

# The genus *Echium* (Boraginaceae) in southern Africa

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**Keywords:** Boraginaceae, *Echium* L., indumentum, *Lobostemon* Lehm., phytogeography, pollen, relationships, southern Africa, taxonomy, weed

## ABSTRACT

The genus *Echium* L. (Boraginaceae) comprises about 60 species, mainly from Macaronesia, Europe, western Asia and North Africa. Two species *E. plantagineum* L. and *E. vulgare* L. were introduced into southern Africa and have become naturalised. The species occur mainly as roadside weeds in the region. *Echium* is closely related to *Lobostemon* Lehm. (incl. *Echiostachys* Levyns), endemic in the southwestern Cape region. Pollen morphology shows a remarkable similarity between these genera, even suggesting that they could be merged. However, other characters, such as bilobed styles (*Echium*) versus undivided ones (*Lobostemon*) and the presence of an annulus, composed of a minute collar or 5–10 minute hairy lobules, at the bottom of the corolla tube inside (*Echium*), in contrast to hairs and/or scales at the base of the filaments (*Lobostemon*) contradict the pollen structure, and *Echium* and *Lobostemon* are therefore regarded as two separate genera. Significant taxonomic characters, an identification key, full descriptions, illustrations and distribution maps of *E. plantagineum* and *E. vulgare* are given.

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## INTRODUCTION

The genus *Echium* L. (1753) comprises about 60 species, distributed in Macaronesia, Europe, western Asia and North Africa (Mabberley 1997). It belongs to the Boraginaceae, a family characterised by an indumentum mainly of trichomes with swollen, multicellular bases, inflorescences of scorpioid or helicoid cymes which uncoil and elongate as the flowers mature, a terminal or gynobasic style, and fruit consisting mostly of four nutlets. Although cosmopolitan, the members of Boraginaceae are particularly well represented in temperate and subtropical regions, with centres of diversity in the Mediterranean region and western North America (Zomlefer 1994).

Two species of *Echium*, *E. plantagineum* L. and *E.*

*vulgare* L., were introduced into southern Africa and are now naturalised in the Western and Eastern Cape, eastern Free State, Lesotho, high mountainous areas of KwaZulu-Natal and in Mpumalanga. Both species occur mainly as roadside weeds in the region. This study forms part of an ongoing revision of the Boraginaceae of southern Africa which is currently in progress.

The purpose of this paper is to present a revision of two species of *Echium* in South Africa and Lesotho. Diagnostic characters, an identification key, full descriptions, illustrations and distribution maps are provided. The generic description of *Echium* and also the species descriptions of *E. plantagineum* and *E. vulgare* are based on behaviour in southern Africa only.

## MATERIALS AND METHODS

Herbarium specimens in BM, BOL, E, GRA, K, NBG, NH, NU, PRE, PRU and SAM were studied to gather data on morphological characters, flowering time and distribution. Both untreated and acetolysed pollen grains were studied. Pollen was acetolysed according to the standard method of Erdtman (1960). For SEM, samples were coated with gold and studied with an ISI-SX-25 microscope. For LM, pollen grains were mounted in glycerine jelly.

## HISTORICAL OUTLINE

According to Smith (1966), *E. plantagineum* was introduced to South Africa from Europe as part of stock feed. A note on Britten 520, a herbarium specimen in PRE dated 1917, *E. plantagineum* might have become established in the region after mixed birdseed had been sown. Wright (1904) records a specimen of Villet (without locality) which may have been collected about 1825–1827. Exactly how and when *E. vulgare* entered the country is not known. The oldest specimens examined date back from 1912 to 1915 when Mary Page, a botanical artist, collected this species in Lesotho.

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Lehmann (1818), like Linnaeus (1762, 1771), Thunberg (1794), Jacquin (1797) and others, published new species under *Echium* from the Cape region. In 1830, however, the genus *Lobostemon* (Boraginaceae) was described by Lehmann, based on a plant grown in the Botanic Gardens at Hamburg, specimens of it then named by him *L. echioides*. Lehmann emphasised the presence of a scale-like outgrowth at the base of the stamens as diagnostic in *Lobostemon* (Levyns 1934). Buek (1837) transferred 32 South African species to *Lobostemon*, most of which had formerly been included in *Echium*. He extended Lehmann's genus to include certain species in which staminal scales were absent, but in which hairs were present on the lower parts of the filaments. De Candolle (1846) also recognised the genus *Lobostemon*. He described some new species, but referred all those without definite scales to the genus *Echium*. In *Flora capensis*, Wright (1904) reverted to Buek's earlier concept of *Lobostemon* in that he once more returned those taxa without scales to the genus. However, he retained one species, *Echium formosum* Pers. in the genus *Echium*. Today *E. formosum* is treated as conspecific with *Lobostemon regulareflorus* (Ker Gawl.) M.H.Buys (Buys & Van der Walt 1994).

Johnston (1924) was of the opinion that *Lobostemon* should be a synonym of *Echium*. He published new combinations in *Echium* for 21 species of *Lobostemon*, described by Buek (1837), De Candolle (1846) and Wright (1904). Some years later, Johnston (1953, 1954) once again separated *Lobostemon* from *Echium* on the position of the annulus and the fact that in *Echium* the style is always 2-lobed, whereas in *Lobostemon* it is simple. His account on *Echium* and *Lobostemon*, published in 1954, appeared after Levyns's (1934) major revision of *Lobostemon*. In the latter publication Levyns described the new genus, *Echiostachys*, based on three species, all formerly placed under *Echium*. Johnston (1954), however, rejected the erection of the genus *Echiostachys*. According to him, this proposed segregate genus differs from the remaining *Lobostemon* species only in their herbaceous habit and the very dense cylindrical thyrses, differences which are no more striking or important than those existing between groups of species in *Echium*.

Both Phillips (1951) and Dyer (1975) distinguished *Echium* and *Echiostachys* from *Lobostemon*, the first two genera with the filaments sometimes hairy at the base, but never with scales or protuberances at the base. *Lobostemon* is retained for those taxa that have filaments with a densely hairy scale, ridge or protuberance at the base. *Echium*, on the other hand, is separated from *Echiostachys* because of its irregular, bilabiate corolla. Dyer (1975) was definitely not aware of Johnston's (1953) account on *Echium* and *Lobostemon*, where he separated the genera based on the position of an annulus inside the corolla tube.

The present authors follow Johnston (1953) and others in regarding *Echium* and *Lobostemon* as two separate genera. Although very similar in pollen morphology, other characters like the structure of the style and a disjunct distribution pattern reveal two distinct genera. For the purpose of the present paper, *Echiostachys* is regarded as synonymous with *Lobostemon*, in agreement with Johnston's view above.

## MORPHOLOGICAL CHARACTERS OF TAXONOMIC SIGNIFICANCE

### Trichomes

The indumentum of the stem, leaf and calyx in *Echium* can be described as hispid or strigose. Three morphologically different types of trichomes have hitherto been reported in the genus: (1) tubercle-based trichomes (setae), often with a concentric ring of epidermal cells surrounding the base, (2) unicellular trichomes, and (3) glandular, multicellular trichomes. These trichome types are simple (unbranched). Glandular trichomes, however, do not occur on the various plant parts of *E. plantagineum* and *E. vulgare*.

The trichome complement of *E. plantagineum* consists of tubercle-based setae, each with a uniseriate, concentric ring of epidermal cells surrounding the base. These setae vary from long and slender to short, and are often stout and sparsely to moderately densely arranged (Figure 1A–C). Furthermore, a sublayer of much shorter, soft, unicellular trichomes is present on the stems, margins and veins of the leaves, as well as the calyx lobes (Figure 1B). *E. vulgare* is characterised by tubercle-based seta with a ring of cells at the base, similar to that of *E. plantagineum*, interspersed with tubercle-based setae, which are short and stout, without a ring of cells at the base (Figure 1D, E). Although the base of shorter setae are usually swollen, there is generally little or no modification of the surrounding epidermal cells (Figure 1E). The setae with a ring of cells occur very sparsely, whereas the shorter ones without prominent rings form a moderately dense sublayer (Figure 1D, E). The combination of trichome types is distinctly different in the two southern African species, and a most useful character for identifying specimens.

If the collective trichome cover of *E. plantagineum* and *E. vulgare* is compared with those of *Lobostemon* species, to which they are closely related, similar but not exactly the same states are found. The nature, composition and relative abundance of trichomes are also of taxonomic importance in other genera of the Boraginaceae. An overview of trichome characters in all southern African taxa of the family is in preparation.

### Corolla

Flowers of *Echium* are borne in thyrsoid inflorescences composed of many lateral helicoid cymes, the latter enlarging in fruit. The shape and colour of the corolla, together with the degree of stamen exertion, are floral characters of prime taxonomic importance in the European species of *Echium* (Gibbs 1971). *E. plantagineum* and *E. vulgare* belong to two different groups. The corolla of *E. plantagineum* is broadly funnel-shaped with two stamens long-exserted (Figure 2). *E. vulgare* has a broadly funnel-shaped corolla with four stamens long-exserted. The stamen number can be used to distinguish between flowering material of the species concerned. In a key to *Echium* species, Gibbs (1972) distinguished two main groups, namely species with the flowers flesh-coloured or yellowish or bluish white, and those

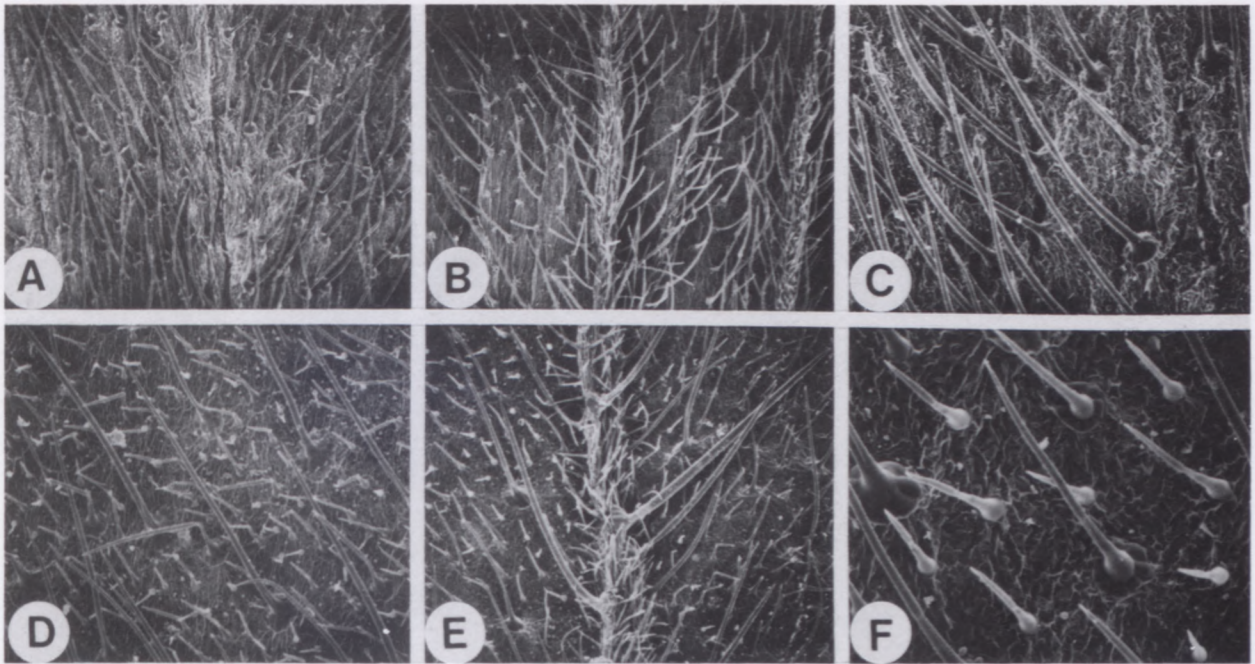


FIGURE 1.—*Echium* leaf surface. *E. plantagineum*: A, upper surface; B, lower surface; C, trichomes. *E. vulgare*: D, upper surface; E, lower surface; F, trichomes. A–C, Hilliard & Burt 6999; D–F, Sidey 3977. A,  $\times 8$ ; B,  $\times 7$ ; C,  $\times 21.5$ ; D,  $\times 22$ ; E,  $\times 15$ ; F,  $\times 57$ .

with flowers blue, reddish purple or pink-carmine turning blue-purple. *E. plantagineum* and *E. vulgare* belong to the second group. The corolla in *E. vulgare* is pilose (Figure 3A), whereas that of *E. plantagineum* is glabrous, except for sparse, simple, long, unicellular trichomes on veins and margins. The corolla indumentum of *E. vulgare* is also characterised by simple, long, unicellular trichomes on the veins and margin, but with similar, shorter trichomes in the intercostal areas of the corolla (Figure 3A, B).

Corollas in the family Boraginaceae are actinomorphic, rarely zygomorphic. In *Echium* and to a lesser extent *Lobostemon*, however, irregular corollas occur. Johnston (1924) was of the opinion that the development of zygomorphy furnishes no substantial basis for the recognition of the tribe Echieae in which *Echium* and *Lobostemon* are placed. He pointed out that between the conspicuously irregular corollas of certain species of *Echium* and the regular corollas of typical species of *Lithospermum* there is every intermediate stage of irregularity. According to Johnston (1924), *Echium italicum* has regular and subregular corollas, and in a number of the echiums of the section *Lobostemon*, the corolla is also regular or practically so. The corolla of both *E. plantagineum* and *E. vulgare* is zygomorphic. On the other hand, evidence from palynology supports the retention of the tribe Echieae (see pollen).

Johnston (1924) regarded *Lobostemon* as a synonym of *Echium*, but later changed his opinion. In a key to the genera of the Lithospermeae, Johnston (1953) separated the two genera on the basis of the position of what is called an 'annulus'. In the case of *Echium*, the annulus, borne 1 mm or less above the base of the corolla tube, is composed of a minute collar or ring of 5–10 minute hairy lobules (Figure 3C). *Lobostemon* is characterised by the presence of an annulus above the corolla base. It is composed of five distinct, densely villous swellings or five

squamose appendages borne below the attachment of each stamen. The two naturalised *Echium* species can therefore not be confused with any member of *Lobostemon* in southern Africa.

In some species of *Echium* and also *Lobostemon*, the margin of the theca of the opened anthers is  $\pm$  ciliate with



FIGURE 2.—Inflorescence of *Echium plantagineum*, Stirton 8218 (PRE). Scale bar: 10 mm.

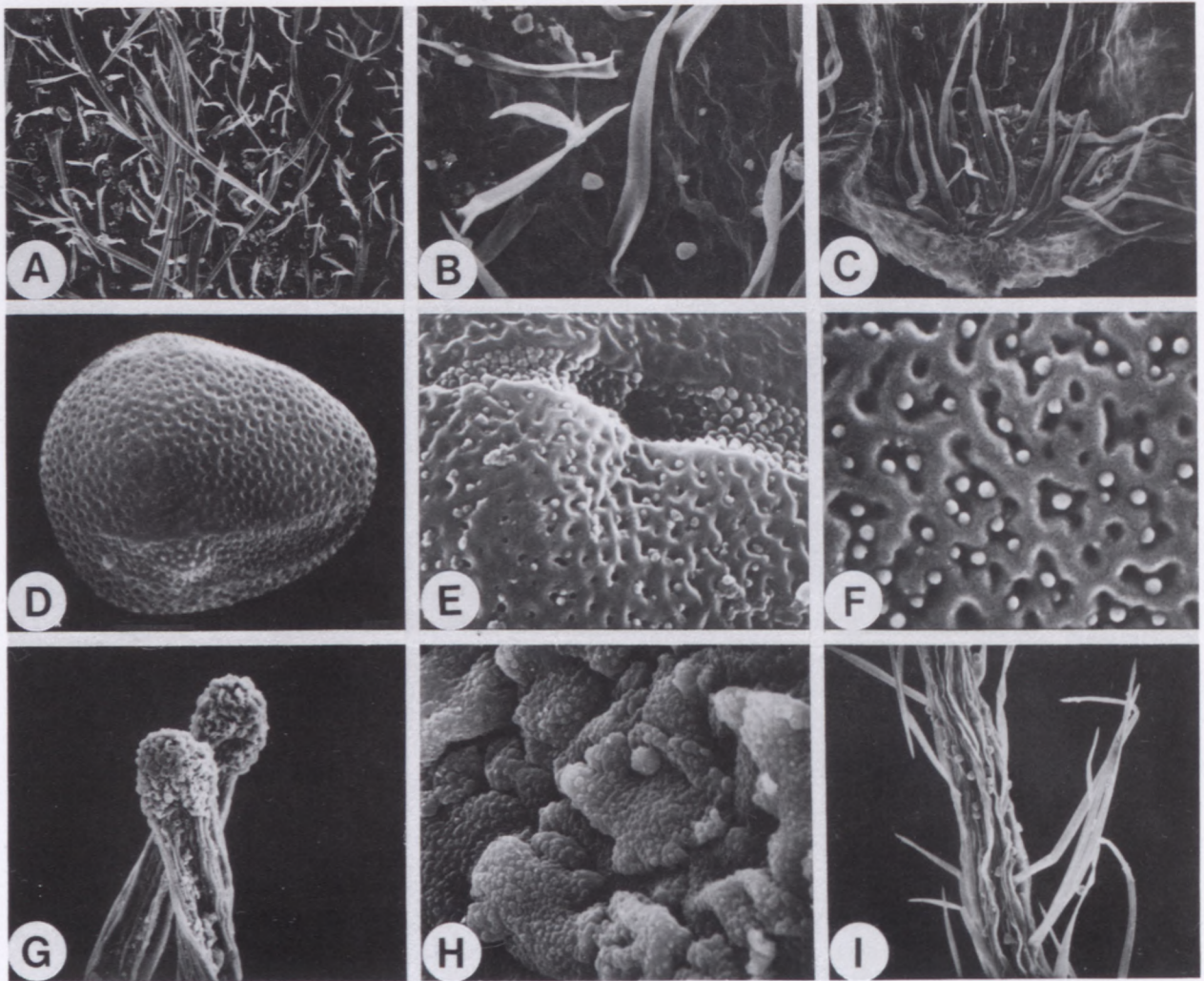


FIGURE 3.—A–C, corolla. *E. vulgare*: A, outer surface; B, simple, unicellular trichome; C, hairy lobule. D–F, pollen. D, *E. vulgare*, pollen grain. E, F, *E. plantagineum*: E, granular colpus; F, tectum with supracteal gemmae. G–I, style of *E. vulgare*: G, stigmas; H, papillae caps; I, trichomes on style. A–C, I, Sidey 3977; D, G, H, Hilliard & Burt 18686; E, Bayer 6005; F, Balsinhas 3546. A,  $\times 35$ ; B,  $\times 155$ ; C,  $\times 68$ ; D,  $\times 2199$ ; E,  $\times 4058$ ; F,  $\times 7546$ ; G,  $\times 91$ ; H,  $\times 1067$ ; I,  $\times 84$ .

very slender elongate incurving hairs (Johnston 1953). According to Johnston (1953) similar slender hairs may also arise from along the midline of the open, empty theca. These characters are not uncommon, although they are usually best developed in specimens of *E. plantagineum* and its allies.

#### Pollen

Pollen grains heteropolar, with one pole  $\frac{1}{3}$  to  $\frac{1}{2}$  wider than the other, broad end obtuse, narrow end more acute in equatorial view, the long sides concave, tricolporate, pear-shaped,  $P = (21\text{--})27\text{--}29(\text{--}37) \mu\text{m}$ ,  $E$  (at widest point)  $= (14\text{--})22\text{--}25(\text{--}29) \mu\text{m}$ . Shape in polar view with broad end rounded-triangular, narrow end more deeply 3-lobed; in equatorial view ovate to ovate-triangular, with protruding ora (Figure 3D). Colpi narrow, elongated, extending over about  $\frac{4}{5}$  the length of polar axis with more or less rounded to pointed ends, somewhat sunken, always free at ends, surface with gemmae (Figure 3E). Endo-apertures (ora) situated closer to the broader pole, more or less circular, aperture membrane covered with gemmae. Tectum microreticulate with densely spaced lumina of different shape and size. Supracteal gemmae confined to margins of lumina (Figure 3F).

Pollen morphology is remarkably similar in the various species of *Echium* (Reille 1995). Pollen of *Echium* in southern Africa is not sufficiently different from that of *Lobostemon*. In equatorial view, grains are triangular to somewhat pear-shaped in outline (Figure 3D), similar to grains of *Lobostemon*. Two shape classes, namely subspheroidal and prolate, were distinguished in the tribe Echieae (Retief & Van Wyk 1997). Grains of *E. plantagineum* as well as *E. vulgare* are subprolate.

Palynological evidence indicates a very close relationship between *Echium* and *Lobostemon*, even suggesting that they might be congeneric. Both genera have tricolporate, anisopolar grains. We follow Johnston (1953) and treat *Echium* and *Lobostemon* as two separate, although closely related, genera. A comparison of the pollen of *Echium*, *Lobostemon* and *Lithospermum*, (type genus of Lithospermae) strongly supports the retention of the tribe Echieae (Retief & Van Wyk 1997).

#### Style

The gynobasic style in *Echium* is almost always bilobed in the upper part with two capitate stigmas (Figure 3G). These stigmas are covered with papillae,

which end in prominent contiguous caps with crenulate margins (Figure 3H). The surface of the papillae caps is covered with cuticular irregularities (Figure 3H). According to Heslop-Harrison (1981), pollen grains of compatible size are wedged between the papillae by bees, whilst grains resting on the surface of the cap do not hydrate or germinate; the papillae caps thus function as a series of juxtaposed parasols. The styles of all *Echium* species are pubescent (Al-Shebaz 1991). Only simple, unicellular trichomes are present (Figure 3I).

The two *Echium* species in southern Africa differ from all *Lobostemon* species in having styles prominently bilobed, unlike those of species of *Lobostemon* which are undivided. Those species of *Echium* with cleft styles show similarity to members of *Ehretia* and *Cordia* also with divided styles. *Echium*, however, differs from *Cordia* in which twice bifid styles occur with linear or clavate stigmatic branches—not a bilobed style with capitate stigmas. The style of *Echium* is similar to that of *Ehretia*, both with bilobed styles and capitate stigmas. The family Boraginaceae is sometimes split into two separate families, namely Boraginaceae *s.str.* and Ehretiaceae. Ehretiaceae includes both *Ehretia* and *Cordia*. *Echium*, a member of the tribe Boragineae (Boraginoideae) has style and stigma characteristics similar to those of members of the Ehretiaceae and this supports the view that the family Boraginaceae is a natural entity and should not be divided into two or even more segregate families. Stigmas in other genera of the Boragineae are conic, discoid, subglobose, obtuse, entire or 2-lobed, thus differing in morphology from those of *Echium*.

#### Fruit

The fruit in *Echium* consists of four nutlets which are ovoid, ovoid-trigonal, oblong-bipyramidal or subglobose

(Edmondson 1978). A broad attachment scar and an erect or incurved beak are also present. The outer surface of the nutlet can be smooth or variously rugose, tuberculate, scrobiculate or reticulate. *E. plantagineum* and *E. vulgare* differ very little in the structure of their nutlets. Both have ovoid-trigonal nutlets with rugose, tuberculate outer surfaces with the tubercles varying in size (Figure 4A–F).

Many taxonomic decisions in the Boraginaceae are based on fruit characters. Fruit in *Wellstedtia* (capsule), *Ehretia* (drupaceous) and *Cordia* (drupe) differ markedly from those of other genera in the family characterised by nutlets. The outer surface of the nutlets varies considerably in sculpture and vestiture. The nutlets of *E. plantagineum* and *E. vulgare* show similarities to those of *Lobostemon*, *Anchusa* and *Heliotropium*. Species of *Myosotis* have smooth and shiny nutlets, whereas nutlets of species of *Cynoglossum* are characterised by simple, barbed trichomes. An overview of the different fruit types present in the southern African Boraginaceae is in preparation.

#### PHYTOGEOGRAPHY

*Echium* is a genus concentrated in the Mediterranean region. Its greatest morphological diversity is centred in Macaronesia. According to Bramwell (1972), 22 species are indigenous to the Canary Islands, three to the Cape Verde Islands and two to Madeira. About 26 species are native to northwestern Africa, the highest concentration in Morocco, and about 15 in the Iberian Peninsula (Gibbs 1971). Several herbaceous species, like *E. plantagineum* and *E. vulgare*, have been introduced by man to various other parts of the world such as southern Africa and Australia where they are now naturalised and widespread.

As pointed out above, *Echium* is very closely related to the South African genus *Lobostemon*. *Lobostemon*,

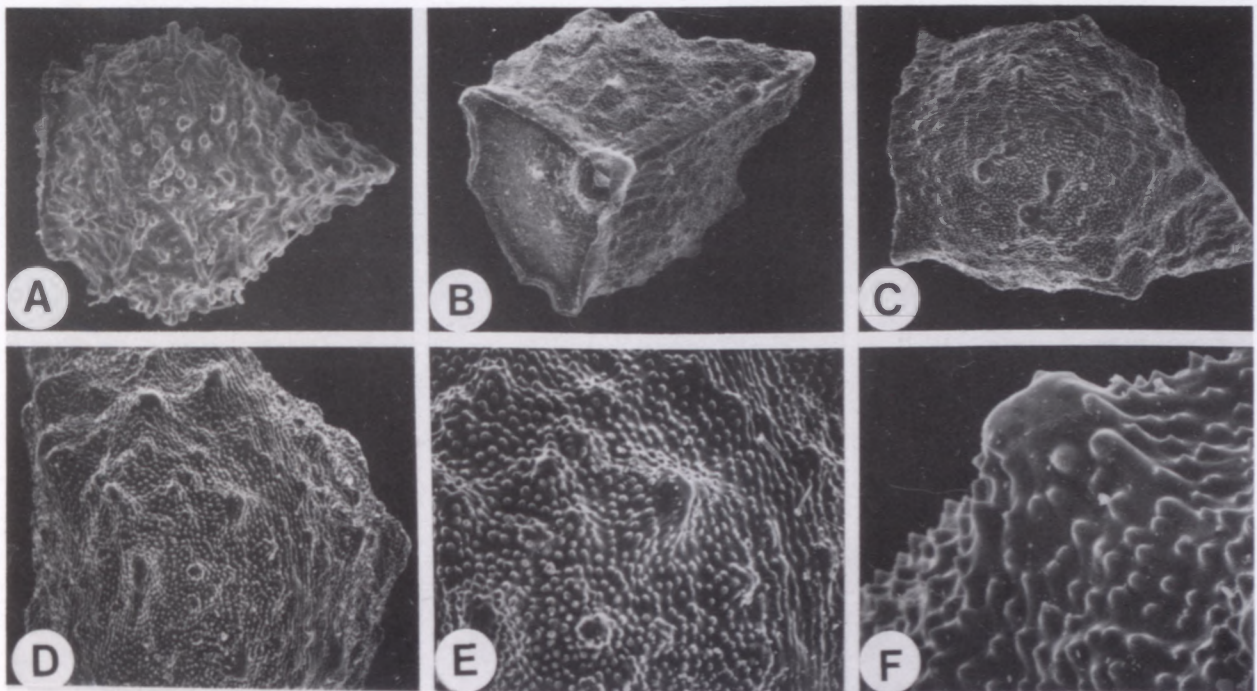


FIGURE 4.—*Echium* nutlet. A, *E. plantagineum*, dorsal face. B–F, *E. vulgare*: B, ventral face with prominent attachment scar; C, dorsal face; D–F, outer surface with large and numerous small tubercles. A, *Germishuizen* 4102; B–F, *Zietsman* 1480. A,  $\times 13.5$ ; B, C,  $\times 16$ ; D,  $\times 23$ ; E,  $\times 44.5$ ; F,  $\times 148$ .

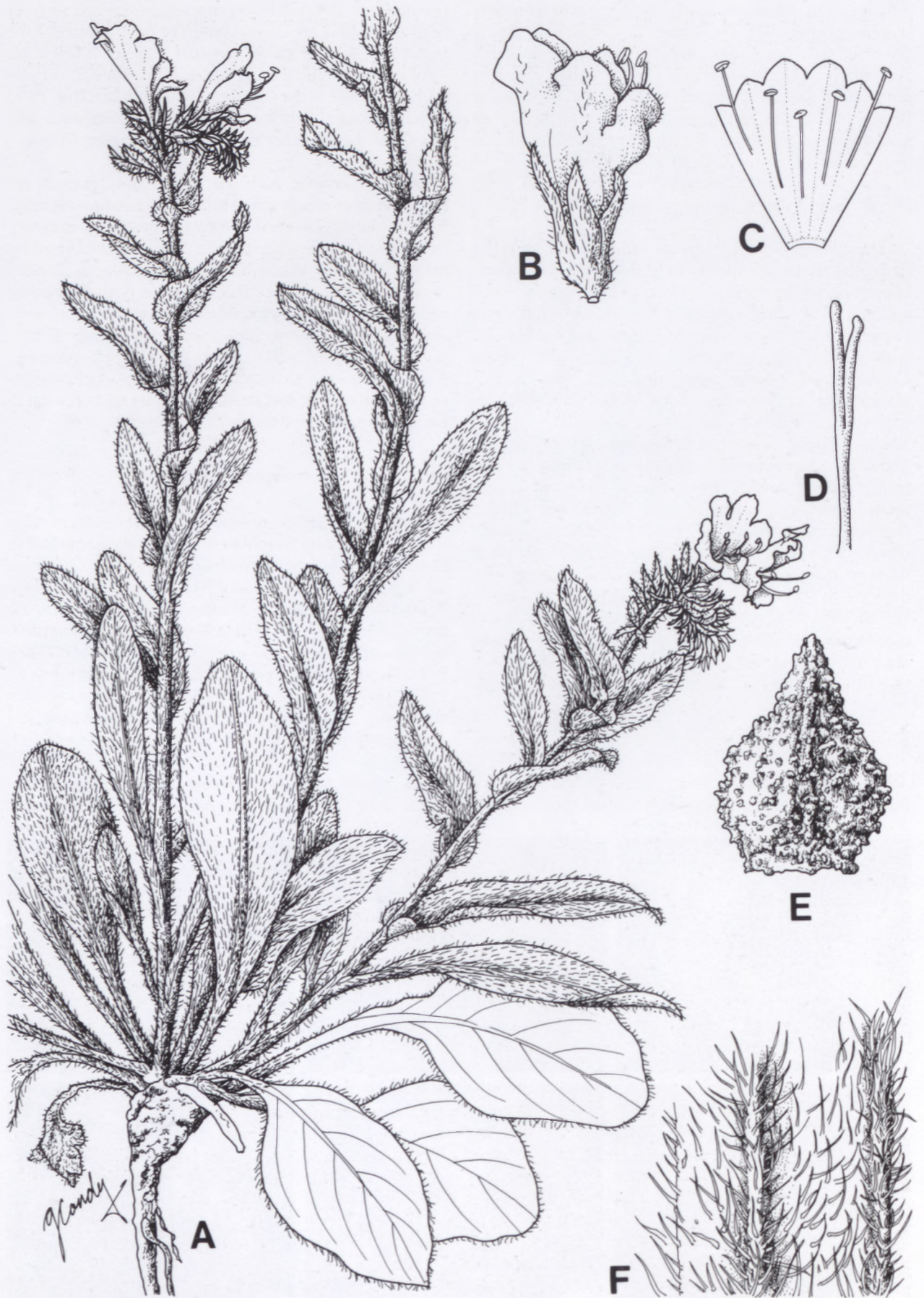


FIGURE 5.—*Echium plantagineum*. A, habit,  $\times 0.8$ ; B, flower,  $\times 2$ ; C, longitudinal section of corolla,  $\times 1.5$ ; D, style,  $\times 22$ ; E, nutlet,  $\times 14$ ; F, lower surface of leaf,  $\times 3$ . A–D, Acocks 9250; E, Germishuizen 4102; F, Hilliard & Burt 6999.

confined to the Cape Floristic Kingdom, and several other taxa in the southern African flora, have a southern Africa-North Africa, Mediterranean and Eurasian disjunct distribution pattern. For example, there are four endemic genera of the Fumariaceae in southern Africa, geographically widely separated from other members of the family in the northern temperate parts of the Old World (Hutchinson 1921). Another example is *Camptoloma* (Scrophulariaceae) with three vacariant species that form part of the disjunct Afro-arid element in African phytogeography (Hilliard 1994). The genus has one species in Namibia-Angola, another in the Canary Islands and the third in a small area around the Horn of Africa. The interpretation of disjunct distributions is often complex and impossible to explain (Stott 1981). It can, for example, be speculated that *Echium* and *Lobostemon* are derived from a once widespread, common ancestor which was a component of a temperate flora on the African continent. Climatic changes took place and *Echium* and *Lobostemon* remained as relicts, evolving separately in a Mediterranean type climate, but now absent in the vast dry parts of Africa. However, there is no satisfactory paleobotanical evidence to verify the above assumption. Long-distance dispersal may also have played a role, but this type of explanation is usually considered highly unlikely for clarifying wide disjunctions on continental areas (Poynton 1983).

***Echium* L.**, Species plantarum: 139 (1753); L.: 175 (1754); Juss.: 130 (1789); DC.: 13 (1846); Benth.: 863 (1876); Gürke: 128 (1897); C.H.Wright: 43 (1904); E.Phillips: 632 (1951); Riedl: 213 (1967); P.E.Gibbs: 97 (1972); R.A.Dyer: 513 (1975); J.R.Edm.: 318 (1978); Toelken: 1155 (1986); Al-Shebaz: 137 (1991); Verdc.: 81 (1991). Type: *E. italicum* L. [lecto., see Al-Shebaz: 138 (1991)].

*Isoplesion* Rafin.: 86 (1836–38).

*Megacaryon* Boiss.: 203 (1879).

Annual, biennial or perennial herbs or shrubs; scabrid, hispid or canescent. *Leaves* alternate, with basal leaves rosulate, petiolate or sessile, densely hairy. *Flowers* in helicoid cymes, grouped in many-branched thyrses or panicles, elongating considerably in fruit, bracteate; bracts small and foliaceous. *Calyx* deeply 5-lobed, somewhat accrescent. *Corolla* blue or purplish blue; zygomorphic; tube narrowly to broadly funnel-shaped, straight, outside pubescent or glabrous, inside usually with a ring of 5–10 distinct scales or lobes or an undulate, entire, somewhat fleshy collar-like membrane at base; throat open, without any appendages; limb markedly oblique; lobes equal or unequal, short, obtuse. *Stamens* 5, variously exserted, inserted on corolla tube at various levels; filaments linear, glabrous or with long hairs; anthers versatile. *Ovary* 4-lobed, with a single ovule in each locule; style gynobasic, linear, bifid at apex, pubescent, long-exserted; stigmas 2, capitate. *Fruit* of 4 nutlets; nutlets convex on one face, keeled on the other, ± triangular at base, rugose, tuberculate.

A genus of about 60 species, mainly confined to Madeira, the Azores and Canary Islands but also found in Europe, western Asia and North Africa. Some herba-

ceous species have been introduced in various parts of the world where they are now naturalised. Two species, *E. plantagineum* and *E. vulgare*, are naturalised in southern Africa; recorded from the Western and Eastern Cape, Free State, Lesotho and Mpumalanga.

### Key to species

- Corolla glabrous, except for sparse simple unicellular trichomes on veins and margin; two stamens long-exserted, three enclosed; basal leaves petiolate, broadly ovate, with prominent lateral veins; indumentum of sparse, simple, long, slender tubercle-based setae with a sublayer of much shorter, fine, simple, unicellular trichomes on leaf margins and especially on midrib of lower leaf surface ..... 1. *E. plantagineum*
- Corolla softly hairy, with simple, unicellular trichomes prominently longer on veins; four stamens long-exserted, one enclosed; basal leaves subsessile, linear-lanceolate or narrowly oblong with lateral veins obscure; indumentum of sparse, simple, long tubercle-based setae with a sublayer of much shorter tubercle-based setae, simple as well as unicellular trichomes on midrib of lower leaf surface ..... 2. *E. vulgare*

1. ***Echium plantagineum* L.**, Mantissa plantarum altera: 202 (1771); C.H.Wright: 44 (1904); P.E.Gibbs: 57 (1971); Bramwell: 64 (1972); P.E.Gibbs: 99 (1972); Piggin: 217 (1977); J.R.Edm.: 322 (1978); Toelken: 1156 (1986); Verdc.: 81 (1991). Type: Barrelier, Plantae per Galliam, Hispaniam et Italiam observatae, iconibus exhibitae 145, t.1026 (1714), see Verdc.: 83 (1991).

*E. lycopsis* auct. non L.

*E. violaceum* auct. non L. (1767).

Annual or biennial herb with 1–many flowering stems, up to 0.8 m high. *Indumentum* of soft, appressed, long (up to 3 mm) tubercle-based setae, each trichome with a concentric ring of cells at base, sometimes stems, leaf margins and veins on lower surface of leaf with a sublayer of soft, much shorter, simple, unicellular trichomes. *Stems* erect or decumbent. *Basal leaves* ovate to oblanceolate, 50–300 × 10–70 mm, with prominent lateral veins on both surfaces; lamina narrowing rather abruptly into petiole; petiole up to 55 mm long. *Cauline leaves* oblong to lanceolate, uppermost ± cordate at base. *Cymes* usually distinctly stalked, lengthening after flowering to 250–300 mm. *Calyx* up to 12 mm long in fruit. *Corolla* blue or deep purplish blue, broadly funnel-shaped, 10–20 mm long, glabrous except for sparse hairs on veins and margins of outside surface, with a ring of 10 distinct pilose lobes within tube. *Stamens*: lower pair long-exserted, the others included or only slightly exserted; filaments with long hairs. *Nutlets* greyish brown, triquetrous, rugose, tuberculate with tubercles varying in size, 2.0–3.0 × 2.0–2.5 mm. *Chromosome number*: n = 8 (Britton 1951). Figure 5.

*Distinguishing characters*: *E. plantagineum* differs from some *Echium* species in the colour of the corolla. *E. italicum* L. and *E. boissieri* Steud., for instance, have yellowish or bluish white or flesh-coloured corollas, whereas *E. plantagineum* has blue or purplish blue flowers. The subglabrous corolla with hairs on veins and margins only, and basal leaves usually broadly ovate to

oblanceolate with prominent lateral veins distinguish *E. plantagineum* from *E. vulgare* and a number of other species, including *E. albicans* Lag. & Rodr., *E. creticum* L. and *E. tuberculatum* Hoffmanns. & Link. *E. vulgare* has a corolla with long, simple, unicellular trichomes on the veins and margins and smaller ones on the corolla itself. The basal leaves of *E. vulgare* are linear-lanceolate to narrowly oblanceolate, attenuating into a short petiole.

**Distribution:** *E. plantagineum* is native to western Europe including southwestern Britain and the Mediterranean area. It has been introduced into other parts of Europe, southern Russia and the Caucasus; it is a widely distributed, troublesome weed in Australia (Verdcourt 1991). In southern Africa this introduced species occurs from the Western Cape, extending more or less along the coast, to the Eastern Cape. It is also found in the temperate mountainous areas of the Free State, Lesotho and KwaZulu-Natal, with a few records from southern Mpumalanga (Figure 6).

**Habitat:** although *E. plantagineum* is most noticeable along roadsides, it also occurs in waste ground and as a weed of cultivation. It has also been recorded from rocky slopes in grassland.

**Flowering time:** September to March.

**Common names:** bloudissel (doring), Paterson's curse, salvation Jane and purple bugloss.

**Illustrations:** Jacq.: t. 45 (1771); Butcher: t. 995 (1961); Verdc.: 82 (1991).

2. *Echium vulgare* L., Species plantarum 139 (1753); P.E.Gibbs: 54 (1971); P.E.Gibbs: 99 (1972); Piggin: 224 (1977); J.R.Edm.: 322 (1978); Toelken: 1156 (1986). Type: *LINN 191.19*.

For synonymy see Gibbs (1971).

Biennial, or sometimes annual herb, up to 1 m high. *Indumentum* of sparse, stout, appressed to patent hairs with a multicellular base and a dense sublayer of much shorter hairs with base not so prominently multicellular.

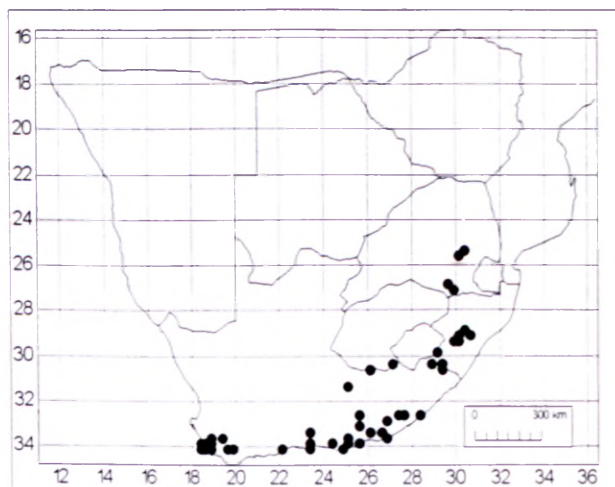


FIGURE 6.—Distribution of *Echium plantagineum*.

**Stem** simple or with many decumbent, flowering stems; usually branched if grazed or damaged. **Basal leaves** linear-lanceolate to narrowly oblanceolate, 50–260 × 10–30 mm, attenuating into a short petiole (sessile), lateral veins not prominent. **Cauline leaves** narrowly lanceolate, sessile. **Calyx lobes** 6–8 mm long in fruit. **Corolla** brilliant blue, fading to mauve, broadly funnel-shaped, 10–15 mm long, puberulous and with sparse long, simple trichomes on veins and margins outside. **Stamens:** four long-exserted, one short-enclosed. **Nutlets** brownish grey, tuberculate with large and numerous small tubercles, triquetrous, with prominent dorsal and ventral keels, beak narrow, acute. **Chromosome number:** n = 16 (Britton 1951). Figure 7.

*Echium vulgare* is a very variable species in other parts of the world. The synonymy of Gibbs (1971) follows a rather broad species concept in his revision of the Spanish members of the genus.

**Distinguishing characters:** *E. vulgare* can be distinguished from other *Echium* species by its prominently exserted stamens, in contrast to, for example, *E. parviflorum* Moench and *E. arenarium* Guss., which have all the stamens included in the corolla. It differs, like *E. plantagineum*, from another group of *Echium* species in having a blue corolla and not one which is flesh-coloured, yellowish white or bluish white. Some *Echium* species, like *E. italicum* L., have a narrowly funnel-shaped corolla with the tube not markedly widening towards the apex. *E. vulgare*, however, belongs to those taxa with a broadly funnel-shaped corolla in which the tube widens markedly towards the apex.

**Distribution:** *E. vulgare*, native to Europe, has been introduced to various countries worldwide, often becoming a weed. In southern Africa the species is found in Mpumalanga, Free State, Lesotho and the Eastern Cape (Figure 8).

**Habitat:** *E. vulgare* is a weed of old cultivated lands, waste places and roadsides, but occasionally also occurs in montane grassland.

**Flowering time:** November to March.

**Common names:** blue devil, blue weed, viper's bugloss.

**Illustrations:** Lam.: t. 94 (1791); Butcher: t. 994 (1961).

#### SPECIMENS EXAMINED

Specimens held at PRE, unless otherwise indicated. The numbers in brackets signify the identity of the specimens: (1) *E. plantagineum*, (2) *E. vulgare*.

Acocks 9250 (1) K, PRE; 16282 (2) K.

Balsinhas 3546 (1). Barnes 94 (1). Bayer 6005 (1). Bayliss 73 (1) GRA, K, PRE; 1133, 6132 (1); 24276 (1) NBG. Bester 710, 955 (1) NH. Bolus 4989 (1) BOL, K. Bos 259 (1) NBG. Boucher 3941 (1), 3395 (1) NBG. Boucher & Ahmed 115 (1). Brink 239 (1) GRA, K, PRE. NBG; 265 (2) GRA, K, PRE. Britten 520 (1); 2969 (1) GRA. Brown sub PRE41060 (1). Brusse 5601 (2). Burgoyne 971 (1). Burrows 2198 (1).

Case sub PRE654738 (1). Chelchinsky 16 (2) GRA. Codd & Dyer 6233 (2) K. Coleman 524 (1) NH, PRE. Comins 1899 (1) GRA, PRE.



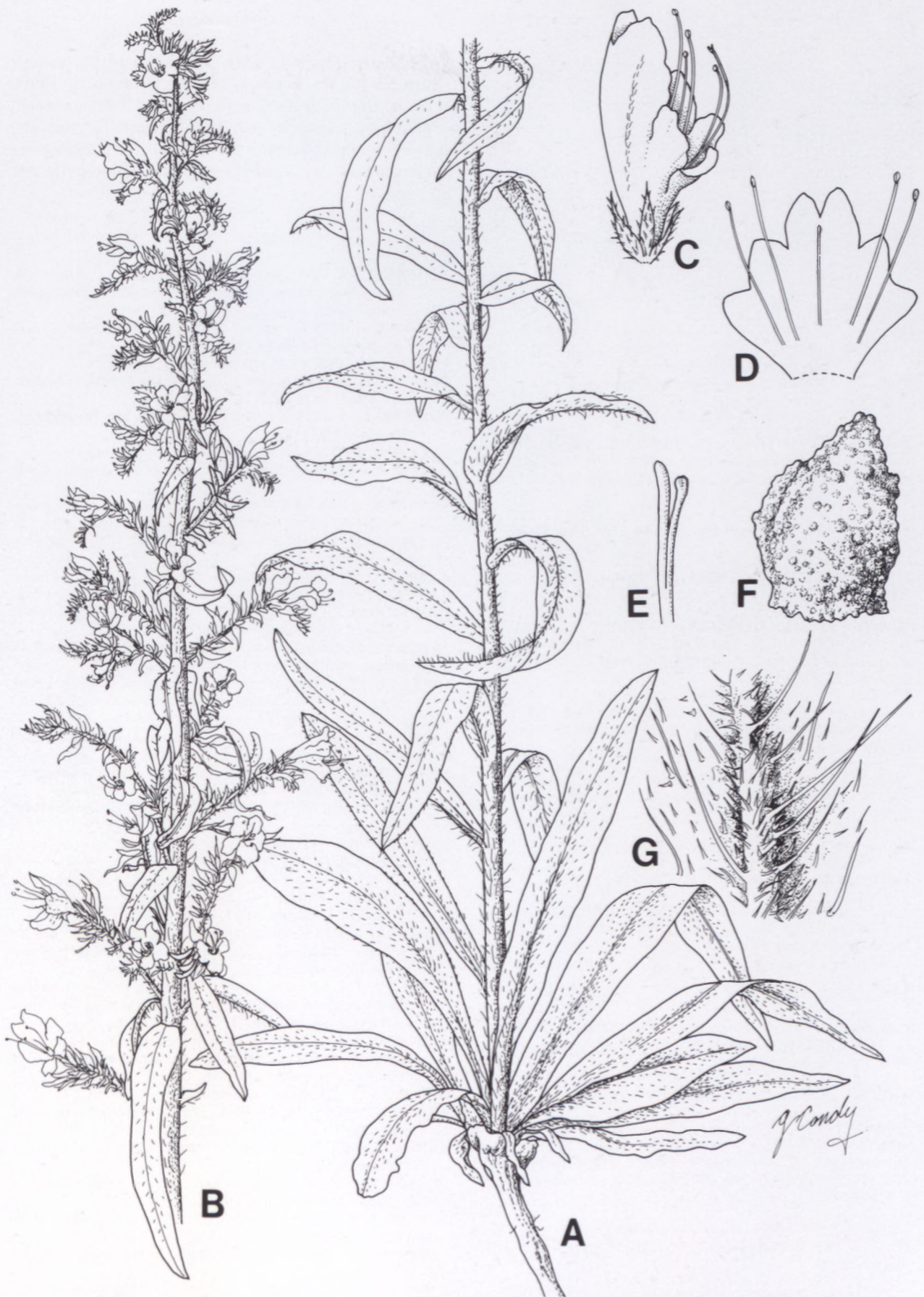


FIGURE 7.—*Echium vulgare*. A, lower part of plant,  $\times 0.8$ ; B, inflorescence,  $\times 0.5$ ; C, flower,  $\times 2$ ; D, longitudinal section of corolla,  $\times 1.5$ ; E, style,  $\times 20$ ; F, nutlet,  $\times 15$ ; G, lower surface of leaf,  $\times 3$ . A, B, Codd & Dyer 6233; C–E, Van Wyk 5268; F, Zietsman 1480; G, Sidey 3977.

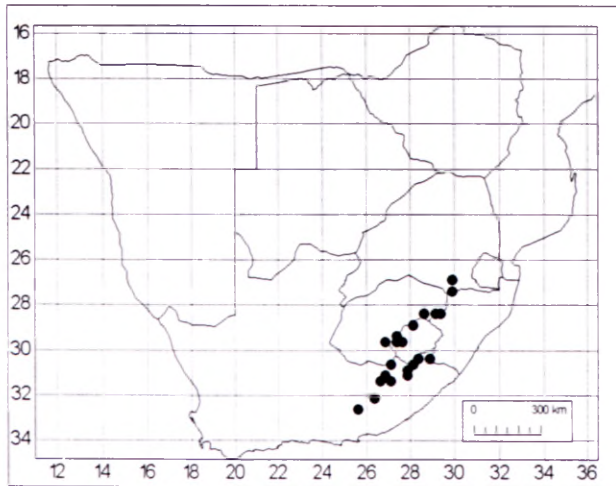


FIGURE 8.—Distribution of *Echium vulgare*.

Dahlstrand 541, 3094 (1) GRA. Davidse 6721 (1). Davies s.n. (1) GRA. De Vries 9 (1) GRA. Dieterlen 1030 (2) PRE. SAM. Dold 1987, 2026 (2) GRA. Drège 442 (1) GRA. Dreyer 14 (2). Drijfhout 4137 (1) NBG, PRE.

Edwards, Cadman & Norris 3163 (2) BOL, NU, PRE. Engelbrecht JE650 (2) J.

Fourcade 1886 (1) BOL, K, NBG; 5825 (1) NBG. Fugler 100 (1) K, PRE.

Gáfney sub PRE10201 (2). Galpin 121 (1) K, NBG; 212 (1) PRE; 4351 (1) GRA, PRE; 7939 (1). Garrett 60 (2) E, NU. Garside 147 (1) K. Germishuizen 4102 (1). Giffen 113 (1); 809 (1) GRA, PRE. Greef 2 (1). Guthrie 3114 (1) NBG.

Hilger 44 (1). Hilliard & Burt 6999 (1) NU, PRE; 18686 (2) E, K, NU, PRE. Hilliary sub NH37460 (1) NH. Hoare 31 (1) GRA. Hoener 1705 (1). Hutton s.n. (1) GRA.

Jacobsz 311 (2) PRE; 2082 (2) NBG, PRE. Jacot Guillarmod 3211 (2); 7341 (1) GRA; 9837 (1) GRA, PRE. Joffe 873 (1) NBG, PRE. Jordaan 1 (1).

Kerfoot 6216 (1). Killick & Marais 2107 (1) K, NU, PRE.

Leendertz 8184 (1). Loubser 3867 (1). Low 754 (1) NBG.

MacCabe 3149 (2). Marais 567 (1) GRA, NBG, PRE; 807 (1) GRA, K, PRE. Muree 12 (1). Marloth 7201 (1) PRE; 10864 (1) NBG, PRE. Marsh 75 (2) K, NH, PRE. Mauve & Tolken 4520 (2) K, PRE. Moll 2663 (1) K, NU.

Nel 77/9(1) GRA.

Page sub BOL16500 (2). Parker 4376 (1) BOL, K, NBG. Pegler 2138 (1) BOL, PRE. Phelan 200 (1) NU. Pienaar & Kok 1225 (1) PRE. PRU. Pretorius 8 (1) NBG.

Retief 373 (1). Rogers 26933, sub TRV3007 (1).

Saaiman 615 (2). Scharf 1763 (1) NBG, PRE. Schlieben 7607 (1) K. Schlieben & Ellis 12331 (1) K, PRE. Schönland 3631 (1) GRA, K. Sidey 3848 (1); 3977 (2) K, NH, PRE. Steyn 27 (1). Stirton 8151, 8218, 8389 (1). Story 2084 (2) GRA, PRE. Strever 721 (2). Strey 7882 (1) K, NH, NU, PRE.

Taylor 5485, 5784, 5978 (1) NBG. Tenant sub PRE14149 (2). Theron 708 (2) K, PRE; 2189 (2) Thode A2716 (1) K, PRE; sub PRE19418 (1). Turner 267 (1).

Van Breda 12 (1). Van Rensburg 1957 (1) K. Van Wyk 5268 (2) PRE, PRU; 5279 (1) PRE, PRU; 12059 (1) PRU. Van Wyk & Abbott 12059 (2). Venter 7244 (2).

Ward 303 (1) NH. Welman 780 (2) GRA, PRE. West 1514 (1). Williams 296, 3155 (1) K. Wolley Dod 1893 (1) K, PRE. Wurtz 464 (1) NBG.

Zietsman 1480 (2).

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