 cm., densely hirsute with appressed setae, silvery, the margins revolute; base attenuate to a distinct petiole about 1 cm. long; apex acute. Inflorescence narrowly cylindrical to elliptical, 8-15 x 4 (-7) cm., lateral cymes simple or bifid, short. Flowers sessile. Calyx about 6 mm.; lobes 5, lanceolate, slightly shorter than tube, densely and shortly hispid, acute, strongly accrescent in fruit. Corolla c. 8 mm., very pale pink, appearing 4-lobed, the two dorsal lobes being united except at the extreme tips, lightly pubescent; annulus a more or less glabrous, entire, fleshy ring. Stamens exserted; filaments pinkish, glabrous. Style exserted, deeply bifid, often reddish, hispid towards the base. Nutlets dark greyish, aculeate to verrucate, subconical. $2n = 16$ (BRAMWELL et al., 1972).

Distribution. Canary Islands: Tenerife, south-west region, known only from the Barranco Seco near the town of Adeje, 350-400 m.

Representative specimens. **Canary Islands: Tenerife:** Barranco Seco de Adeje, 10.III.1969, *Bramwell* 960 (RNG); *ibid.*, 1.VI.1969, *Bramwell* 1718 (LTR, RNG, SEV); Tarifa Botanical Garden, cultivated from seedlings transplanted from the *loc. class.* by *Sventenius*, 30.III.1969, *Bramwell & Humphries* 3176 (BM, RNG).

This species was first discovered at Barranco Seco by Dr. E. R. SVENTENIUS and planted in the Tarifa Botanical Garden. In 1969 I visited this locality with Dr. SVENTENIUS and was able to collect a number of herbarium specimens and seed. The species has been maintained in cultivation at Tarifa for about ten years and the characters distinguishing it from *E. virescens*, its nearest relative, have remained constant. It has been cultivated at Reading alongside *E. virescens* for over two years and remains distinct from it.

E. sventenii occurs on dry, south-facing slopes in a dense *Rubio-Euphorbietum* community along with species such as *Sonchus pinnatus* subsp. *cana-*

riensis, *Hypericum canariense*, *Euphorbia regisjubae*, *Cistus symphytifolius* and *Rubia fruticosa*. It appears to be confined to the narrower, upper part of the Barranco Seco where a populations of some 40 to 50 plants occurs.

15. **E. webbii** Coincy, *Bull. Herb. Boiss., sér. 2, 4*: 270 (1903).

E. bifrons Webb & Berth., *Phyt. Canar.* 3: 43 (1844), non DC. (1913).

Shrub up to 1.5 m.; bark silvery; stem densely hispid with hairs up to 0.5 mm. Leaves lanceolate, 8-10 (-12) cm., attenuate to base, subsessile, the apex obtuse to acute: veins prominent beneath; upper surfase light green-silvery with indumentum of short, dense, silky hairs. Inflorescence thyrsoïd, 10-20 cm., ovate, lateral cymes usually simple, short; peduncles up to 5 mm., elongating in fruit. Flowers sessile. Calyx hispid, about 3 mm.; segments linear, obtuse, accrescent in fruit. Corolla blue, infundibuliform, 9-10 mm.; lobes c. 2 mm., rounded at apex, very sparsely hairy on midveins; annulus a continuous, slightly lobed ring, the margin slightly hairy. Stamens exserted; filaments glabrous. Style exserted, lightly hairy near the base; tip bifid. Nutlets blackish, subconical, echinulate. $2n = 16$ (BRAMWELL et al., 1972).

Type. «*E. bifrons* Ins. Palmae In Convalle del Rio», undated, *Webb* (P!).

Distribution. Canary Islands: La Palma; Cumbrecita, Barranco de las Angustias, Caldera de Taburiente, Los Tilos, Fuencaliente.

Representative specimens. **Canary Islands: La Palma:** Convalle del Río, undated, *Webb* (CGE, K, P); *ibid.*, 2.VI.1913, *Sprague & Hutchinson* 200 (K); *ibid.*, 2.VI.1913, *Sprague & Hutchinson* 206 (K); *ibid.*, 29.IV.1880, *Hillebrand* (Z); Barranco de las Angustias, 14.VI.1913, *Sprague & Hutchinson* 472 (K); *ibid.*, 18.IV.1901, *Bornmüller* 2664 (P); *ibid.*, 900 m., III. 1906, *Pitard* 625 (P); *ibid.*, 500 m., 10.VI.1969, *Bramwell* 1891 (RNG); *ibid.*, 550 m., 10.VI.1969, *Bramwell* 1892 (LTR, RNG, SEV); La Caldera, 900 m., 18.IV.1901, *Bornmüller* 2666 (P, Z); *ibid.*, 21.IV.1866, *Husnot* (P); *ibid.*, 25.III.1905, *Pitard* 266 (MPU, P); *ibid.*, El Capadero, 13.VI.1913, *Sprague & Hutchinson* 394 (K); *ibid.*, Tenerra, 14.VI.1913, *Sprague & Hutchinson* 487 (K); La Cumbrecita, 15.VI.1892, *Murray* (BM, K); *ibid.*, 2.V. 1901, *Bornmüller* (BM); *ibid.*, 1250 m., 9.VI.1969, *Bramwell* 1887 (LTR, RNG, SEV); Cumbre de Garafía, 10.VIII.1919, *Ortega* (K); Calvera del

Barranco del Carmen, 11.V.1889, *Christ* (Z); Los Tilos, 550 m., 6.VI.1969, *Bramwell* 1820 (RNG); Pinar above Barlovento, 7.VI.1969, *Bramwell* 1835 (LTR, RNG); Pinar de Fuencaliente, 700 m., 9.VI.1969, *Bramwell* 1875 (RNG, LTR); La Palma, ad rup., 1845, *Bourgeau* 233 (BM, P, Z); La Palma 300 m., 31.V.1936, *Brooke* 247 (BM).

E. webbii occurs in the forest zone of La Palma from 500 to 1800 m. It is found on forest cliffs in the laurel woods of Los Tilos and the north-east, but more frequently as a pine-forest shrub on cliffs and steep slopes. Occasionally plants are found on dry rocky slopes in the xerophytic zone down to 400 m.

WEBB (1844) considered this species to be *E. bifrons* DC., but as pointed out by COINCY (1903) *E. bifrons* is very similar to *E. virescens* and DE CANDOLLE (1813), in the original description of the species, mentions its variability and susceptibility to mutation in cultivation which suggest that it was probably a segregating hybrid, possibly *E. virescens* x *E. strictum*, a hybrid sometimes cultivated under the name *E. fastuosum*.

E. webbii is a fairly constant species, leaf-width being the most variable character with the narrowest-leaved plants found in the lower part of the altitudinal range. It hybridises with *E. brevirame* in the field.

Within the section *Virescentia*, which has a different species on each of the four western Canary Islands, *E. webbii* is best distinguished by its short indumentum, its very short, simple lateral cymes and its attractive blue corolla.

16. *E. acanthocarpum* Svent., *Plantae Macaronesienses Novae vel Minus Cognitae* 1: 4 (1968).

Shrub 1-2 m. bark greyish-brown, hispid. Leaves ovate-lanceolate, up to 30 x 5-10 cm., subsessile, densely hispid on both surfaces, the veins very prominent below; apex acute. Inflorescence an ovate to cylindrical, dense thyrses up to 40 cm., lateral cymes simple or rarely bifid. Flowers sessile. Calyx 5-6 mm., hispid; segments linear-lanceolate to lanceolate, accrescent in fruit. Corolla c. 15 mm., narrowly infundibuliform to campanulate, blue, hispid; lobes short; annulus a continuous fleshy ring, slightly lobed, hairy at margin. Stamens exserted; filaments reddish, glabrous; anthers bluish. Style exserted, hispid, deeply bifid at tip. Nutlets blackish, very ornate, papillate, echinulate. $2n = 16$ (BRAMWELL, unpubl.).

Type. «Junonia Minor (La Gomera) in rupibus sylvis locis humosis

800-1000 m. supra mare in circumiencia loca Roque Agando, 26 Julii 1964», *Sventenius* (ORT!).

Distribution. Canary Islands: La Gomera; Roque Agando, Monte El Cedro (*Bramwell* 1969).

Representative specimens. **Canary Islands: Gomera:** Roque de Agando, 1000 m., 26.VII.1964, *Sventenius* (ORT); *ibid.*, 800-1000 m., 24.V. 1965, *Sventenius* (ORT); *ibid.*, V.1969, *Sventenius* (ORT, RNG); *ibid.*, 900 m., 27.VI.1969, *Bramwell* 2015 (RNG, LTR); Monte El Cedro, 1000 m., 26.VI.1969, *Bramwell* 1988 (RNG); cultivated, seed collected at Agando, VI.1969, *Bramwell* (RNG).

E. acanthocarpum is found on forest cliffs in the central region of La Gomera where it is very rare. It occurs between 800 and 1000 m. with other endemic cliff plants such as *Sonchus gonzalez-padroni*, *Crambe gomerae*, *Sideritis lotsyi* and *Aeonium rubrolineatum*. The species is a member of the *E. webbii*/*E. virescens* group with densely hispid leaves and a dense inflorescence of blue flowers. Little variation has been observed in the limited material available.

17. ***E. hierrense*** Webb ex Bolle, *Ind. Sem. Hort. Berol.* 1867: 7 (1867).
E. bifrons DC. var. *hierrense* (Webb ex Bolle) Christ, *Bot. Jahrb.* 9: 127 (1888).
 [*E. hierrense* Webb in Bourg., *Pl. Canar. Exsicc.* 894 (1845), *in sched.*]

Shrub up to 1.5 m.; stem hispid. Leaves lanceolate to ovate-lanceolate, 5-8 x 1-1.5 cm., shortly petiole to subsessile; apex acute; both surfaces finely hispid, upper greenish; large trichomes absent. Inflorescence a dense, cylindrical thyrse about 10 cm., lateral cymes simple, shortly pedunculate, few flowered. Flowers subsessile. Calyx 3-5 mm., segments lanceolate, acute, hispid, accrescent in fruit. Corolla 10-12 mm., blue, infundibuliform; tube broad; lobes 3 mm., rounded, lightly pubescent on outer surface; annulus a well developed fleshy, undulating ring with a few hairs on the margin. Stamens well exserted, the filaments glabrous. Style exserted, subglabrous to lightly pubescent, shortly bifid at tip. Nutlets black, 3 mm., rugose.

Type. «Hierro, El Golfo in rup., 15 Junii 1845», *Bourgeau* 894 (FI!).

Distribution. Canary Islands: Hierro, coastal and forest regions.

Representative specimens. **Canary Islands: Hierro:** El Golfo, 15.VII.1845, *Bourgeau* 894 (BM, FI, K); *ibid.* in rupestribus sylvae, leg. H. de la Perraudière, 26.V.1855, *Bourgeau* 1440 (C, FI, K, Z); *ibid.*, 1000 m., 2.V.1855, *Perraudière* (K); *ibid.*, Sabinosa, 600 m., 18.VII.1858, *Lowe* (K); *ibid.*, Sabinosa, V.1911, *Burchard* (K); *ibid.*, Frontera, in forest scrub, 450 m., 6.IV.1971, *Bramwell* 3298 (RNG); *ibid.*, Punta de Salmar, 200 m., 9.IV.1971, *Bramwell* 3341 (BM, RNG).

E. hierrense is a small shrub apparently confined to the west part of Hierro in the El Golfo region where it occurs on the steep cliffs between Punta de Salmar and Acantilados de Sabinosa between 400 and 800 m. It generally occurs in the upper xerophytic zone and in *Erica arborea* heath.

CHRIST (1888) considered *E. hierrense* to be a variety of *E. bifrons* (*E. webbii*) but it is easily distinguishable from that species by its short, broad leaves, dense thyrses, large corolla-lobes and pinkish flowers. In general facies, *E. hierrense* is more like its Teneriffean counterpart *E. virescens*, but in habit and inflorescence characters it is quite distinct. Only a few specimens have been seen and these show little variation. The variation observed in calyx-length is perhaps due to different states of maturity of the specimens.

18. *E. candicans* L. fil., *Suppl.*: 131 (1781).

E. pallidum Salisb., *Prodr.*: 114 (1796).

E. cynoglossoides Desf., *Tabl.* 2: 86 (1804).

E. fastuosum Dryander ex Aiton, *Hort. Kew.* 2: 300 (1810), non Salisb. (1796).

E. densiflorum DC., *Cat. Pl. Horti Monsp.*: 108 (1813).

E. branchyanthum Hornem., *Hort. Hafn.* 1: 183 (1813).

E. macrophyllum Lehm., *Pl. Asper.*: 412 (1818).

E. maderense Hort. ex Steudel, *Nomencl. Bot.*, ed. 2, 1: 514 (1840).

E. marianum Boiss., *Diagn. Pl. Or.*, sér. 1, 11: 90 (1849).

E. pavonianum Boiss., *op. cit.*: 91 (1849).

E. candicans var. *nornhae* Menenzes, *Fl. Archip. Mad.*: 180 (1914).

[«*E. thyrsoflorum* Masson», in *Herb. Banks et Herb. L. fil.*]

Shrub 1-2 m.; stem finely and densely hispid; bark whitish, loose, papery. Leaves lanceolate to ovate-lanceolate, up to 25 x 2-4 cm., acuminate at apex, densely hispid; hairs up to 0.2 cm., some with a pronounced tubercu-

late base; veins very prominent below, densely hairy; petiole short. Inflorescence narrow, spiciform, dense, 10-25 cm., lateral cymes usually simple, the peduncles c. 5 mm. Flowers sessile. Calyx 4-5 mm., hispid; segments lanceolate, acute, accrescent (up to 7 mm.) in fruit. Corolla blue to violet often with a white stripe on each lobe, infundibuliform, 9-11 mm., lobes obtuse or rounded, hairy along mid vein, subequal, 2 mm.; annulus of up to 10 conical lobes, hairy at the base. Stamens exserted, the filaments pink, glabrous. Style exserted, slightly hairy towards base, bifid at tip. Nutlets 2 mm., blackish, rugose-papillate. $2n = 16$ (LITARDIERE, 1943).

Type. «*E. candicans* Madeira, Masson. *E. thyrsiflorum* in rupis alter (Masson ex litteris)», (LINN!).

Distribution. Madeira Archipelago: Madeira, Porto Santo. Records of this species from Tenerife pertain to *E. virescens*.

Representative specimens. **Madeira Archipelago: Madeira:** s.l., 1776, Masson (BM, LINN); *ibid.*, 1768, Banks & Solander (BM); Malhada Valha, 1100 m., VII.1865, Mandon 182 (BM, C, K, Z); Curral, VII.1852, MacGillivray 58 (K); Madeira 3000 ft., 12.VII.1827, Lowe (K); *ibid.*, VII.1828, Lowe (K); *ibid.*, 28.VII.1837, Lowe 336 (K, BM); Camacho, 22.II.1895, Murray (BM); Ribeiro Frio, undated, Murray (BM); Ribeiro de Poco, 3300 ft., 11.IV.1949, Sledge (BM); Ribeira del Levada, VIII.1901, Vahl (C); Madeira s. l., 1845, Kamphövener 158 (C); Pico Arierio, 24.V.1969, Hansen (C); Pico Grande, 1400 m., 1.VIII.1900, Bornmüller 1005 (Z); Levada dos Minhasicos, 23.VII.1877, Hillebrand (Z); Rib. Vasco Gil, 4.VII.1962, Sven-tenius (ORT, RNG); cultivated, undated, Hort. Monsp. (sub nomen *E. densiflorum*) (MPU). **Porto Santo:** Pico Castelo «probably cultivated», 27.V. 1967, Hansen (C).

Two frutescent *Echium* species recorded from the Iberian Peninsula, *E. marianum* Boiss. and *E. pavonianum* Boiss., both seem to be referable to *E. candidans*. Both species are known only from single collections, the localities given are Sierra Morena and Aldegüela (Extremadura?) respectively, and according to LACAITA (1925), who examined both specimens (Herb. Boiss.) and attempted to trace the localities in more detail, there is little evidence to show that *E. candidans* is native in Spain.

I have not seen any material of this species from the island of Porto Santo other than HANSEN's specimen (C) from Pico Castelo which he presumes to be cultivated or an escape from cultivation (*in sched. et in litt.*).

E. candicans occurs on the island of Madeira in the high mountain valleys and ravines of the cloud zone in the centre of the island. It is a shrub of forest-cliff habitats above about 800 m. but is widely cultivated as an ornamental garden plant («pride of Madeira») and is probably well naturalized in the lower zone.

19. *E. nervosum* Dryander in Aiton, *Hort. Kew.*, ed. 2, 1: 300 (1810).

E. fastuosum sensu Curtis' *Bot. Mag.* tab. 6868 (1886), non Salisb., Dryander nec Jacq.

[*E. branchyanthum* Hornem. sensu Lowe, *in sched.*]

Erect, branched shrub; bark papery, whitish; stems densely hispid. Leaves lanceolate, 7-10 (-15) x 1-1.5 cm., attenuate to a short petiole at base; acute; surfaces densely hispid, the veins very prominent and densely hairy below; spines more or less absent. Inflorescence thyrsoid, ovate, dense, 5-25 cm.; lateral cymes simple or bifid. Flowers sessile. Calyx hispid, c. 5 mm.; segments lanceolate, rounded at the apex. Corolla narrowly infundibuliform, blue with a white stripe along the centre of each lobe, 8-11 mm., the lobes rounded, about 3 mm., lightly pubescent on outer surface; annulus more or less continuous with 10 pronounced lobes on the margin, finely pubescent. Stamens exserted. Style exserted, somewhat setose near base, shortly bifid. Nutlets greyish, 3 mm., with well developed conical tubercles.

Type. «*Echium nervosum* Hort. Kew» (BM!).

Distribution. Madeira Archipelago: Madeira, Porto Santo, Las Desertas.

All known localities for this species are between sea-level and 300 m. The main area is on the sea-cliffs at Praia Formosa and around Funchal Bay. A number of variants of this species have been recorded by BORNMÜLLER (fma. *minor* and fma. *major*, *in sched.*) and by MENENZES (var. *laxiflorum* Menenzes, *Fl. Archip. Madeira* 116, 1914), but from the material seen it does not seem possible to give these minor variants taxonomic status as they are probably due to age differences between plants sampled. *E. nervosum* is recorded by HANSEN (1969) from Porto Santo and Las Desertas. PICKERING (1962) gives the locality Zimbralinho for Porto Santo and this also seems to be an area of coastal cliffs. I have not, however, been able to trace any specimens originating from either of these islands and all the specimens I have seen have been from the island of Madeira itself.

Representative specimens. **Madeira Archipelago: Madeira:** Funchal, 2. IV.1888, Kuntze (K); *ibid.*, 21.X.1888, Kuntze (K); in rup. marit. ad Fun-

chal et San Roque, IV.1865, *Mandon* 183 (BM, C, K); cliffs east of Funchal, II.1849, *Lowe* 577 (BM); *ibid.*, 9.I.1832, *Leman* (BM); Funchal, sea-cliffs, 7.VII.1895, *Murray* (BM); *ibid.*, 12.VII.1895, *Murray* (BM); Funchal, 22.VII.1902, *Vahl* (C); the English Church Garden, 24.III.1828, *Lowe* 336 (BM); sea-cliffs, 3.IV.1829, *Lowe* (K); Sta. Anna cliffs, IX.1829, *Lowe* (K); sea-cliffs, 1837, *Lowe* (BM, CGE); Riberia Brava 100 m., 30.IV.1924, *Riley* 34 (BM, K); San Vicente, sea-cliffs, 15.XII.1858, *Lowe* (BM); cliffs along Camino Real, III.1829, *Lowe* (BM); Calhao, III.1832, *Lowe* 696 (BM); Calheta, 19.II.1897, *Murray* (BM); Pinaculo, 29.XII.1967, *Hansen* (C); Praia Formosa, 9.IV.1900, *Bornmüller* 1003 (Z); *ibid.*, 9.IV.1900, *Bornmüller* 1002 (Z); *ibid.*, 9.IV.1900, *Bornmüller* 1004 (Z); *ibid.*, 1.III.1877, *Hillebrand* (Z); São Gonçalo, II.1865, *Norman* (CGE); Madeira s. l., 1856, *Mason* 288 (CGE, K); Canaries ex Hort. Orotava, 15.I.1922, *Borgensen* 135 (Z).

20. *E. onosmifolium* Webb & Berth., *Phyt. Canar.* 3: 46 (1844).

Shrub up to 1 m. Stems with dense indumentum of stiff, simple trichomes. Leaves 4.5-10 (-13) x up to 1 cm., linear-lanceolate, somewhat revolute at margins, the base attenuate to a short petiole; apex acute; upper surface with dense, large-based setae; lower surface usually with simple hairs, the setae confined to lower surface of midrib. Inflorescence a narrow, cylindrical thyrse, 15-20 cm., tapering towards apex; lateral cymes with short, hispid peduncle. Flowers subsessile. Calyx 5-6 mm., segments linear-lanceolate, acute, densely hispid. Corolla 10 mm., white or pale pinkish (rarely blue), infundibuliform with a narrow tube, lobes about 2 mm., rounded, lightly pubescent on outer surface; annulus a very poorly developed pubescent ring. Stamens exserted, the filaments reddish. Style exserted, hispid; apex bifid. Nutlets subconical, greyish brown, echinulate. $2n = 16$ (BORGÉN, 1970).

Type. «Sur les rochers de Tirajana, V.1839», *Despreaux* 31 (FI!).

Distribution. Canary Islands: Gran Canaria, southern slopes, Tirajana, Fataga.

Representative specimens. **Canary Islands: Gran Canaria:** Paso de la Plata, Cumbre de Tirajana, IV.1846, *Bourgeau* 367 (BM, CGE, FI, K, Z); *ibid.*, 2.V.1855, *Bourgeau* 1434 (C, FI, K, Z); *ibid.*, 26.III.1971, *Bramwell & Humphries* 3093 (BM, RNG); Tirajana, 9.V.1894, *Murray* (K); Barranco de Tirajana, 750 m., 24.II.1969, *Kunkel* 12502 (RNG); Los Lajeales supra

Tirajana, 1200 m., V.1926, *Burchard* 336 (CGE, Z); San Bartolomé de Tirajana, 600 m., 18.V.1957, *Larsen* (C); Caldera de Tirajana, 700 m., 27.III.1969, *Bramwell* 1039 (LTR, RNG, SEV); Santa Lucía de Tirajana, 550 m., 27.III.1969, *Bramwell* 1074 (LTR, RNG, SEV); *ibid.*, 26.III.1971, *Bramwell & Humphries* 3088 (BM, RNG); Valle de Fataga, 9.V.1894, *Murray* (BM); *ibid.*, 400 m., 30.III.1969, *Bramwell* 1175 (LTR, RNG, SEV); Degollada de la Manzanilla, V.1914, *Burchard* 398 (K); Barranco de Tejeda, 1300 m., 27.III.1969, *Bramwell* 1024 (LTR, RNG, SEV); Termisas, 450 m., 26.III.1971, *Bramwell & Humphries* 3027 (BM, RNG); Gran Canaria s. l., undated, *Lowe* (BM, K); ex Insula Canaria, undated, *J. Ball* (FI); Hort. Berol. «cult. e seminibus a me in Canaria lectis», 1862, *Bolle* (Z).

E. onosmifolium is confined to the dry southern slopes of Gran Canaria in the zone between 400 and 1500 m. It is usually associated with xerophytic scrub vegetation containing such species as *Euphorbia obtusifolia*, *Cneocha-maelea pulverulenta*, *Parolinia ornata* and *Kickxia spartioides* which are typical southern xerophytic species. At higher altitudes, 1000-1500 m., the leaves tend to be broader and the indumentum less dense. Plants in cultivation have leaves up to 1.5 cm. wide.

This species occupies rather an isolated position taxonomically. In view of its dense, spicate inflorescence and narrow leaves, it is placed in section *Virescentia* but in other aspects such as the narrow corolla-tube and rough indumentum it also resembles members of the section *Stricta* and it appears to be somewhat intermediate between the two sections.

The narrow, revolute leaves with dense appressed setae are characters consistent with *E. onosmifolium* having a greater degree of exposure to very dry conditions than the other members of section *Virescentia*.

21. *E. callithyrsum* Webb ex Bolle, *Index Sem. Hort. Berol.* 1: 6 (1867).
[*E. callithyrsum* Webb in Bourgeau, *Pl. Canar. Exsicc.* 432 (1846),
nom. nud.]

Shrub, 30-100 cm.; stems ascending to erect, softly hairy; bark papery, densely hispid. Leaves lanceolate to ovate-lanceolate, 10-15 (-20) x 2-3 cm., shortly petiolate; apex acute to apiculate; upper surface with large-based setae, lower with simple trichomes and prominent, densely pubescent veins. Inflorescence an ovate, lax to dense thyrse, 10-14 cm. Flowers sessile. Calyx 4-6 mm.; segments linear, obtuse, hispid, slightly enlarging in fruit. Corolla deep blue, infundibuliform, 10-15 mm.; lobes 2-3 mm., obtuse, light-

ly pubescent on outer surface; annulus a narrow, poorly developed ring with a few short hairs on the margin. Stamens exserted, the filaments glabrous, often reddish. Style exserted, densely hairy, shortly bifid at tip. Nutlets brown, echinulate or tuberculate.

Type. «In rupestribus la Cumbre de Tenteniguada, Aprilis 1846», Bourgeau 432 (P!).

Distribution. Canary Islands: Gran Canaria, Rincón de Tenteniguada, Tejeda, Juncalillo.

Representative specimens. **Canary Islands: Gran Canaria:** in rupestribus, La Cumbre de Tenteniguada, IV.1846, Bourgeau 432 (BM, CGE, K, P, Z); *ibid.*, 1500 m., IV. 1924, Burchard 232 (CGE, Z); *ibid.*, V.1914, Burchard 339 (K); *ibid.*, VI.1910, Burchard (K); Juncalillo, below Pinos de Galdar, 29.III.1969, Bramwell 1132 (LTR, RNG, SEV); Rincón de Tenteniguada, 26.III.1971, Bramwell & Humphries 3134 (BM, RNG); Jardín Canario, Tafira Alta, 30.III.1971, Bramwell & Humphries 3172 (RNG); Gran Canaria s. l., undated, Bolle (K).

E. callithyrsum is a very rare species found only on mountain cliffs between 800 and 1500 m. in the central mountains of Gran Canaria. It was discovered by BOURGEAU in 1846 on the high cliffs of Tenteniguada where it was also collected by BURCHARD in 1910.

CHRIST (1888) included this species in his series *Simplicia* mistakenly thinking that it was an unbranched, monocarpic plant but SPRAGUE & HUTCHINSON (1914) correctly transferred *E. callithyrsum* to his series *Virrescentia* on account of its branched stem and perennial habit.

22. *E. handiense* Svent., *Addit. Fl. Canar.* 1: 47 (1960).

Shrub, 0.8-1 m.; stems rough, brownish, hispid, erect to spreading. Leaves elliptic to broadly lanceolate, 10-17 x 3-5 cm., acute, shortly petiolate, densely hispid with simple and large-based setae. Inflorescence thyrsoid, cylindrical, 10-25 cm.; lateral cymes bifid, rarely simple. Flowers sessile. Calyx 6-7 mm., accrescent in fruit; lobes linear-lanceolate, subacute, densely setose. Corolla 15 mm., infundibuliform, deep blue; lobes 3-4 mm., round, subcrenulate at the margin, densely pilose; annulus an entire, densely hairy ring. Stamens exserted, filaments reddish, glabrous. Style exserted, hispid, deeply bifid at tip with filiform lobes. Nutlets ovoid-conical, rugose to papillate, blackish. $2n = 16$ (BORGÉN, 1970).

Type. «Insula Herbania (Fuerteventura dicta); regione Handiae in monte dicto "Pico de la Zarza" circa 800 m. supra mare, ubi est sat rara; 21 Martii 1946», *Sventenius* (ORT!).

Distribution. *E. handiense* is known only from a single locality, Pico de la Zarza, in the southern Jandia region of the island of Fuerteventura.

Representative specimens. **Canary Islands: Fuerteventura:** Pico de la Zarza, 21.III.1946, *Sventenius* (ORT); *ibid.*, 14.IV.1955, *Sventenius* (ORT); *ibid.*, 700 m., 9.V.1969, *Bramwell* 1587 (RNG); cultivated specimen, from seed collected at Pico de la Zarza 9.V.1969, VI.1971, *Bramwell* (RNG).

This extremely rare species is confined to the north facing cliffs of the Jandia range of mountains. It occurs in deep crevices and fissures on the cliff face. *E. handiense* is morphologically most similar to *E. callithyrsum* of Gran Canaria. This latter species is also more or less confined to chasmo-phytic habitats and the two species can be considered as vicariants.

Sect. 5. STRICTA (Christ ex Spr. & Hutch.) Bramwell, *stat. nov.*

Echium 4. *Stricta* Christ, *Bot. Jahrb.* 9: 128 (1888), *nom. illeg.*

Echium series *Stricta* Christ sec. Spr. & Hutch., *Bull. Misc. Inf. Kew.* 1914: 265 (1914).

Echium sect. *Stricta* (Christ) Pettersson, *Soc. Sci. Fenn. Comm. Biol.* 12: 36 (1960), *non rite publ.*

Small, branched shrubs. Inflorescence lax with long internodes. Corolla pink or bluish, more or less regularly lobed.

Type. *E. strictum* L. fil.

23. *E. strictum* L. fil., *Suppl.*: 131 (1781).

E. molle Poiret, *Encycl. Méth. Bot.*, 8: 663 (1808).

E. fastuosum Salisb., *Prodr.*: 114 (1796)?

E. ambiguum DC., *Cat. Pl. Hort. Monsp.*: 107 (1813).

E. foliosum Lehm., *Pl. Asperif.*: 412 (1818).

E. lineatum Jacq. fil., *Eclog.*: 62 (1844).

E. lineolatum Webb & Berth., *Phyt. Canar.*, 3: 46 (1844).

E. strictum var. *lineolatum* (Webb & Berth.) Christ, *Bot. Jahrb.*, 9: 128 (1888).

Shrub up to 1 m.; stem hispid; bark brownish. Leaves ovate or broadly lanceolate, 7-18 x 2-7 cm., shortly petiolate to subsessile; both surfaces shortly hispid with a very variable indumentum; apex acute. Inflorescence a lax thyrse up to 30 cm., tapering upwards; lateral cymes widely spaced, simple to rarely trifid, pedunculate; peduncles hispid. Flowers sessile. Calyx hispid, the segments linear, about 3 mm., acute or obtuse, often somewhat unequal, strongly accrescent in fruit. Corolla variable, pinkish or pale blue, sometimes with deep blue lines, infundibuliform, 5-8 mm., lightly pubescent on outer surface, lobes more or less equal, rounded; annulus a slightly hairy, thin, undulating ring. Stamens well exserted, the filaments pinkish, glabrous. Style exserted, densely hispid, bifid at tip. Nutlets blackish, 2-3 mm., echinulate with acute projections. $2n = 16$. (BORGES, 1969; BRAMWELL et al., 1971).

Type. «In rupibus Teneriffae», Masson (BM!).

E. strictum is a very variable species and, in the past, it has been split into several distinct species. *E. ambiguum* was separated by DE CANDOLLE (1813) but was later, in the *Prodromus*, placed under *E. strictum* as a variety. This taxon is not known from the Canaries but both of the cultivated specimens seen from the *Hort. Monsp.* collection and labelled *E. ambiguum* in DE CANDOLLE's handwriting (MPU) come within the range of variation of subspecies *strictum*.

WEBB (1844) separated *E. lineolatum* and *E. strictum* on the basis of the calyx segments. He also used the density of leaf-indumentum and the presence of a blue stripe on the corolla as supporting characters. As pointed out by COINCY (1903), the calyx character varies between flowers of the same inflorescence in many cases, and corolla colour also varies within a single population and in many cases seems to be a development phenomenon, older corollas turning blue just before they shrivel, with the blue pigment originating along the mid-veins of the corolla lobes. In some plants the pigment is present when the corolla opens, but in others, it develops very late in the life of the flower. The density of leaf-indumentum tends (except in the Gomoran plants) to be associated with the degree of exposure to dryness, very hairy plants usually being found in dry, sunny localities and the scabrous ones in shade or damp conditions.

E. strictum is a widespread species but except for two cases it is difficult to correlate discontinuities in variation with ecology or geography. The species is found in mid- to upper xerophytic zone localities and on cliffs in the forest

zone. The north-west Tenerife populations found on cliffs and screes at Teno are narrow-leaved and have a very spiny calyx and deep blue flowers and on this basis are recognised as a distinct subspecies. Populations from the island of Gomera are also distinctive as they have very long hairs on the leaves and a very long narrow corolla-tube and subspecific rank has also been accorded to these.

Key to the subspecies of E. strictum.

Whole plant very densely white-hispid; corolla-tube very narrow (c) subsp. **gomerae**
Plants lightly hispid; corolla infundibuliform

Leaves lanceolate, indumentum coarse, spiny; corolla deep blue; lobes undulate
(b) subsp. **exasperatum**

Leaves ovate, hispid; corolla pink or pale blue; lobes rounded (a) subsp. **strictum**

(a) subsp. **strictum**.

Distribution. Canary Islands: widespread in the western and central Canaries.

Representative specimens. **Canary Islands: Tenerife:** s.l. «in rupibus», undated, *Masson* (BM); ibid., «convallibus», undated, *Webb* (BM, CGE, K); Bajamar, in saxosis collium, 6.III.1855, *Bourgeau* 1437 (C, K, Z); ibid., 9.I.1969, *Bramwell* 501 (LTR, RNG, SEV); ibid., basalt cliffs, 19.II.1969, *Bramwell* 805 (RNG, SEV); San Antonio, 21.IV.1861, *Lowe* 32 (K); Cumbre de Anaga, undated, *Webb* (K); ibid., Cruz de Afure 700 m., 1.III.1969, *Bramwell* 812 (CGE, LTR, RNG, SEV); Icod el Alto, 20.IV.1902, *Murray* (K); ibid., in laurel woods, 13.IV.1969, *Bramwell* 1261 (LTR, RNG, SEV); Taganana, in rup., 14.VI.1900, *Bornmüller* 1000 (Z); ibid., Roque de las Animas, 150 m., 18.IV.1969, *Bramwell* 1349 (RNG); Icod., 2.VI.1899, *Murray* (K); ibid., III.1933, *Trewihewy* 129 (K); Tigaiga, 7.V.1902, *Murray* (EM); Güimar, IV.1855, *Perraudière* (C, K); ibid., Barranco de Badajoz, 1882, *Hillebrand* (Z); ibid., Ladera de Güimar, 2.III.1969, *Bramwell* 835 (RNG); Puerto de Orotava, 1889, *Christ* (Z); ibid., 22.III.1933, *Asplund* (K); Santa Ursula, Los Charcos, undated, *Pérez* (K); ibid., 25.III.1933, *Asplund* (K); Valle de San Andrés 600 m., 7.II.1969, *Bramwell* 647 (LTR, RNG, SEV); ibid., El Bailadero, 19.VI.1969, *Bramwell* 1735 (LTR, RNG, SEV); Adeje, Barranco del Infierno, 800 m., 16.III.1969, *Bramwell* 976 (CGE, LTR, RNG, SEV); Los Silos, Las Cuevas Negras, 300 m., 17.IV.1969, *Bramwell* 1823 (RNG, SEV); Valle Guerra, 13.II.1955, *Proby & Tristram*

52 (K); Rocks above Realejo, 28.I.1837, *Lowe* (CGE). **Gran Canaria:** Santa Brígida, III.1846, *Bourgeau* 368 (BM, CGE, K, Z); Caldera de Bandama, undated, *Lowe* (K); Los Tilos de Moya, 6.V.1890, *Murray* (K); *ibid.*, 3.III.1933, *Asplund* (K); Barranco de la Virgen, 30.IV.1890, *Murray* (K); El Dragonal, 30.IV.1894, *Murray* (BM, K); Barranco de la Angostura, 17.IV.1897, *Gelert* (C, K); Firgas, 25.IV.1882, *Hillebrand* (Z); *ibid.*, 31.III.1921, *Borgesen* 776 (C); Barranco de Guiniguada, 18.III.1921, *Borgesen* 717 (C); Tafira Alta, 28.III.1969, *Bramwell* 1089 (RNG); Valle de Agaete, 29.III.1969, *Bramwell* 1152 (LTR, RNG, SEV); Moya, 2.IV.1969, *Bramwell* 1236 (RNG). **Hierro:** El Golfo, 8.VI.1845, *Bourgeau* 234 (BM, CGE, K); *ibid.*, 26.V.1855, *Perraudière* (K); *ibid.*, Frontera, 6.IV.1971, *Bramwell* 3283 (BM, RNG); *ibid.*, laurel woods near Fuente de Tinco, 7.IV.1971, *Bramwell* 3305 (BM, RNG); Vuelta de Jinamar, 11.V.1899, *Murray* (BM, K). **La Palma:** Calvera del Barranco del Carmen, 12.V.1887, *Christ* (Z).

- (b) subsp. **exasperatum** (Webb ex Coincy) *Bramwell*, *comb. et stat. nov.*
E. exasperatum Webb ex Coincy, *Bull. Herb. Boiss.*, sér. 2, 4: 491 (1903).
 [*E. exasperatum* Webb in *Bourgeau*, *Pl. Canar. Exsicc.* 897 (1846), *in sched.*]

Erect shrub, 20-60 cm. Leaves lanceolate, subacute, densely covered with erect, stiff trichomes. Inflorescence with simple or bifid cymes. Calyx echinulate. Corolla deep blue; lobes usually undulate at margin.

Type. «*E. exasperatum* Webb M. S. Teneriffa ad rupes supra Buenavista, 11 Maii 1846», *Bourgeau* 897 (P!).

Distribution. *E. strictum* subsp. *exasperatum* is confined to the coastal cliffs west of Buenavista in the northwest area of Tenerife. *Index Kewensis* erroneously lists this plant from the Cape Verde Islands.

Representative specimens. **Canary Islands: Tenerife:** Buenavista, 11.V.1846, *Bourgeau* 897 (BM, FI, K, P); *ibid.*, 27.III.1933, *Asplund* (K); *ibid.*, west of the town, 25.I.1969, *Bramwell* 558 (CGE, LTR, RNG, SEV); Roque del Fraile, 120 m., 25.I.1969, *Bramwell* 558 (LTR, RNG, SEV); *ibid.*, east slopes, 13.II.1969, *Bramwell* 639 (LTR, RNG, SEV); *ibid.*, 5.IV.1971, *Bramwell & Humphries* 3278 (RNG); Barranco de la Cueva, 400 m., 6.XII.1968, *Bramwell* 438 (RNG); *ibid.*, 19.II.1969, *Bramwell* 736 (RNG); **Pun-**

ta de Teno, 100 m., 16.III.1969, *Bramwell* 976 (LTR, RNG, SEV); *ibid.*, 50 m., 19.VI.1969, *Bramwell* 1731 (RNG).

(c) subsp. **gomeræ** (Pitard) Bramwell, *comb. et stat. nov.*

E. lineatum Jacq. fil. var. *gomeræ* Pitard, *Les îles Canaries, Fl. Archip.*: 277 (1908).

Whole plant densely hairy; lower surface of leaves with very long hairs on the veins. Calyx segments lanceolate-ovate. Corolla tube narrow; lobes longer than in subsp. *strictum*.

Type. No type specimen is indicated in PITARD's prologue and there are no specimens of the plant in his Canarian *exsiccatae*. He did, however, give the locality «Risco de Agulo 400 m.». This locality is in the Hermigua valley and I propose to designate a specimen collected by LOWE «Monte de Hermigua, 18 May 1861» as a neotype. This specimen is conserved in the Kew Herbarium (K!).

Distribution. Canary Islands: Gomera, common between 300 and 1000 m. on the north coast of the island.

Representative specimens. **Canary Islands: Gomera:** Monte Hermigua, 18.V.1861, *Lowe* 140 (K); Roque de Vallehermoso, 400 m., 30.VI.1969, *Bramwell* 2027 (RNG); Los Barranquillos above Epina, 800 m., 1.VII.1969, *Bramwell* 2057 (RNG).

24. *E. stenosiphon* Webb in Hooker, *Niger Fl.*: 155 (1849).

E. glabrescens Pettersson, *Soc. Sci. Fenn. Com. Biol.* 22: 39 (1960).

Lax shrub up to 1 m. Stem brownish, subglabrous or hispid, with large, white, pustular trichomes. Leaves ovate to ovate-lanceolate, 5-10 x 2-3 (-5) cm.; Lower cauline distinctly petiolate, the upper becoming sessile; apex usually obtuse; indumentum dense, consisting of very large-based, pustular trichomes. Inflorescence few flowered; lateral cymes simple; peduncles long. Flowers subsessile. Calyx-segments ovate to lanceolate, obtuse, c. 7 mm., densely hispid. Corolla bluish, up to 18 mm., subsalveriform with a long, narrow tube, obliquely symmetrical throat, and short, subequal lobes; outer surface densely hispid along the veins; annulus of 5 poorly developed lobes or subentire. Two stamens well exerted, three included within the corolla; anthers bluish. Style exerted, hispid, shortly bifid at tip. Nutlets greyish, echinulate.

Type. «in Insula S. Nicolai Cap Vert, 29 Martii 1822», *Forbes* 32 (K!).

E. stenosiphon is the commonest *Echium* species in the Cape Verde Islands. It is a xerophytic zone plant found at the edges of fields and on dry volcanic slopes from 100 to about 1000 m.

E. stenosiphon is a variable species paralleling *E. strictum* of the Canaries and it is extremely undercollected as are most Cape Verde Islands species. Leaf-shape, indumentum and dimensions of the corolla tube are very variable and subsp. *stenosiphon* and subsp. *lindbergii* seem to represent the extremes of range of these characters. They might be considered as distinct species (as they were by PETTERSSON, 1960) if it were not for the existence of several intermediate specimens even amongst the small sample seen. PETTERSSON's *E. glabrescens* also comes within the range of variation of *E. stenosiphon* (subsp. *stenosiphon*) and seems to be intermediate between this and subsp. *lindbergii* in size of the trichomes but in indumentum density and most other characters the type specimen (*Lindberg*, 15.XII.1953; H photo!) corresponds closely to the type of subsp. *stenosiphon*.

Key to the subspecies of E. stenosiphon.

Indumentum of large, rough-based trichomes; calyx segments ovate; corolla subsalveriform
(a) subsp. **stenosiphon**

Indumentum of small, white, pustular trichomes; calyx segments narrowly lanceolate;
corolla tube more or less campanulate (b) subsp. **lindbergii**

(a) subsp. **stenosiphon.**

Distribution. Cape Verde Islands: São Antão, São Vicente, São Nicolau.

Representative specimens. **Cape Verde Islands: S. Vicente:** s. l., 1841, *Vogel* 81 (K); *ibid.*, 1842, *Ansell* (K); *ibid.*, 1873, *Moseley* (BM); *ibid.*, IX.1853, *Welwitsch* 5469 (BM); *ibid.*, 600 m., 17.X.1934, *Dinklage* 3169 (BM); *ibid.*, Monte Verde, IX.1934, *Chevalier* 45805 (P). **S. Nicolau:** s. l., 29.III.1822, *Forbes* 32 (K); *ibid.*, 1851, *Bolle* (Z); *ibid.*, Thome Pires, 25.II.1864, *Lowe* (BM, K). **S. Antão:** Campo de Cão, 1934, *Chevalier* 45336 (P).

(b) subsp. **lindbergii** (Pettersson) Bramwell, *comb. et stat. nov.*

E. lindbergii Pettersson, *Soc. Sci. Fenn. Com. Biol.* 22: 36 (1960).

Leaves ovate-lanceolate, acute; indumentum of dense, small, pustular trichomes. Inflorescence bracts oblong to lanceolate, sessile, broad-based.

Calyx segments narrowly lanceolate, obtuse to subacute. Corolla blue-violet, the tube broader than in subsp. *stenosiphon*; lobes rounded.

Type. «S. Antão; Cova, 31.XII.1953», H. Lindberg (H!).

Representative specimens. **Cape Verde Islands:** s. l., 1808, *St. Hilaire* (P). **S. Antão:** Ribeira Grande à Cova, 1934, *Chevalier* 48592 (P); Cova, 1934, *Chevalier* 48591 (P); *ibid.*, 31.XII.1953, *Lindberg* (H, photo).

Sect. 6. AUBERIANA Bramwell, *sect. nov.*

Herbae perennes; caudex lignosus. Inflorescentiae laxae. Corolla caerulea; lobii subaequales. Stamina subexserta.

Type. *E. auberianum* Webb & Berth.

25. *E. auberianum* Webb & Berth., *Phyt. Canar.* 3: 42 (1844).

E. bourgaeum Webb sensu Christ, *Bot. Jahrb.* 9: 126 (1888), *in syn.*, non Webb ex Coincy (1903).

[*E. mordax* Solander, *in sched.*]

Perennial with short woody stock. Stems one to several, ascending or erect, up to 80 cm., densely hispid. Leaves in a basal rosette, linear to narrowly oblanceolate, 16-20 x 0.7-1.5 cm., petiolate; apex acute; both surfaces densely covered with long (up to 3 mm.) tuberculate setae; midvein prominent below; stem leaves decreasing in length above. Inflorescence thyrsoid, densely setose; lateral cymes pedunculate. Flowers shortly pedicellate. Calyx campanulate; segments linear, acute, 8-10 mm., accrescent in fruit, very densely hispid with yellowish trichomes. Corolla blue 10-15 mm., infundibuliform, the tube pubescent; lobes rounded, the anterior slightly longer than the others; annulus an entire, lightly hispid ring. Stamens all included in the corolla or two slightly exserted; filaments reddish. Style deeply bifid (2-3 mm.), slightly exserted. Nutlets brownish, 2-2.5 mm., rugose, conical.

Type. «P. Auber: *E. auberianum* Webb habit. ad basin coni superioris montis alti (Pico de Teyde) inter scorias et pumices montis albi. Dedit. P. Barker Webb». (FI!).

Distribution. Canary Islands: Tenerife, endemic to the subalpine zone.

Representative specimens. **Canary Islands: Tenerife:** Montis albi, inter scorias et pumices, undated, *Auber* (FI, P); inter juxta montium arenosis, 1778, *Masson* (BM); Los Azulejos, 2250 m., 22.VI.1954, *Lindquist* (BM); Cañada de las Arenas Negras, VIII.1965, *Bramwell* 65 (LIVU); Montaña de las Arenas Negras, 2200 m., 22.X.1968, *Bramwell* 266 (RNG); *ibid.*, 30.V.1969, *Bramwell* 1713 (LTR, RNG, SEV).

E. auberianum is a very rare species of which only two or three small populations exist. It is found on dry cinder and pumice slopes above 2000 m. on the southern side of Las Cañadas del Teide. In habit, the species is intermediate between the frutescent Macaronesian and herbaceous mediterranean groups of *Echium*.

SPRAGUE & HUTCHINSON (1914) placed it in the same group as the monocarpic species *E. wildpretii*, *E. simplex* and *E. pininana* and it is probably most closely allied to these species.

The largest population occurs at Montaña de las Arenas Negras on steep slopes of black volcanic cinder (150 individuals) and a second fairly large population was seen on pumice and cinder flats below Montaña de Diego Hernández. The *locus classicus* at Montaña Blanca now has only a very small population of this species (8 plants in 1969) and a small population of about 10 plants was noted at Montaña Rajada near the foot of the Pico de Teide.

This species was first collected by MASSON in 1778 and was recognised by SOLANDER as a new species (*E. mordax* sp. nov., *in sched.*; BM), but remained undescribed until it was rediscovered by AUBER about 1830 and described by WEBB & BERTHELOT.

Sect. 7. DECAISNEA Bramwell, *sect. nov.*

Frutices ramosissimi. Inflorescentiae confertae, breviter conicae. Corolla lactea vel caesia; lobii aequales.

Type. *E. decaisnei* Webb & Berth.

26. *E. decaisnei* Webb & Berth., *Phyt. Canar.* 3: 49 (1844).

E. thyrsiflorum Link in Buch, *Phys. Besch. Canar. Ins.* 144 (1821), *pro parte, quoad pl. Canariae.*

Shrub, 0.5-2 m. Stem and branches, brown, lightly hispid near tips. Leaves lanceolate, 8-15 x 1.5-2.5 cm., the apex acute; base shortly petiolate;

upper leaf-surface with evenly distributed very short, large-based spines or flat discs; lower surface with spines confined to margins and vein, otherwise glabrous. Inflorescence large, up to 20 cm., dense, broadly conical; lateral cymes simple. Flowers shortly padicellate. Calyx subglabrous, occasionally with a few setae, accrescent in fruit; segments up to 7 mm., ovate to lanceolate, obtuse. Corolla white with pale blue stripes or very rarely blue, 10-14 mm., broadly infundibuliform with a broad, open throat; lobes 2-4 mm., rounded, the outer surface lightly pubescent; annulus a continuous, scarcely lobed ring. Stamens exerted; filaments glabrous. Style exerted, sparsely hairy, deeply bifid at tip (1-1.2 mm.). Nutlets dark brown, rugose with acute, conical protruberances.

Type. «Despreaux: sp. nov. aff. *E. giganteum*» (FI!). This specimen is also labelled «*E. decaisnei* Nob.» in Webb's handwriting, and I take it to be the type specimen of this species.

E. decaisnei is a variable species of the xerophytic and lower montane zones between 100 and about 1000 m. It is abundant and often dominant over wide areas of the south-west of Gran Canaria and is also frequent on the north side of the island always in *Euphorbietea* communities. In the dry south-east of the island it is rarer and tends to be replaced in the more xeric habitats by *E. onosmaefolium*.

Small populations from Lanzarote and Fuerteventura are rather distinct and are referred to subspecies *purpurienne*.

Key to the subspecies of E. decaisnei.

Leaves lanceolate; indumentum of very short spines; corolla-lobes 2-3 mm.

(a) subsp. **decaisnei**

Leaves oblanceolate; indumentum of flat discs; corolla-lobes 3-4 mm.

(b) subsp. **purpurienne**

(a) subsp. **decaisnei**.

Distribution. Canary Islands: Gran Canaria; widespread.

Representative specimens. **Canary Islands: Gran Canaria:** Arucas, 25.VI.1925, *Spooner* (BM, K); *ibid.*, 1.V.1890, *Murray* (K); Barranco de la Angostura, 14.III.1846, *Bourgeau?* (FI); *ibid.*, 12.V.1897, *Gelert* (C); *ibid.*,

2.VII.1966, *Hansen* (C); *ibid.*, in rupibus praerupt., 22.IV.1855, *Bourgeau* 1433 (C, FI, K, Z); Las Palmas, 12.VII.1949, *Keay* 25355 (K); *ibid.*, 11.V.1892, *Murray* (K, BM); Caldera de Bandama, III.1896, *Collett* (K); *ibid.*, 26.V.1923, *Asplund* (K); Mogan, 10.V.1894, *Murray* (K); *ibid.*, 11.V.1894, *Murray* (BM); between Mogan and Tirajana, 10.V.1894, *Murray* (K); Tafira Alta, 15.V.1900, *Bornmüller* 1009 (Z); *ibid.*, 20.V.1957, *Larsen* (C); *ibid.*, 450 m., 28.III.1969, *Bramwell* 1098 (RNG, SEV); Vallesquillo, 25.III.1846, *Bourgeau* 852 (FI); Cuesta de Silva, 16.V.1894, *Murray* (K); Guía, V.1892, *Murray* (BM); *ibid.*, 8.V.1890, *Murray* (LIVU); Santa Lucía, V.1926, *Burchard* 335 (CGE, Z); Barranco de Guiniguada, 230 m., 19.I.1969, *Kunkel* 12305 (C, Ku); Barranco de Aguaje, 26.IV.1897, *Gelert* (C); Barranco de Tejeda, 700 m., 27.III.1969, *Bramwell* 1025 (RNG, SEV); Juncalillo, 600 m., 30.III.1969, *Bramwell* 1139 (RNG); San Bartolomé de Tirajana, II.1906, *Pitard* 265 (P); Barranco de Fataga, 21.III.1971, *Bramwell & Humphries* 3034 (BM, RNG); Santa Lucía de Tirajana, 23.III.1971, *Bramwell & Humphries* 3087 (RNG); Gran Canaria, *Despreaux* (CGE, FI, P); Caldera de Bandama, undated, *Webb* (FI); Tafira, 8.II.1911, *Jarhandiez* (FI).

- (b) subsp. **purpuriense** Bramwell, *Cuad. Bot. Canar.* 12: 5 (1971).
E. famarae Lems & Holzap., *Bot. Gaz.* 129: 97 (1968), *nomen nudum*.

Shrub up to 1 m. Leaves distinctly oblanceolate, obtuse; indumentum consisting of flat discs usually without central spines. Calyx segments obtuse. Corolla lobes larger than in the typical form, 3-4 mm. long, spreading, rounded. Nutlets dull, blackish.

Type. «Lancerotta in rupibus supra las salinas, 1845», *Bourgeau* 310 (K!).

Distribution. Canary Islands: Lanzarote, Fuerteventura.

Representative specimens. **Canary Islands: Lanzarote:** Las Salinas, 1845, *Bourgeau* 310 (BM, CGE, FI, K, P, Z); Famara, 1400 ft., 16.V.1902, *Murray* (K); *ibid.*, 450 m., 14.V.1969, *Bramwell* 1632 (RNG); Peñitas de Chache, 700 m., 14.V.1969, *Bramwell* 1632A (RNG). **Fuerteventura:** below Pico de la Zarza, 500 m., 9.V.1969, *Bramwell* 1588 (RNG); Rochers de Handia, parte de Barlovento, undated, *Bolle* (FI).

E. decaisnei subsp. *purpurienne* is found only on the cliffs at Famara on Lanzarote and Jandia on Fuerteventura between 200 and 700 m. in the xerophytic zone. It inhabits step-crevices and rocky slopes in areas of basalt rock and is most frequent on the summits of the Famara massif on Lanzarote.

27. *E. hypertropicum* Webb in Hooker, *Niger Pl.* 15 (1849).

E. hypertropicum var. *nudum* (Lowe) Coincy, *Bull. Herb. Boiss.*, sér. 2, 4: 497 (1903).

[*E. nudum* Lowe, *in sched.*]

Shrub, up to 1 m. Young branches densely pubescent becoming subglabrous. Leaves broadly lanceolate, up to 12 (-20) x 3-3.5 (-5) cm., subacute to obtuse, tapering to a short petiole, densely and finely hispid with small pustular trichomes, the veins prominent below, hispid. Inflorescence a dense, ovate thyrse; lateral cymes usually simple, pedunculate. Flowers $\pm$ sessile. Calyx 5-6 mm.; segments somewhat unequal, lanceolate, obtuse to subacute, densely hispid, strongly accrescent in fruit. Corolla broadly infundibuliform, white or pinkish, 8-10 mm.; lobes large, ovate, subequal, lightly pubescent; annulus entire to sublobed, pubescent. Stamens exserted. Style exserted, subglabrous, scarcely bifid at the tip. Nutlets dark brown to blackish, covered with conical tubercles.

Type. CHEVALIER (1935) cites «J. da Silva Feijo in Herb. Mus. Paris» as the type for this species, but the only specimen cited in WEBB's protologue is «In herb. ins. Cap Virid. Mus. Par.» without a collector's name. WEBB also states in the introduction to *Spicilegium Gorgoneum* that he consulted the specimens collected by G. ST. HILAIRE in the Paris Museum and there is a specimen of *E. hypertropicum* amongst these specimens which I take to be the holotype: «G. St. Hilaire 1808, Cap-Vert» (P!).

Distribution. Cape Verde Islands: San Thiago, Ilha de Fogo, Brava, São Antão.

Representative specimens. **Cape Verde Islands:** s. l., 1808, *St. Hilaire* (P). **San Thiago:** Porto de la Cruz, 15.VII.1934, *Chevalier* 44606 (P); **Ile de Fogo:** Chandra Furna, 800 m., 1934, *Chevalier* 44928 (P). **Brava:** s. l., 28.III.1864, *Lowe* (K, P); *ibid.*, 29.III.1864, *Lowe* (BM).

LOWE labelled a number of his Cape Verde sheets of *Echium* with the name *E. nudum*. He mistook the then unrecognised *E. vulcanorum* Chev., a densely sericeous plant, to be Webb's *E. hypertropicum* and considered the much less hairy plant he had collected to be a new species when it was, in fact, identical with WEBB's species. COINCY (1903) who did not see any material of *E. vulcanorum* which was still undescribed at the time, considered correctly that the LOWE specimens were identical with *E. hypertropicum* Webb but, perhaps in view of the scarcity of specimens available, cautiously retained LOWE's taxon giving it varietal status. SPRAGUE & HUTCHINSON (1914) retained both species as they had available the same material as LOWE, did not see the type of WEBB's *E. hypertropicum*, and followed LOWE's determinations of the Kew specimens. CHEVALIER (1935), who collected extensively in the islands, found all three Cape Verde species and also studied the herbarium material at Paris (P). He recognised that *E. nudum* Lowe and *E. hypertropicum* Webb were in fact the same species and also that there was a third species involved which he finally described as *E. vulcanorum* A. Chev.

E. hypertropicum was recorded from the Canary Island of La Palma (PITARD & PROUST, 1908) on the basis of a specimen at Paris (P), but further investigations have shown that this record is a mistake due to the switching of two labels, possibly during mounting, of specimens sent to Paris by LOWE. The label of a sheet of *E. pininana* from La Palma has become transposed with a label of *E. hypertropicum* from the Cape Verde, both plants being unnamed and the labels bearing only collecting data. This went unnoticed and PITARD & PROUST, who later consulted the specimens, obviously did not detect the error and recorded *E. hypertropicum* from La Palma. Duplicates of both sheets at Kew are correctly labelled.

This species seems to be a xerophytic species growing amongst rocks between 100 and 1000 m. It is similar in floral morphology and in ecology to *E. decaisnei* Webb & Berth. and CHEVALIER (1935) suggests that the two species are vicariants.

Sect. 8. GENTIANOIDEA Bramwell, *sect. nov.*

Frutices parvi. Inflorescentiae laxae. Calycis tubus lobii circiter aequans. Stamina non vel leviter exserta.

Type. *E. gentianoides* Webb ex Coincy.

28. *E. gentianoides* Webb ex Coincy, *Bull. Herb. Boiss.*, sér. 2, 4: 498 (1903).

E. thyrsoiflorum Link in Buch, *Phys. Besch. Canar. Ins.* 144 (1825),
p. p., quoad pl. palmense.

[*E. gentianoides* Webb in Bourgeau, *Pl. Can. Exsicc.* 893 (1846),
in sched.]

Shrub up to 70 cm. Stem woody, glabrous, silvery grey. Leaves lanceolate, 5-10 x 0.7-1 cm., glabrous with short, large-based spinules above, $\pm$ glabrous below; apex subacute to obtuse; petiole short. Inflorescence thyrsoid, lax; lateral cymes simple; peduncles spiny. Flowers shortly pedicellate. Calyx 8-10 mm., campanulate, the tube exceeding the subacute lobes; central veins with prominent tuberculate spinules. Corolla blue-violet, up to 25 mm., infundibuliform, narrowing abruptly to the base, the throat oblique; lobes 4 mm., rounded to ovate, lightly pubescent, ciliate at the margins; annulus a poorly developed subglabrous ring. Stamens glabrous, two long exserted, three short and included; filaments pinkish-blue. Style equalling or slightly longer than the corolla, hirsute, bifid at apex. Nutlets blackish, broadly conical, rugose.

Type. «*E. gentianoides* Webb mss., 11 August 1845, La Palma in monte excelso Cumbre de Garafia», *Bourgeau* 893 (P!).

Distribution. Canary Islands: La Palma.

Representative specimens. **Canary Islands: La Palma:** Cumbre de Garafía, 11.VIII.1845, *Bourgeau* 893 (BM, K, P); Gran Pared circa Roque del Faro, 1100 m., 25.VI.1968, *Sventenius* 31043 (ORT, RNG); Topo Alto de Los Corrales, 1900 m., 25.VII.1946, *Ceballos & Ortuño* (Inst. Forestal, Madrid); Roque de los Muchachos, VI.1970, *Santos* (LAG).

E. gentianoides is a very rare species known only from a few localities on the outer northern slopes of the Gran Caldera de Taburiente. The species is apparently a chasmophyte found only on forest cliffs between 1100 and 1900 m. in the cloud zone. This area of the island is a very poorly explored one and the species may be more common than is apparent from the present state of knowledge.

E. gentianoides is unique amongst Canarian *Echium* species because of its well developed calyx tube with very short lobes, its densely spiny inflorescence and the completely glabrous lower surface of the leaves. CEBALLOS

& ORTUÑO (1951) state that in their specimens from Topo Alto de los Corrales, 1900 m., the stamens and style are shorter than or $\pm$ equal to the corolla, whereas in the specimens collected by SVENTENIUS (ORT, RNG) above Roque del Faro, 1100 m., the stamens and style are longer than the corolla. The affinities of this species are difficult to interpret. The leaves are somewhat similar to those of *E. decaisnei*, a point which probably led LINK (1825) to give a description of his *E. thyrsiflorum* which includes characters of both *E. gentianoides* and *E. decaisnei* and has localities on both Gran Canaria and La Palma. Apart from the leaves and habit, *E. gentianoides* has little in common with the other Canarian species and is, therefore, placed in a monotypic section of its own.

Acknowledgements. I would like to thank the Consejo Superior de Investigaciones Científicas (Madrid) for financial support from October 1968 to August 1969 when I carried out field studies in the Canary Islands and the University of Reading Research Board for a Research Studentship from October 1970 to September 1971 which enabled me to complete the project at Reading. Field studies were also undertaken in the Spring of 1971 with the aid of grants from the University of Reading Research Board and the Godman Exploration Fund. I am particularly indebted to Professor V. H. HEYWOOD (Reading) for guidance and encouragement throughout and to Dr. D. M. MOORE who gave valuable advice on the experimental and phytogeographical sections. I am very grateful to Professor E. F. GALIANO who allowed me to be based at the University of Sevilla for part of the period between October 1968 and August 1969. Special thanks are due to Dr. E. R. SVENTENIUS for all his help and advice in the field, with identifications of specimens and discussion of all aspects of the Canarian Flora, for his generous hospitality and assistance during my field excursions to the Canaries, and for allowing me to consult his unique collection of rare botanical literature on the Canary Islands.

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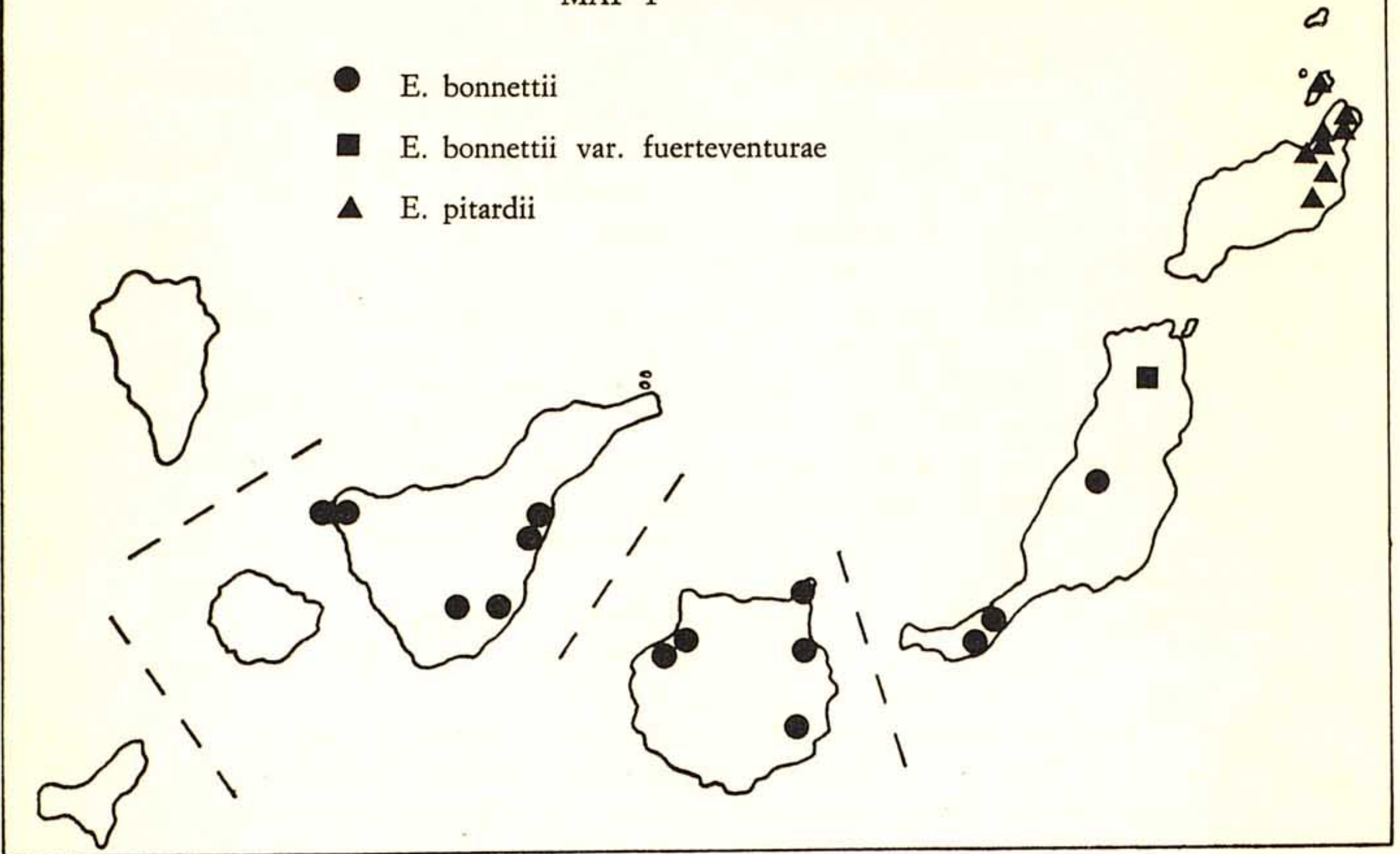
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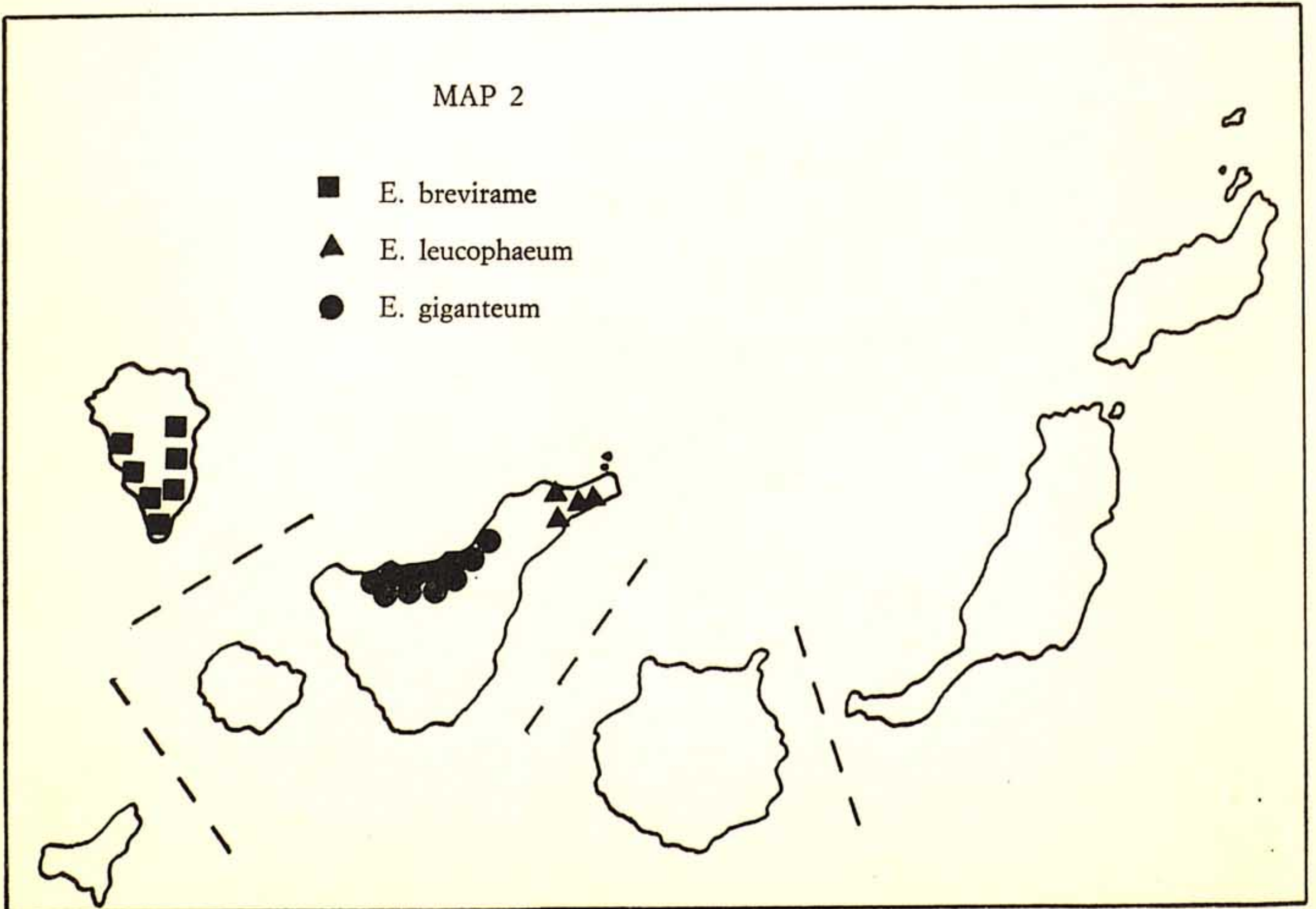
MAP 1

- *E. bonnettii*
- *E. bonnettii* var. *fuerteventurae*
- ▲ *E. pitardii*



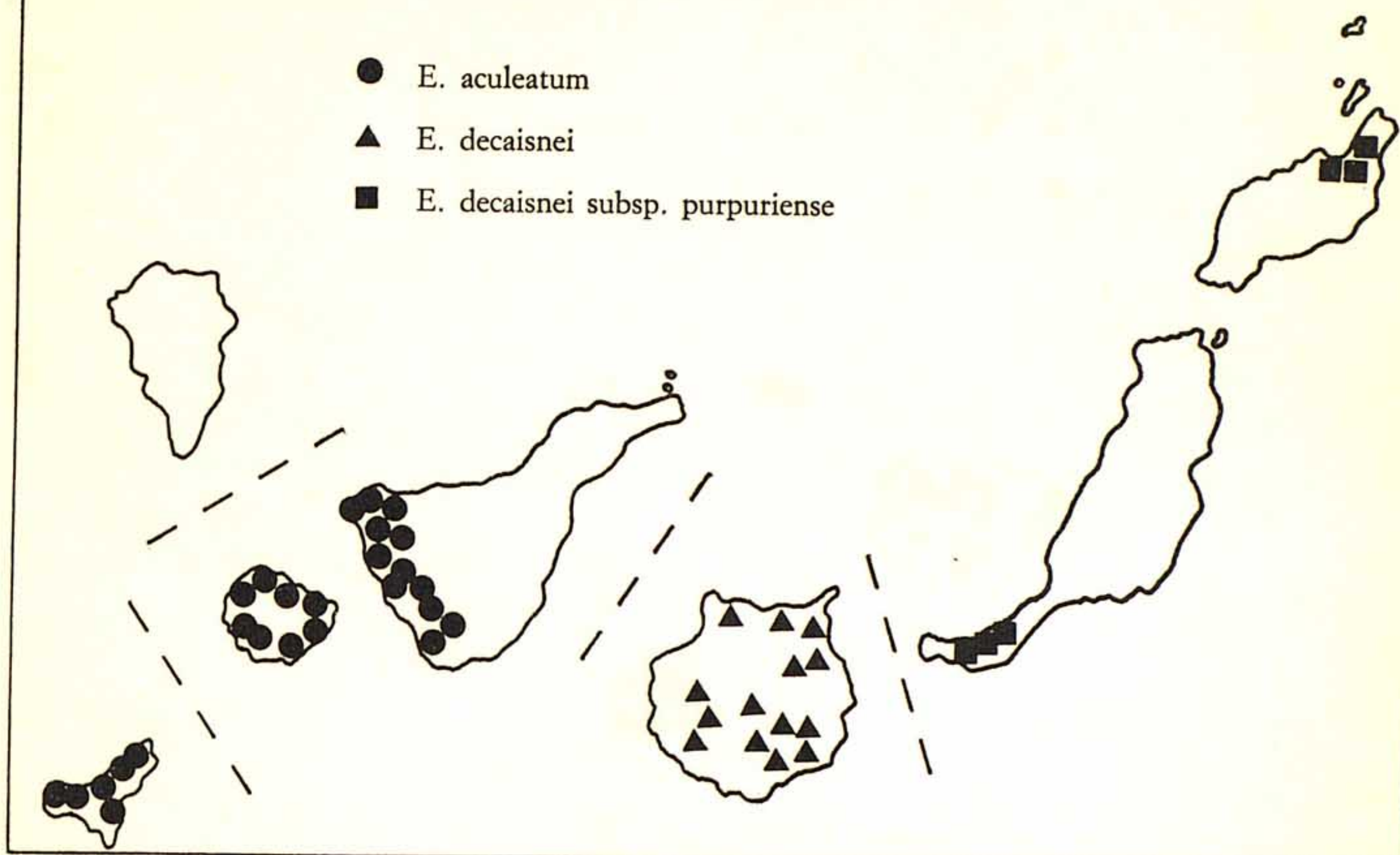
MAP 2

- *E. brevirame*
- ▲ *E. leucophaeum*
- *E. giganteum*



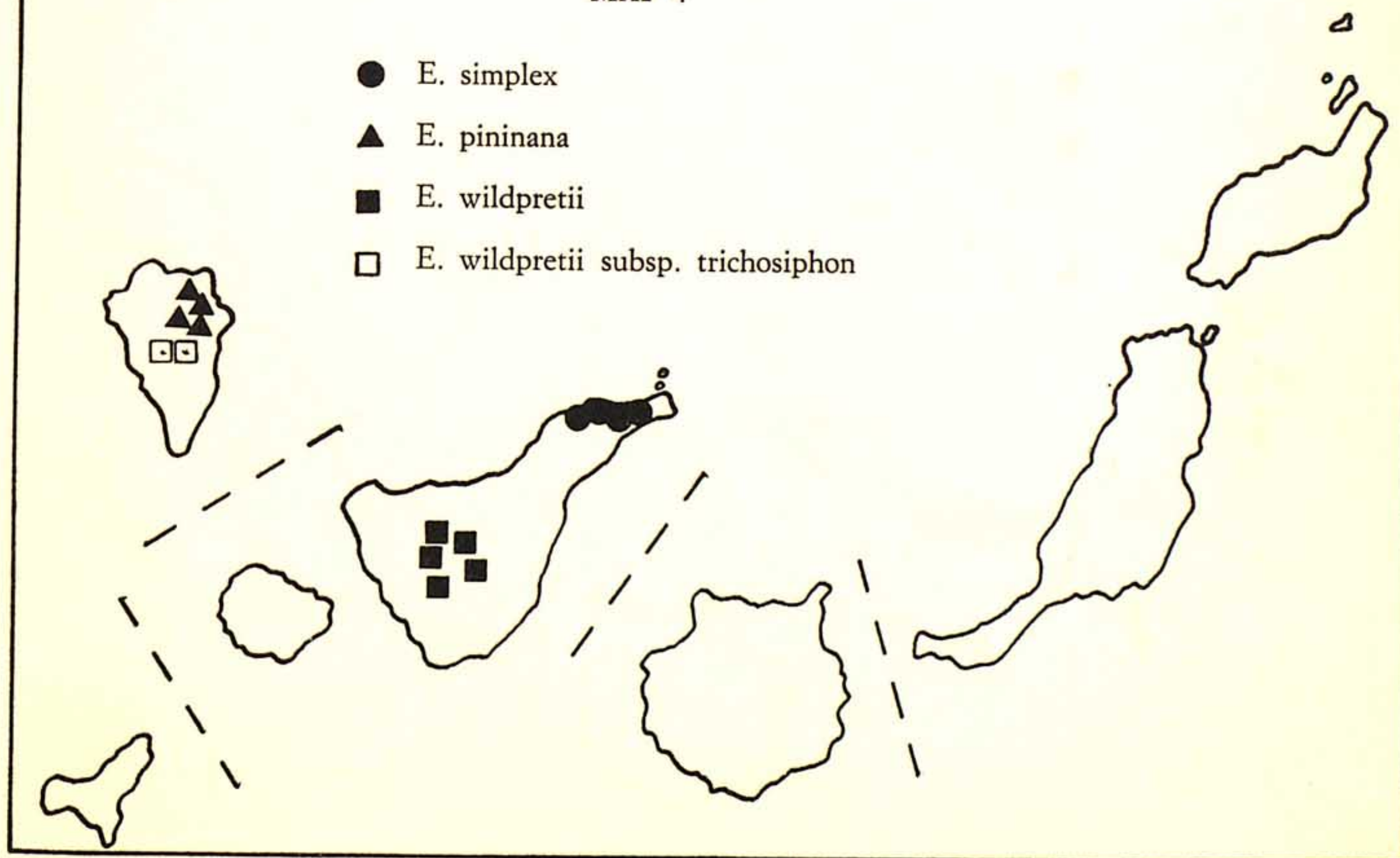
MAP 3

- *E. aculeatum*
- ▲ *E. decaisnei*
- *E. decaisnei* subsp. *purpuriense*



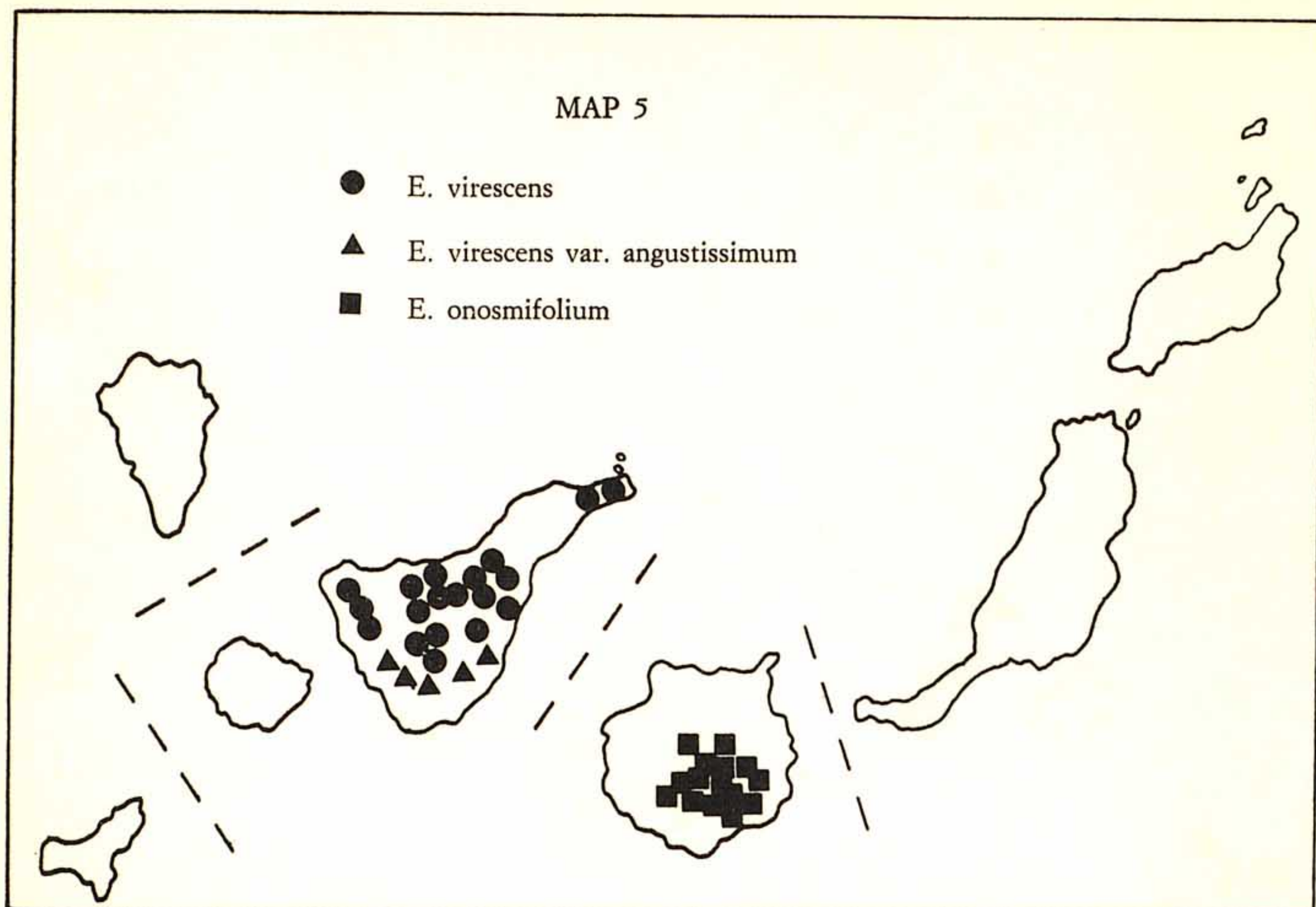
MAP 4

- *E. simplex*
- ▲ *E. pininana*
- *E. wildpretii*
- *E. wildpretii* subsp. *trichosiphon*



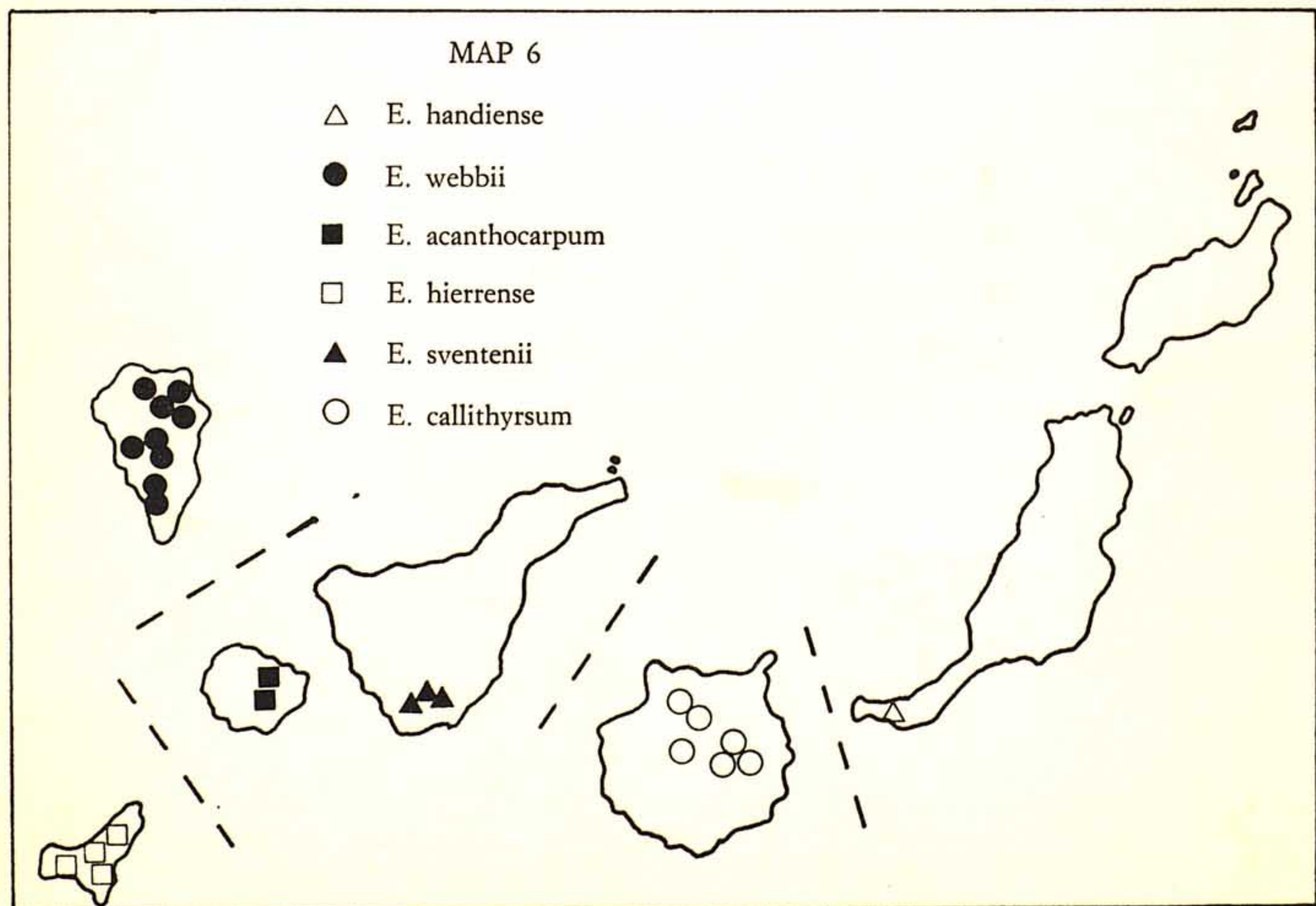
MAP 5

- *E. virescens*
- ▲ *E. virescens* var. *angustissimum*
- *E. onosmifolium*



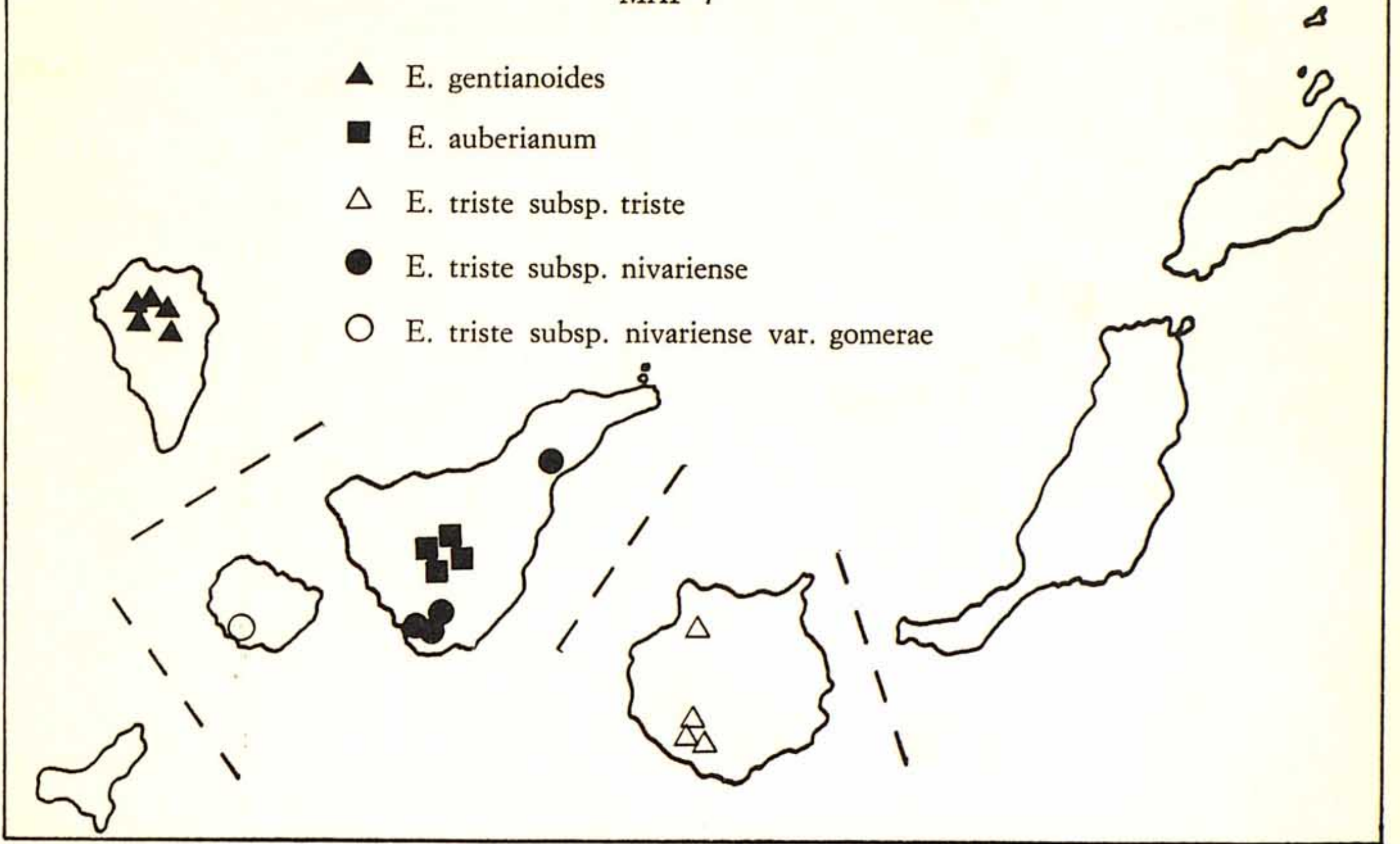
MAP 6

- △ *E. handiense*
- *E. webbii*
- *E. acanthocarpum*
- *E. hierrense*
- ▲ *E. sventenii*
- *E. callithyrsum*



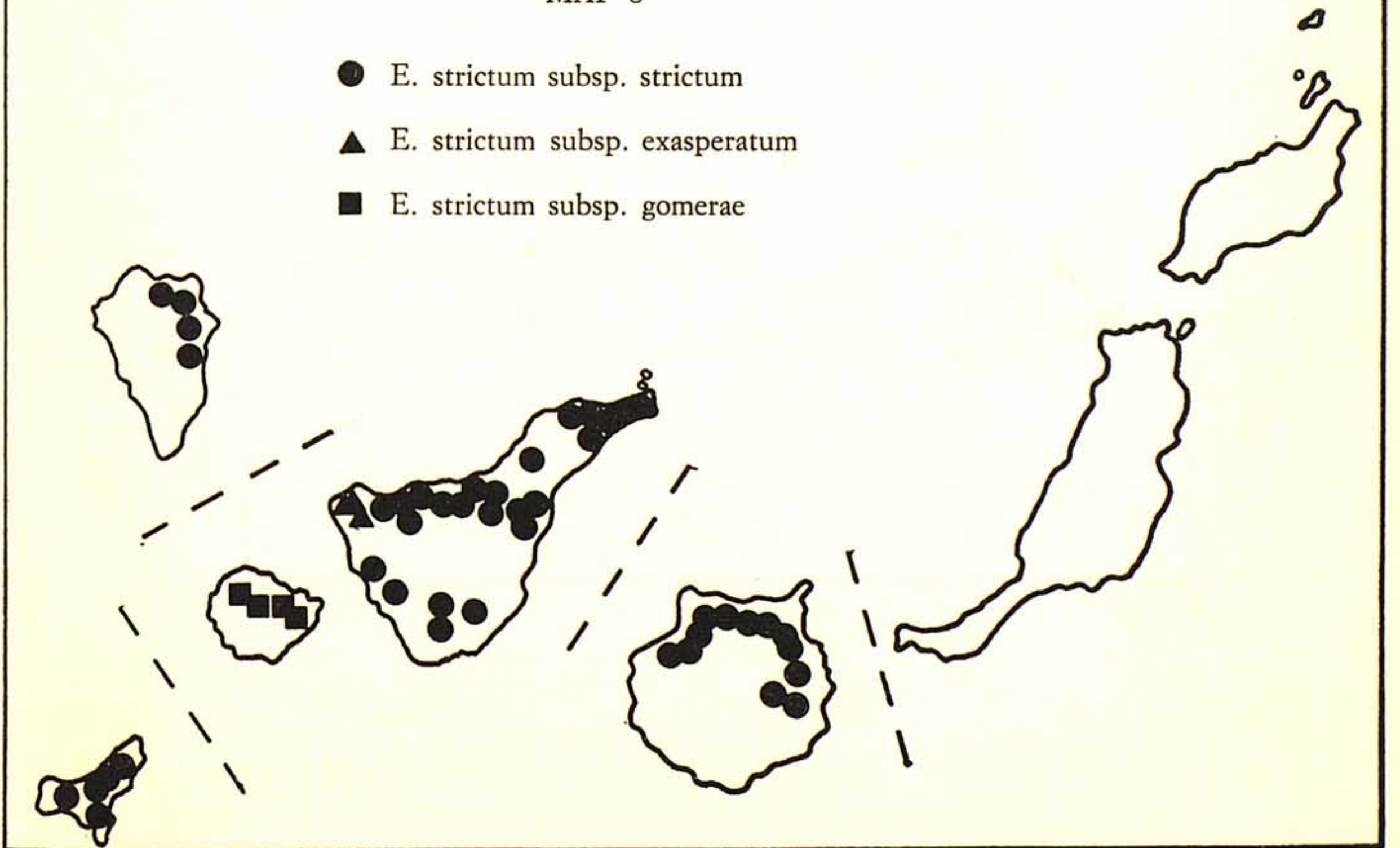
MAP 7

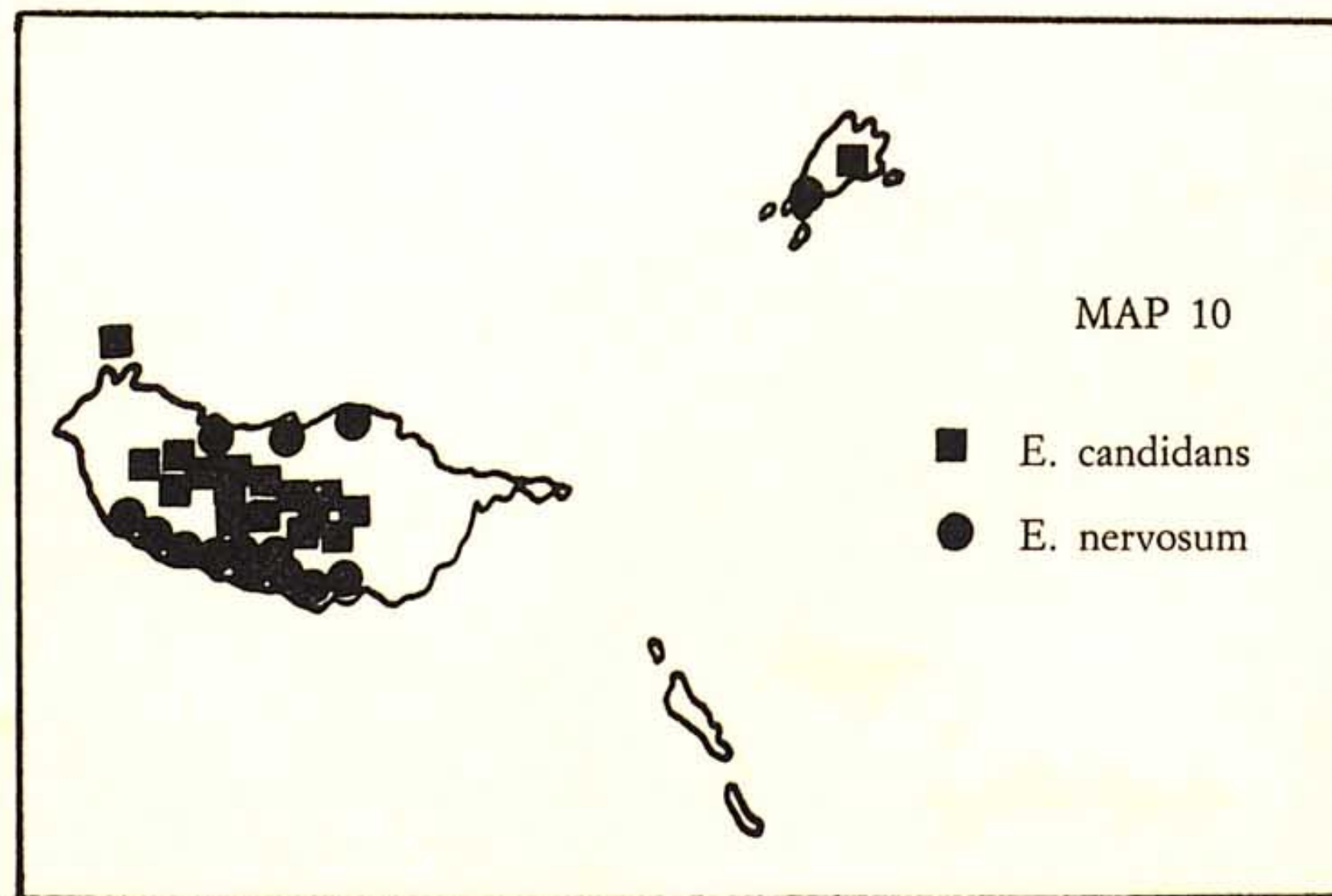
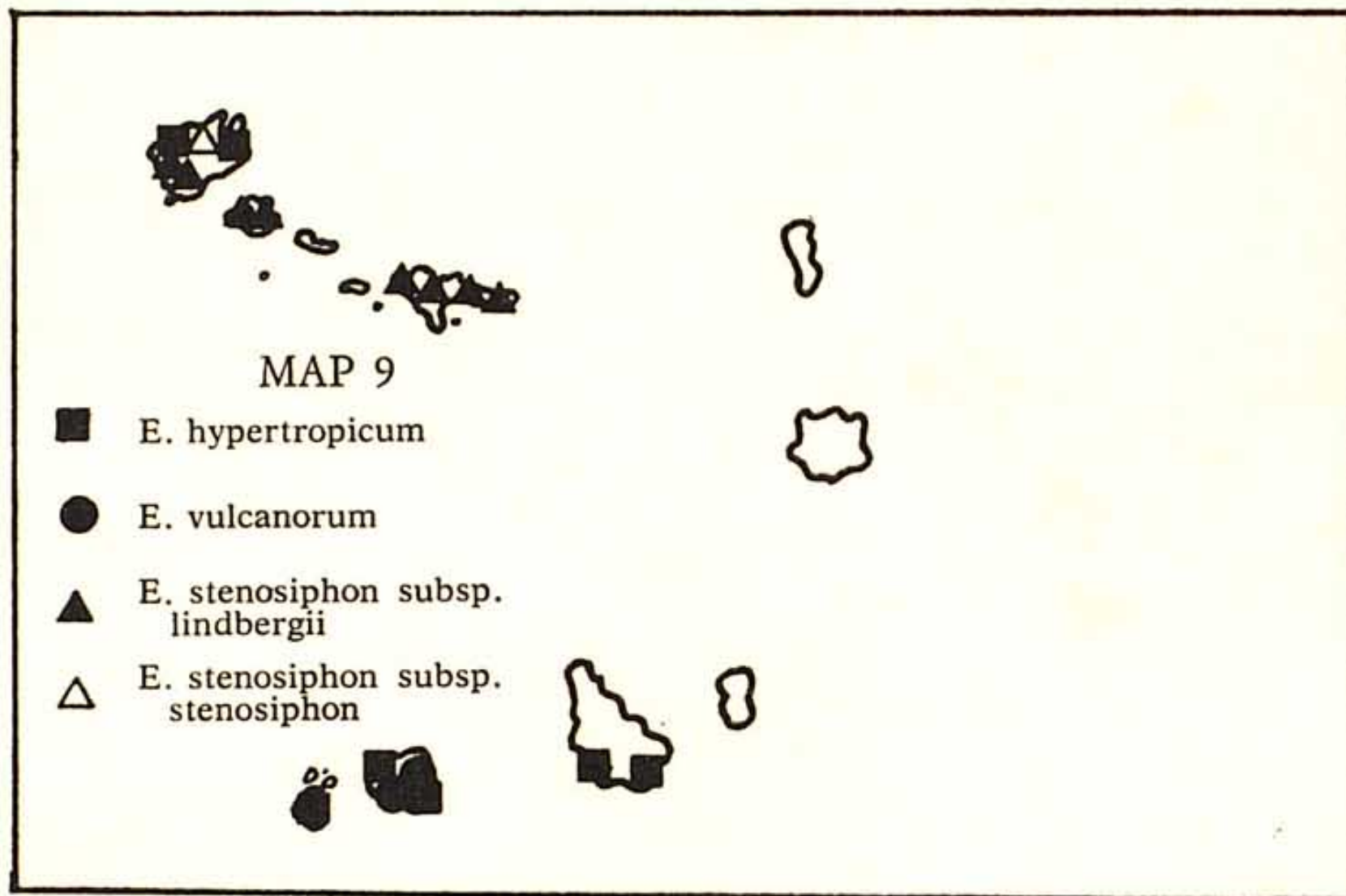
- ▲ *E. gentianoides*
- *E. auberianum*
- △ *E. triste* subsp. *triste*
- *E. triste* subsp. *nivariense*
- *E. triste* subsp. *nivariense* var. *gomeræ*



MAP 8

- *E. strictum* subsp. *strictum*
- ▲ *E. strictum* subsp. *exasperatum*
- *E. strictum* subsp. *gomeræ*





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