TAXONOMIC STUDIES ON THE GENUS ECHIUM.
I. AN OUTLINE REVISION OF THE SPANISH SPECIES

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Resumen. En este trabajo, se perfila una revisión de las especies españolas del género *Echium*, incluyéndose una clave para la determinación de las 15 reconocidas para España, cada una de las cuales va acompañada de una descripción y citación detallada del material estudiado. Se han reunido en este trabajo los siguientes cambios nomenclatoriales que habían sido efectuados por diversos autores: el nombre *E. pomponium* Boiss. debe ser reemplazado por *E. boissieri* Steudel, y *E. maritimum* Willd. por *E. sabulicolum* Pomel. Además, en este trabajo se revalidan algunos nombres, varios de los cuales no habían sido utilizados en trabajos florísticos españoles; por ejemplo: *E. humile* Desf. (= *E. angustifolium* Lam.), *E. asperrimum* Lam. (= *E. pyrenaicum* Desf., *E. italicum* sensu Willkomm pro parte) y *E. creticum* L. (= *E. austral* Lam.). En esta última especie, se comprueba que *E. creticum* subsp. *coincyanum* (Lacaita) R. Fernandes es un taxon bastante variable y poco conocido hasta ahora, que se encuentra ampliamente distribuido en el Sur de España.

This contribution to the classification of the genus *Echium* is based on studies which were begun in 1969 and which are still in progress. The publication of a taxonomic revision at such an unfinished stage of a research programme requires some explanation since, ideally, a revision or monograph should culminate the investigation of a group of plants and so provide a synthesis of the available data.

In this case, however, I feel that it is worthwhile to attempt an outline revision of the Spanish Echia even though some of the data and conclusions are incomplete and the limits of one or two of the taxa are still critical. The alternative would be to delay publication for several years until current studies on cytology, breeding relationships and pollination ecology, all of
which necessarily make slow progress, are more complete. The reasons for this decision are twofold: First, the only previous extensive treatment of the Spanish species of *Echium* is that by Willkomm (1870) and since the publication of this work there have been numerous changes in the taxonomy and nomenclature of the genus. Moreover, the various publications which discuss some of these taxonomic and nomenclatural problems are virtually all scattered in non-Iberian journals and are thus not readily available to Spanish botanists. Secondly, the genus *Echium* has tended to suffer from a surfeit of short taxonomic notes devoted to various species, eg. Coincy (1900a & b, 1901, 1902), Lacaita (1919, 1923, 1925), Klotz (1962a, b & c); although these studies are individually very valuable they do lack many of the advantages which even a modest revision can provide in the way of keys, diagnoses and citation of specimens.

This first contribution, therefore, is simply an outline revision of the genus *Echium* in Spain which should allow ready identification of the Spanish species and which also provides a summary of much of the available exsiccata, distributional data and literature for the genus. The revision also aims to draw attention to remaining taxonomic problems and it is hoped that it will facilitate and encourage further studies on the genus within a framework of the current taxonomy and nomenclature of the group.

These studies on the genus *Echium* in Spain were greatly promoted by the award of a Visiting Research Fellowship by The Royal Society, London, which enabled me to spend seven months at the University of Sevilla in 1969. I am most grateful to The Royal Society and to the Consejo Superior de Investigaciones Científicas for the financial support of this Fellowship, and to Professor E. F. Galiano for extending to me the laboratory facilities of the Department of Botany at the University of Sevilla (SEV). I am further indebted to Professor Galiano for the generous provision of field excursion facilities during my stay, and to all of the staff of the Department of Botany at Sevilla for the benefit of their company and field experience during many enjoyable botanical excursions in Andalucia.

I am also indebted to the Directors of the following herbaria for the loan of specimens: Botanical Institute of the University of Coimbra (COI), Conservatoire et Jardin botaniques, Genève (G), Facultad de Farmacia, Universidad de Granada (GDA), The University of Leicester (LTR), Instituto Botánico «A. J. Cavanilles», Madrid (MA), The Manchester Museum, The University, Manchester (MANCH); and to the Directors of the Royal Botanic Gardens at Edinburgh (E) and Kew (K), and The Linnaean Society of London (LINN), for the use of library and herbarium facilities.
SOME GENERAL ASPECTS OF THE GENUS ECHIUM

It is intended that the infra-generic classification of the genus Echium, together with cytology and pollination ecology etc. will be considered in a separate publication. The notes included here are simply intended to provide a general background for the species treated in this revision.

Species diversity and Phytogeography.

The genus Echium contains two distinctive evolutionary nodes: the predominantly woody species of the macaronesian archipelago (comprising some 25 species), and the herbaceous species which are chiefly distributed in Europe and North Africa (totalling, perhaps, some 25 species). Within the latter group the main centres of species diversity are the Iberian peninsula with 16 or so species, and North-West Africa (particularly Morocco) with c. 20 species (*), whilst a secondary cluster of taxa occurs in the Eastern Mediterranean which includes the polymorphic E. angustifolium complex.

Growth habit.

Most of the Spanish species of Echium appear to be biennial plants but four species have been described as perennials, viz. E. albicans, E. humile, E. lusitanicum and E. rosulatum, and two species E. arenarium and E. parviflorum seem to be annuals. However, it is difficult to obtain reliable information and some species are likely to be variable in growth form; thus E. flavum and E. vulgare may behave as biennial or perennial plants, and likewise E. arenarium as an annual or biennial.

It seems reasonable to take as a working hypothesis the view that the perennial habit is ancestral with the annual species as evolutionarily advanced (at least in this growth characteristic), and with the European Echias there is some data which supports this view (see comments under floral morphology below). However, the perennial species of Echium in Spain form a rather heterogeneous group: whilst floral and vegetative morphology suggest that E. albicans and E. humile are perhaps related taxa (and possibly allied to the E. angustifolium complex in the Eastern Mediterranean), the species E. rosulatum

(*) Excluding the 30 or so species described by Sennenh from the Rif mountains.
latum and E. lusitanicum are distinctive from this former pair and from each other.

**Indumentum.**

Species of *Echium* present the common boraginaceous characteristic of possessing two types of trichome: rather stout, tubercle-based setae, and simple hairs, the latter usually forming an underlayer when the setae are dense. The nature and relative abundance of these trichome types are of taxonomic importance since the indumentum imparts a distinctive appearance to many species.

Thus, in *E. albicans* the relatively sparse setae and very dense, whitish, appressed hairs give a distinctive whitish-cinereous aspect to this species. Likewise, the presence of dense, whitish, patent setae, particularly those of the calyx, contribute to the characteristic facies of *E. humile*.

The group of species which possess a very narrowly infundibuliform to hypocrateriform, generally flesh-coloured corolla, ie. *E. asperrimum*, *E. boissieri*, *E. flavum*, *E. italicum* and *E. lusitanicum*, also show a common pattern of leaf setae. In these species the generally conspicuous, more or less lanceolate basal rosette leaves have dense, appressed, softish setae. *E. plantagineum* is another species characterised by having soft, appressed setae on the basal leaves but this species in otherwise very distinct from the former group. On the other hand, species such as *E. gaditanum*, *E. creticum* and *E. vulgare* tend to have rather irregularly spreading, more or less harsh setae on the basal leaves.

The nature of the underlayer of simple hairs on the flowering stems also provides a character of taxonomic importance, and the Spanish species of *Echium* can be grouped as follows:

(a) Underlayer of hairs on the flowering stem forwardly or irregularly directed (*E. albicans*, *E. arenarium*, *E. humile*, *E. parviflorum*, *E. plantagineum* and *E. sabulicolum*)

(b) Underlayer of hairs on the flowering stem rather irregularly directed but mostly deflexed (*E. asperrimum*, *E. boissieri*, *E. flavum*, *E. italicum* and *E. lusitanicum*).

(c) Underlayer of hairs on the flowering stem uniformly appressed and deflexed (*E. creticum*, *E. gaditanum*, *E. vulgare* and *E. rosulatum*).
This character is of interest since in some cases it correlates with other characters in groups of putatively related species, eg. all the species of group (b) share the same corolla type and basal leaf indumentum as noted above. However, it is curious that the indumentum type apparently provides a reliable differential character between the species *E. creticum* and *E. sabulicolum*, some specimens of which are otherwise very similar in general morphology.

**Calyx.**

The extent to which the calyx teeth enlarge during fruiting varies considerably between taxa, eg. very little in *E. vulgare*, markedly in *E. creticum*, and to an extraordinary extent in *E. parviflorum* in which species the calyx segments may eventually equal the upper cauline leaves in size.

**Corolla.**

The shape and colour of the corolla, together with the degree of stamen exsertion are taxonomic characters of prime importance in the European species of the genus *Echium*. The Spanish species fall into the following general groupings:

(a) Corolla very narrowly infundibuliform to hypocrateriform, with 4-5 long-exserted stamens; (*E. asperrimum, E. boissieri, E. flavum, E. italicum* and *E. lusitanicum*).

(b) Corolla broadly infundibuliform with 3-5 variously exserted stamens; (*E. albicans, E. humile, E. gaditanum, E. rosulatum, E. vulgare*).

(c) Corolla broadly infundibuliform with 1-2 stamens exserted; (*E. creticum, E. plantagineum, E. sabulicolum*).

(d) Corolla narrowly infundibuliform with all stamens included; (*E. arenarium, E. parviflorum*).

The differences in corolla morphology and stamen presentation presumably reflect differences in pollination syndrome within the genus. Studies by the present author are very incomplete but it is tempting to speculate that species of groups (b) & (c), which possess bluish to purplish coloured flowers, are pollinated by various insects (Hymenoptera ?) which enter the
broad funnel-like corolla tubes. On the other hand the species of group (a) have flesh-pink or bluish-white flowers and this combination of pallid flower colour together with a narrow corolla tube and long-exserted stamens suggests pollination by crepuscular, hovering Lepidopteran insects. Finally, the two species of group (d) with all the stamens included in the corolla tube are very likely to prove to be derived autogamous taxa, and this would certainly correlate with the annual habit of these species.

Clearly, all the above statements must be treated simply as speculative generalisations requiring observational and experimental verification. The significance of the variation in stamen exsertion between species of groups (b) and (c) is not at all clear, but again perhaps a trend towards autogamy is involved here. Some taxa tend to bridge the corolla types as outlined above, eg. the broader, dilated corollas of *E. lusitanicum* subsp. *polycaulon* approach those of the *E. vulgare* type. Similarly, the rather narrowly infundibuliform corolla of *E. humile* approaches the condition found in group (a).


Annual, biennial or perennial, usually stout, hispid herbs or shrubs, with an indumentum of tubercle-based setae and an underlayer of usually short, appressed or patent hairs. Inflorescence of spike-like or paniculate, unilateral cymes, often much enlarging in fruit. Calyx distinctly 5-toothed, sometimes accrescent. Corolla broadly to very narrowly infundibuliform, with a tapering tube and usually oblique, open throat, more or less hairy outside. An annulus of 10 minute, distinct or hair-tufted scales, or sometimes a collar-like membrane is usually present at the base of the corolla tube. Stamens 5, unequal, included or variously exserted from the corolla tube. Style exserted, stigma capitate or bifid. Nutlets 4, more or less triquetrous at the base, rugose.

KEY TO THE SPANISH SPECIES

1a All stamens completely included in the corolla tube 2
1b At least 1-2 stamens exserted from the corolla tube 3

2a Calyx 6-8 mm. at anthesis, enlarging up to 15 mm. in fruit with the teeth 3-6 mm. wide at the base 15. parviflorum
2b Calyx 5-7 mm. at anthesis, enlarging up to 10 mm. in fruit with the teeth 2-3 mm. wide at the base 14. arenarium

3a Corolla narrowly infundibuliform to hypocrateriform, flesh-coloured, or yellowish- or pinkish- to bluish-white (brown or blue-grey when dry) 4
3b Corolla ± broadly infundibuliform, blue, reddish-purple, or pink-carmine turning blue-purple (reddish to blue or purple when dry) 9

4a Inflorescence intricately branched 5
4b Inflorescence ± spike-like 6

5a Corolla 13-18 mm., stamen filaments dark pink-carmine; basal leaves usually ± oblanceolate, ± cuneate at the base, usually harshly setose 5. asperrimum
5b Corolla 10-12 mm., stamen filaments pale; basal leaves ± lanceolate, ± attenuate at the base, softly setose 6. italicum

6a Corolla 7-12 mm., yellowish-, or pinkish- to bluish-white 7
6b Corolla 13-18 mm., fleshy-coloured 8

7a Plant biennial, usually with a single, erect flowering stem, and usually ± yellowish-setose; corolla 10-12 mm. 6. italicum
7b Plant perennial, with several to many ascending flowering stems, usually ± greyish-setose; corolla 7-10 mm. 7. lusitanicum

8a Plant usually with a single or at least a dominant, ± massive flowering stem, 60-200 cm.; calyx 8-9 mm. at anthesis; corolla 16-18 mm. 3. boissieri
8b Plant with 1- several, ± slender flowering stems, 20-80 cm.; calyx 5-8 mm. at anthesis; corolla 13-16 mm. 4. flavum

9a Corolla 7-10 mm. 10
9b Corolla 11-40 mm. 11

10a Basal leaves usually more than 250 mm.; flowering stems several to many, arising from beneath the basal rosette 7. lusitanicum
10b Basal leaves usually less than 100 mm.; flowering stems 1- several arising from the centre of the basal rosette 8. vulgare

11a Calyx 10-17 mm. at anthesis, densely villous with long, white hairs and sparse setae 1. albicans
11b Calyx 5-10 mm. at anthesis, without long white hairs, ± densely setose 12

12a Corolla subglabrous, hairy on the veins and margins only; basal leaves usually broadly ovate to spatulate, with prominent lateral veins 9. plantagineum
12b Corolla ± uniformly hairy; basal leaves usually lanceolate to oblanceolate, without prominent lateral veins 13
13a Most flowers with only 1-2 exserted stamens
14
13b Most flowers with 3-5 \pm distinctly exserted stamens
15
14a Stems with an underlayer of forwardly or irregularly directed, \pm patent hairs; upper cauline leaves usually oblanceolate to spatulate, attenuate or petiolate
10. sabulicolum
14b Stems with an underlayer of uniformly deflexed, appressed hairs (at least in the lower third); upper cauline leaves usually narrowly elliptic, lanceolate or obovate, \pm abruptly sessile
11. creticum
15a Leaves usually 1.5-3 mm. wide, linear-oblong to very narrowly lanceolate
2. humile
15b Leaves 5-30 mm. wide, narrowly lanceolate to broadly oblanceolate or obovate
16
16a Plant usually with several to many robust, ascending stems which arise from a \pm woody stock; upper cauline leaves ovate to broadly lanceolate; corolla usually with 3-4 variously exserted stamens
17
16b Plant usually with 1- several, \pm slender flowering stems, usually lacking a stout woody stock; upper cauline leaves \pm narrowly lanceolate; corolla usually with 4-5 long-exserted stamens
8. vulgare
17a Biennial; corolla clear blue to bluish-violet, \pm abruptly dilating at midlength; stems and particularly lower leaves usually with conspicuously white-pustulallate setae
12. gaditanum
17b Perennial; corolla pinkish-violet, dilating uniformly; stems and leaves usually without conspicuously white-pustulallate setae
13. rosulatum


Erect, more or less softly hairy perennial, 10-75 cm., with 1 several flowering stems; leaves and stems with a dense layer of appressed, whitish hairs and setae which give the plant a distinctive whitish-cinereous appearance. Leaves 40-70 x 3.5-9 mm., linear-oblong to narrowly lanceolate. Flowers borne in loosely cylindrical cincinni. Calyx 10-17 mm. in flower, scarcely accrescent, with long white hairs and sparse setae. Corolla 16-21 mm., infundibuliform, uniformly hairy, pink-carmine to bluish-purple, with 3-4 exserted stamens. Nutlets c. 3.5 x 1.8 mm., triquetrous, with whitish-grey, irregularly anastamosing rugae on a black surface.

*Type.* Not traced.
Distribution. Endemic to the mountains of southern Spain. Rocky meadows and ledges (Map 1) (*).

Granada: Sierra Nevada, regionis subalpinis, 4000-6000’, 28.VI.1851, Ball (E); Sierra Nevada a San Gerónimo, 28.VI.1851, Bourgeau (E); Sierra Nevada, rocailles calc. vers le Dornajo, 1650 msm, 1.VII.1926, Jabandiez 205 (E); Padul, 12.V.1942, Muñoz Medina (GDA); Sierra Nevada, c. S. Gerónimo et Trevenque, 3/12.VI.1895, Porta & Rigo 341 (MANCH); Sierra Nevada et Yunquera, Willkomm (E); Sierra Nevada in aridis calc. loco La Vibora, 25.VI.1845, Willkomm (E). Málaga: Serranía de Ronda, 1849, Boissier & Reuter (E); Mesas de Villaverde: Ardales, 11.VI.1930, Ceballos & Vicioso (MA); Sierra de las Nieves, 4.VI.1934, Cuatrecasas (GDA); Gobantes, above the Pantano del Chorro, 24.IV.1969, Galiano, Gibbs, Silvestre & Valdés 1367.69 (E, SEV); near Ronda on the road to San Pedro de Alcántara, 2.V.1969, Galiano, Gibbs, Silvestre & Valdés 1550.69 (E); c. 10 km. from Ronda on the road to Campillos, 20.VI.1969, Gibbs 69.402 (E); El Chorro, 14.IV.1969, Gibbs, Silvestre & Valdés 1171.69 (E, SEV); Alora, sierras above the town, 14.IV.1969, Gibbs, Silvestre & Valdés 1095A.69 (E); Sierra de Mijas et Alora, 3-15.V.1879, Huter, Porta & Rigo (E, MANCH); Torremolinos, 9.IV.1935, Laza Palacios (GDA); Sierra de Ronda, 29.VI.1889, Reverchon (E, MANCH); between Benaoján and Cueva de la Pileta, 10.V.1968, Tutin (LTR). Cádiz: rocky slopes below Grazalema (C.344), 1.VI.1969, Gibbs 69.259 (E); Sierra de Grazalema, 17.IV.1890, Reverchon (MANCH).

This distinctive and handsome species of Echium appears to be restricted to the calcareous mountains of the betic ranges, particularly the Sierra de Grazalema, Serranía de Ronda and Sierra Nevada.


(*) Maps are based only on Spanish specimens which have been seen (except where otherwise stated) and they do not, therefore, give the complete distribution of the species.
MAP 1
DISTRIBUTION OF ECHIUM ALBICANS and E. HUMILE
● E. albicans
▲ E. humile
**Icon.** Fig. nostra no. 1.

Erect, hispid perennial 10-25 cm. with several flowering stems; leaves and stems, and especially the calyx, with dense, patent, white-translucent setae and an underlayer of short, whitish hairs. Leaves 20-40 x 1.5-3 mm., linear to very narrowly oblanceolate. Inflorescence of few flowered cincinni borne on short lateral branches. Calyx 6-8 mm. at anthesis, not elongating markedly in fruit. Corolla 12-14 mm., rather narrowly infundibuliform, densely appressed hairy, bluish-purple, with 4-5 more or less long-exserted stamens. Stamen filaments pale-carmine, pollen yellow-grey. Nutlets not seen.

**Type.** «In arenis deserti prope Cafsam» (Herb. Desfontaines, photo !).

**Distribution.** North Africa (Morocco, Algeria & Tunisia) and SE Spain. Arid slopes and semi-steppe (Map 1).

**Alicante:** Alicante, hills south of the town, 7.V.1928, Ellman & Sandwith 1051 (K); between Benidorm and Alicante, and Sierra de las Cabras, 9-25.V.1891, Porta & Rigo 354 (K, MANCH). **Murcia:** environs de Murcia en Fuente Alamo, 14.IV.1851, Bourgeau 1314 (E, K); Cerro de San Julián, between Cartagena and Escombreras, 10.V.1928, Lacaita 92/28 (BM); c. Abarán, 22.V.1928, Lacaita 216/28 (G); Cieza, 9.V.1928, Lacaita 67/28 (BM); Játiva and Hellín fide Rouy (1880). **Almería:** Sierra Alhamilla, foothills near Pechina, 22.IV.1928, Ellman & Sandwith 1224 (K); empalme de Berja a Adra, 25.IV.1921, Gros 14 (BM, MA); Almería occid. versus locis rupest. supra Muritriculum, 25.IV.1879, Huter, Porta & Rigo 422 (G, K); Gádor V.1922, Pau (BM, G, MA); Sierra Alhamilla, 300-400 msm, IV.1890, Porta & Rigo 49 (K, MANCH); Barranco del Caballar, 5.V.1934, Ripley 77 (K); Carretera de Cantoria, 23.V.1959, coll unknown (GDA).

*Echium humile* is a species with a limited distribution in SE Spain which has had a confused taxonomic and nomenclatural history. The species was first described by LAMARCK as *E. angustifolium*, and according to LACAITA (1919, 345) the type specimen in LAMARCK’s herbarium is from Tobarra in Murcia province. Subsequently, DESFONTAINES described his species *E. humile* from North Africa without any reference to *E. angustifolium*.

COINCY (1900) originally maintained the Spanish plants as *E. angustifolium* Lam. and the North African *E. humile* as distinct species, but he subsequently (1902) treated *E. humile* as a variety of *E. angustifolium* Lam.
Fig. 1. — *Echium humile* Desf. A: corolla (x 3.5); C: stem; D: calyx (x 3.5).
Murcia: Fuente Alamo, Bourgeois 1314 (E).
I have likewise compared specimens referable to these two species from North Africa and SE Spain and I cannot find any constant characters which warrant taxonomic separation at a formal taxonomic rank.

LACAITA (1919, 437) drew attention to the neglected *E. angustifolium* Miller (*Gard. Dict.* 1768), a distinct East Mediterranean species which renders LAMARCK's epithet a later homonym. Consequently, if the North African and Spanish plants are treated as conspecific the legitimate name for this species is *E. humile* Desf.

The names *E. pycnanthum* Pomel (originally described as *E. densiflorum*, but this is a later homonym of *E. densiflorum* DC.) and *E. eriobotrum* Pomel are very likely also synonyms of *E. humile* Desf. but I have not been able to examine type material of these taxa.

   
   
   *E. lagascae* Boiss., *Elenchus*: 67 (1838) non Roem. & Schult. (1819).
   

   *Icon.* Boissier, *Voyage botanique dans le Midi de l'Espagne*, t. 124 (1841) as *E. pomponium*.

   Large, erect, hispid biennial, 60-250 cm., usually with a single or at least one dominant flowering stem; indumentum of the stem of dense, whitish patent setae and an underlayer of dense, short hairs, indumentum of the leaves of more or less soft, appressed setae. Basal rosette leaves usually prominent, 100-350 x 40-50 mm., elliptical to lanceolate; cauline leaves c. 70-150 x 10-20 mm., narrowly elliptic to lanceolate. Inflorescence spike-like with short cincinni. Calyx 8-9 mm., densely white-hispid, not elongating markedly in fruit. Corolla 16-18 mm., 'very narrowly infundibuliform, finely hairy especially on the lobes, flesh-pink with 5 long-exserted stamens. Stamen filaments carmine, pollen grey-blue. Nutlets 3-3.5 mm., triquetrous, covered with irregular tubercles.


   *Distribution.* S Spain, S Portugal, Morocco and Algeria. Commonly a species of roadbanks and disturbed habitats (Map 2).
Albacete: Alcaraz, 8-1000 m, 1890, Porta & Rigo 421 (MANCH).
Jaén: Torreperogil, 10.IX.1951, Galiano 477 (MA); near Martos, 16.IV.1969, Gibbs 69.293A (E); Sierra de Cazorla, Cerro de los Carboneros, 13.VII.1951, Heywood 1270 (BM); Linares-Basea station, 3.VI.1927, Wilmott (BM); Córdoba to Granada, 45 km from Granada, 15.VI.1966, Verdcourt (K).
Málaga: Campillos to Ronda (C.341), 20.VI.1969, Gibbs 69.401 (E); Gaucín VI.1916, Gros (MA); Casarabonela, 2-3000 m, 23.V.1879, Huter, Porta & Rigo 421 (MANCH); Torremolinos, VIII.1934, Laza (GDA); Jimena, Serranía de Ronda, 2-3000 m, 4.VI.1895, Porta & Rigo (MANCH); Ronda, 15.VI.1889, Reverchon 325 (MANCH); Alora to Carratraca, 12.V.1968, Tutin (LTR); Antequera, Cañada del Madroño, 16.VI.1930, C. Vicioso (MA); Sierra de Antequera, coll. unknown (GDA).
Cádiz: Los Barrios, V.1962, Borja (MA); Sanlúcar de Barrameda, 24.V.1849, Bourgeau 336 (BM); Grazalema, alrededores, 1.VI.1969, Gibbs 69.225 (E); Puerto de Santa María, Gutiérrez (MA); Grazalema, 26.VI.1890, Reverchon (E, MANCH); near Algeciras, 20.VI.1963, Stocken 224.63 (E).

This striking species of Echium is more commonly known under the name E. pomponium Boiss. Unfortunately, as has been noted by Fernandes (1969), this name is predated by Echium boissieri Steudel.

The species was first described by Schott (1819) as Echium albicans but this epithet is a later homonym of E. albicans Lag. & Rodr. Subsequently, it was described by Boissier (Elenchus 1838, 67) as Echium lagascae but this too is a later homonym of E. lagascae Roem. & Schult. In November 1840, Steudel published the second edition of the Nomenclator Botanicus in which he listed «E. boissieri Steud. Hispan.» with «E. albicans Schott ? (non Lagas.)» and «E. lagascae Boiss. (non R. & S.)» as synonyms. This undoubtedly constitutes valid publication of the name E. boissieri Steudel.

However, in the Voy. Bot. Midi Esp., 424, which Baum (1968) has recently dated as published in March 1841, Boissier apparently considered this species to be the same as E. glomeratum Poiret, which is in fact a distinct East Mediterranean taxon. Then in May 1841 (cf. Baum 1968) the plate for this species was published under the name E. pomponium Boiss., and this name was validly published with the plate since an analysis of important characters was figured. However, E. pomponium Boiss. of May 1841 is clearly pre-dated by E. boissieri Steudel. In his later publications, Boissier seems to have cited E. boissieri Steudel as a synonym of his own E. pomponium without reference to dates of publication.
MAP 2

DISTRIBUTION OF E. FLAVUM AND E. BOISSIERI

E. FLAVUM
E. BOISSIERI

vunnvi3.3
Of the two synonyms listed by Steudel for *E. boissieri*, the earliest name, i.e. *E. albicans* Schott, and therefore the name one would ordinarily choose for lectotypification, is cited with a query. It therefore seems reasonable to choose the other name, *E. lagascae* Boiss. in order to typify *E. boissieri*, and since *E. lagascae* Boiss. and *E. pomponium* Boiss. are based on the same material the lectotype chosen by Sauvage & Vindt (1956) for *E. pomponium* can stand for *E. boissieri* Steudel.


*Icon.* Desfontaines, *Flora Atlantica*, t. 45 (1798).

Erect, hispid biennial or perennial, 20-28 cm., with 1 or several ascending flowering stems; stems and leaves with more or less soft, dense, patent setae and an underlayer of short, spreading whitish hairs. Basal rosette leaves 40-150 x 8-27 mm., narrowly obovate to narrowly lanceolate; cauline leaves very narrowly elliptic; all leaves with dense, appressed, soft setae and an underlayer of fine hairs. Inflorescence more or less spike-like. Calyx 5-8 mm. at anthesis, c. 12 mm. in fruit. Corolla 13-16 mm., very narrowly infundibuliform, flesh-pink, rather sparsely short-hairy, with 5 long-exserted stamens; filaments carmine, pollen blue-grey. Nutlets c. 3 x 2.5 mm., triquetrous, whitish, irregularly contoured and minutely tuberculate.

*Type.* «Atlante prope Tlemsen» (Herb. Desfontaines, photo !).

*Distribution.* Mountains of Central, East and SE Spain; Moyen and Grand Atlas mountains of Morocco. Rocky meadows (Map 2).


Echium flavum is a widespread if somewhat disjunctly distributed species which appears to be largely restricted to calcareous substrates although the localities in the Sierra de Gredos would seem to be an exception to this. Rather harshly setose specimens from SE & S Spain have been described as var. setosum Willkomm, loc. cit., 484: «int. Novelda et Valldigna Cav. ! et Granat. Sierra Bermeja Wk.»). Since at least in southern Spain *E. flavum* is sympatric with the much more strigose *E. boissieri* Steudel, which is probably a closely related species, this taxon probably merits further detailed field studies.

   
   *E. italicum* var. β L., *Mant.*: 334 (1771) non L. 1753 et 1762 per syn.
   
   
   
Fig. 2.—\textit{Echium asperrimum} Lam. A: corolla (x 1,4); C: stem; D: calyx (x 1,4).
Almería: Vélez Rubio, Reverchon 1102 (E).
E. italicum sensu Willk. in Willk. & Lange, Prodr. Fl. Hisp. 2: 486 (1870) pro parte.


Icon. Fig. nostra no. 2.

Erect biennial up to 100 cm., much branched from near the base and with an indumentum of dense, white-grey, patent, stinging setae and an underlayer of short appressed hairs. Basal rosette usually persisting until flowering, leaves 120-250 x 30-50 mm., broadly lanceolate, with more or less harsh setae; cauline leaves narrowly lanceolate. Inflorescence intricately branched, broadly pyramidal. Calyx 6-7 mm. at anthesis, c. 8 mm. in fruit. Corolla 13-18 mm., very narrowly infundibuliform, flesh-pink, hairy, with 4-5 long-exserted stamens; filaments carmine, pollen blue-grey. Nutlets c. 4 x 3 mm., triquetrous, brown rugose.

Type. Ile de Pomegue, pr. Marseille (P-LAM) fide Lacaita (1919) & Klotz (1962a).

Distribution. North Italy; Southern France; Islas Baleares; most of Spain except for the NW and SW. Roadsides and uncultivated slopes (Map 3).
MAP 3
DISTRIBUTION OF
ECHIUM ASPERRIMUM
Additional records from Klotz 1962 a

LACAITA (1919, 402 et seq.) clearly distinguished between Echium asperrimum Lam. and E. italicum L., two taxa which had been confused by most previous authors. Unfortunately, LACAITA referred to the former species as E. pyrenaicum Desf. and he attempted to reject the name E. asperrinum Lam. as a nomen confusum. However, the nomenclatural grounds for such rejection are very slender: LAMARCK (1792) provided an adequate description and according to LACAITA (1919) and KLOTZ (1962a) there is a good specimen of this species in the LAMARCK herbarium at Paris.

Echium asperrimum can usually be distinguished from E. italicum by the following characters:

E. asperrimum

- plant much-branched from near the base
- setae harsh and stinging (greyish-white on dried specimens)
- corolla 13-18 mm., flesh-pink
- stamen filaments deep carmine

E. italicum

- plant usually with erect, scarcely branched flowering stems
- setae more or less soft (usually yellowish on dried specimens)
- corolla 10-12 mm., bluish-, yellowish- or pinkish-white
- stamen filaments pale-coloured

Not all specimens are as unambiguously distinct as this tabulation suggests: some plants of E. italicum have branched stems, and occasionally
the flower size of some specimens of *E. asperrimum* can be within the range of *E. italicum*. A detailed study should be made of these two species in the region where they are sympatric, i.e., NE Spain, the Balearic Islands and SE France.

Klotz (1962a, 301) has provided a distribution map of *E. asperrimum* in Spain which partially complements that given in the present study (Map 3) since the present map adds records for Salamanca and Oviedo provinces which are lacking in Klotz's distribution, but the latter records many more localities in southern Spain. Indeed, the distribution of *E. asperrimum* in the region of Andalucía appears to be rather under-recorded since in the herbarium material which has been studied for this species there is only one specimen (Smythies 63) from the provinces of Cádiz, Málaga, Jaén and Granada. Willkomm (1870) cites Puebla de Don Fadrique and La Sagra (Granada) and Alhaurín (Málaga), and Galiano & Heywood (1960) record this species from the Sierra de Cazorla (Jaén). Klotz (1962a) does not cite the specimens on which his distribution maps are based.


*Icon.* Jacquin, *Florae Austriacae*, t. 16 (1778).

Erect, hispid biennial, 40-100 cm., usually with a single, unbranched flowering stem but sometimes much-branched. Basal leaves 200-350 x 15-40 mm., lanceolate, with appressed, soft setae; cauline leaves more or less narrowly elliptic. Inflorescence usually more or less spike-like but sometimes branched. Calyx 6-7 mm. Corolla 10-12 mm, very narrowly infundibuliform, yellowish- or bluish- or pinkish-white, sparsely hairy, with 4-5 long-exserted stamens; filaments white-translucent, pollen yellowish. Nutlets c. 3 x 2.5 mm., triquetrous, whitish-grey, irregularly tuberculate.

*Type.* Specimen in the Linnaean herbarium no. 191.17 (LINN).

*Distribution.* Widespread in south and central Europe but restricted to the NE coastlands and Balearic Islands in Spain (Map 4).

*Gerona:* Catalogne, Cabañas, pelouse, 4.VI.1908, Sennen 572 (E), sub. *E. pomponium* var. *paui*. *Baleares:* Mallorca: Cala Ratjada, 5.VI.1966, Bowden & Sims 373 (BM); Puerto de Pollensa, 2.VII.1968, L. F. & I. K. Ferguson 2145 (BM); Puig Mayor, 2.VI.1966, Bowden & Sims 290 (BM);
MAP 4
DISTRIBUTION OF ECHIUM LUSITANICUM and E.ITALICUM

- E.lusitanicum subsp. lusitanicum
- E.lusitanicum subsp. polycaulon
- E.italicum

Echium italicum has been confused with E. asperrimum in a number of earlier floristic works; see observations under the latter species.


Echium broteri Samp. in Lusitano (1900); ex Coutinho in Bol. Soc. Brot. 21: 113 (1905).

Icon. Fig. nostra no. 3.

Erect or ascending, more or less softly setose-hairy perennial with several to many flowering stems. Basal leaves 250-450 x 15-70 mm., broadly lanceolate, with appressed soft setae; cauline leaves narrowly lanceolate. Inflorescence spike-like. Calyx 5-7 mm. Corolla 7-10 mm., narrowly to more or less dilated infundibuliform, sparsely hairy, bluish-white to dark blue-grey, with 5 long-exserted stamens; filaments pale carmine, pollen blue-grey. Nutlets c. 2.5 x 1.8 mm., triquetrous, greyish to black with scattered and more or less anastamosing rugae.

Type. See discussion below.

Distribution. C & N Portugal; W & WC Spain (Map 4).

Two subspecies are recognised:
corolla bluish-white, very narrowly infundibuliform (a) subsp. lusitanicum.
corolla dark bluish-grey, infundibuliform but dilated towards the apex (b) subsp. polycaulon.

(a) subsp. lusitanicum.

Corolla usually 7-8 mm., very narrowly infundibuliform, white flushed pink turning white flushed blue; upper cauline leaves usually finely appressed setose.


Orense: Alrededores de Bande, Merino (MA); San Carme, Merino (MA).
Salamanca: Sierra de Gata, Puerto Perales, 17.VI.1956, Lainz (E).
Fig. 3.—Echium lusitanicum subsp. polycaulon (Boiss.) P. Gibbs. A: corolla (x 1.4); C: stem; D: calyx (x 1.4). Toledo: Talavera de la Reina, Smythies 351 (E).


Corolla usually 8-10 mm., infundibuliform but rather broadly dilated towards the apex, clear blue to dark bluish-grey; upper cauline leaves more or less densely spreading setose.

Type. Extremadura, valley of Plasencia, Herb. Pavon (Herb. Boiss. G ?).

Distribution. WC Spain.

Avila: Sierra de Gredos, Poyales del Hoyo, 11.VIII.1962, Adshead & Scott 452A (BM); entre Adrada y Arenas de San Pedro, 26.VI.1928, Cuatrecasas 2249 (MA) Sierra de Gredos, El Arenal, 31.VII.1956, Deverall & Flannigan (E); Candeleda, 27.VI.1927, Lacaita 362/27 (K). Salamanca: 'Bordes de los Caminos', VII.1964, Bellot, Borja & Monasterio (G, MA). Cáceres: Valle de Jerte, 18.VI.1967, Borja, Ladero & Izco (LTR); Bords de la rivière près Plasencia, 21.V.1883, Bourgeau 2467 (G, MA); Tornavacas, 12.VII.1924, Gros 2 (BM); Jerte, 23.V.1923, Lacaita 162/23 (BM); La Bazagona, between the station and the river Tiétar, 2.VI.1923, Lacaita 231/23 (G, MA); Valle de Plasencia, entre Tornavacas y Cabezuela del Valle, VII.1803, coll. unknown (MA).

This species has had a somewhat confused taxonomic history. Brotero (Fl. Lusit. 1: 290, 1804) considered that the name E. lusitanicum L. referred to a variant of E. vulgare, and he treated the plants of Echium lusitanicum from Portugal as conspecific with E. italicum L. Hoffmannsegg & Link (Fl. Port. 1: 185, 1810) likewise referred this taxon to E. italicum as var. lusitanicum. This early confusion was perhaps in part due to the fact that in the protologue for E. lusitanicum Linnaeus used the misleading phrase «corollis stamine longioribus» (*).

Sampaio (Lusitano 1900) subsequently attempted to correct Brotero’s

(*) Lacaita (1919, 419) suggested that this inept diagnosis by Linnaeus could be explained by supposing that «longioribus» was a slip of the pen for «brevioribus». However, Fernandes (1970) has much more reasonably suggested that the error possibly lay in writing «stamine» instead of «staminibus». Thus, «Echium staminibus corollis longioribus» would apply to the floral morphology of E. lusitanicum.
error by referring the Portuguese plants to the new specific name *E. broteri* Samp. *Lacaita* (1919, 414 *et seq.*) and more recently *Fernandes* (1970) have clarified the nomenclatural situation with regard to *Echium lusitanicum*, and these authors are in agreement that there is no reason why the Linnaean name should not be applied to this species.

However, there are some remaining problems concerning the typification of *Echium lusitanicum*. The protologue for this taxon does not cite any earlier Linnaean sources, but the following synonyms are listed:

«*Echium caule simplici, foliis caulinis lanceolatis sericeis, floribus spicatis lateralibus. Roy. Lugdb. 407*».

«*Echium amplissimo folio, lusitanicum. Tournef. inst. 135 ?*».

There is a specimen of *E. lusitanicum* in the Linnaean herbarium (LINN) no. 191.23 but it bears the inscription «*Echium lusitanicum folio amplissimo Tcurn.*» in the handwriting of Jan Burman, and «lusitanicum» added in the hand of LinnaeusFil. The lack of any species number (ie. «6 lusitanicum») on this specimen indicates that Linnaeus did not have it before him at the time that he drafted the entry for the *Species Plantarum*, and this is supported by *Lacaita* (1919, 417) who has stated that the Burman herbarium was not received by Linnaeus until 1760.

*Lacaita* (*loc. cit.*) has noted that Le Héman (*Plantae e familia asperifoliorum nuciferae, 452, 1818*) reported that there are several specimens of *E. lusitanicum* in the herb. Vahl which were given by Van Royen. *Fernandes* (1970) has suggested that since it is very possible that Linnaeus saw such Van Royen specimens during his stay in Holland then they could serve to typify *E. lusitanicum*. However, the I.D.C. microfiche of the Vahl herbarium at Copenhagen does not appear to include any specimens of *E. lusitanicum*, but the Van Royen herbarium at Leiden does contain three specimens labelled *E. lusitanicum* and through the courtesy of the Director of the Rijksherbarium I have been able to examine these specimens. All three examples are certainly *E. lusitanicum* and since these specimens could well have formed the basis for Van Royen's «*Echium caule simplici... Lugdb. 407*» they have been chosen as lectotype material for *Echium lusitanicum* L.

*Echium tuberculatum* Gilib., *Exerc. Phyt.*: 41 (1792) nom. illeg. (*)
non Hoffmanns. & Link (1809).


*E. vulgare* var. *pustulatum* (Sibth. & Sm.) Rouy in Rouy & Foucaud,
*Fl. Fr.* 6: 113 (1900).


Iber.* 29: 43 (1930).


Erect, hispid biennial 20-90 cm. with 1- several flowering stems; indumentum of appressed to patent, more or less soft setae and an underlayer of short, usually deflexed, appressed hairs. Basal and lower cauline leaves 50-150 x 10-20 mm., narrowly oblanceolate, attenuate to petiolate at the base; upper cauline leaves narrowly elliptic to lanceolate, sessile. Inflorescence more or less spike-like or branched. Calyx 5-7 mm. at anthesis, not enlarging markedly in fruit. Corolla 10-19 mm., infundibuliform, blue to bluish-violet, usually with 4-5 long-exserted stamens; filaments pale, pollen bluish. Nutlets 2.5 x 1.5 mm., more or less triquetrous, rugose, brownish.

*Type.* Specimen no. 191.19 in the Linnaean herbarium (LINN).

*Distribution.* Most of Europe, from Scandinavia and S Britain to C Portugal eastwards to the Urals (Map 5).

**Gerona:** Llers, 13.VI.1908, Sennen 571 (MANCH). **Barcelona:** Sierra de Cadí, 1-2 km. from Castellar de Nuch, 8.VII.1966, Chater & Moore 53

(*) LITARDIERE (1942), KLOTZ (1960) and FERNANDES (1969) have treated *Echium tuberculatum* Gilib. as a validly published name, and as such it would be an earlier homonym of *E. tuberculatum* Hoffmanns. & Link, a distinct species from Portugal. However, in both the Flora Lithuanica (1782) and the Exercitia Phytologica GILIBERT did not consistently follow the binomial system and thus, under Art. 23 sub (3) of the International Code for Botanical Nomenclature all names published in these works must be rejected. Consequently, *E. tuberculatum* Hoffmanns. & Link remains the legitimate name for the Portuguese species.
Manlleu, 4.VII.1925, Gonzalo (MA); San Cugat, 5.VIII.1925, Sennen (MA); Sarriá, 3.V.1912, Sennen 2751 (MA). Lérida: Val d’Arán, route de Viella, 15.VIII.1934, Estival (MA); Bellver, 4.VII.1920, Font Quer (BM).

Huesca: Bielsa, VI, Campo (MA); San Cosme de Guara, 8.VII.1902, Pau (MA). Zaragoza: Nombrevilla, 18.VI.1897, Bernal (MA); San Martín del Moncayo, 7.VI.1946, Rivas Goday (MA); Calatayud, 4.VI.1907, B. Vicioso (MA). Navarra: Tafalla, 1.VI.1936, Escrudie (MA); Pamplona, 25.V.1927, Wilmott (BM).

Gandía, García (MA); Bicorp, VI.1915, C. Vicioso (MA). CuencA: Puente Vadillos, 16.VI.1935, Caballero (MA); Hoz de Beteta, 13.VII.1932, Caballero (MA); Laguna de El Tobar, 22.VI.1935, Caballero (MA); Poveda, 16.V.1901, Reyes (MA); Uña to Tragacete, 24.V.1968, Smythies 268 (E). Madrid: Sierra Guadarrama, Cercedilla, VI.1912, Beltrán & C. Vicioso (MA); Ciempozuelos, 8.IX.1960, Gibbs 100 (MANCH); Navacerrada, Dehesa de Majaserrones, VII.1911, Pau (MA); Buitrago, 1.VI.1918, Vicioso (MA); Arganda, V.1915, C. Vicioso (MA); near Aranjuez, 30.V.1927, Wilmott (LTR). Avila: Sierra de Gredos, Hoyo del Espino, 3.VIII.1962, Adshead & Scott 347 (LTR); Sierra de Gredos, El Arenal, 16.VII.1956, Deverall & Flannigan 171 (E); Sierra de Gredos, near Navarredonda, 28.VI.1927, Wilmott (BM). Salamanca: La Alberca, 27.VI.1946, Caballero (MA); Salamanca, 5.VII.1961, Harrison (LTR); Salamanca, 17.V.1923, Lacaita 72/23 (BM, MA). Cáceres: Puerto de Béjar, Baños de Montemayor, 6.VI.1945, Caballero (MA); Jerte, 8.VII.1924, Gros 5 (BM).

Echium vulgare is a very variable species which requires detailed study throughout its area of distribution. In the present revision a rather wide species concept has been adopted. Plants with sparsely setose, rather conspicuously white-tuberculate stems and leaves which have been referred to under the names E. pustulatum Sibth. & Sm. or E. hispanicum Asso, have been included under E. vulgare; in the material which has been studied, although there are occasional plants with these characters, which when singled out certainly seem to be distinctive, such plants are connected by intermediate forms to others with more typical E. vulgare facies.

Likewise, E. asturicum Lacaita, which was distinguished largely on the basis of its growth habit, has also been treated as conspecific with E. vulgare. Future cultivation or transplant studies may well confirm that certain forms of E. vulgare from the Northern provinces of Spain are distinctive in forming a basal rosette of leaves in the first year of growth, and subsequently producing lateral flowering stems in successive years (cf. the studies on Prunella vulgaris by Böcher, 1963). However, it is difficult to treat such physiological variation in growth habit in a formal taxonomic study.


Erect, softly hairy biennial, 20-60 cm., with 1- several flowering stems; indumentum of soft, appressed setae and an underlayer of sparse hairs. Basal leaves 50-140 x 15-40 mm., broadly ovate, petiolate, with prominent lateral veins; cauline leaves oblong to lanceolate, the uppermost more or less caudate at the base. Inflorescence usually branched. Calyx 7-10 mm. at anthesis, up to 15 mm. in fruit. Corolla 18-30 mm., broadly infundibuliform, purple, hairy only on the veins and margins, usually with 2 more or less exserted stamens; filaments rather sparsely hairy, pollen bluish. Nutlets c. 2.5 x 2 mm., triquetrous, tuberculate, pale brownish-grey.

Type. Illustration in Jacques Barrelier Plantae per Galliam, Hispaniam et Italiam observatae, iconibus exhibitae 145, t. 1025 (1714).

Distribution. S Europe extending into C Europe and locally naturalised in N Europe (Map 6).

rena, Venta de Cárdenas, 30.IV.1930, Cuatrecasas (MA). Córdoba: c. 2 mls NW of Córdoba, 4.V.1924, Ellman & Hubbard 86 (K); Córdoba, 28.IV.1964, Gilson (LTR); Trespuentes, 20.V.1920, Pau (MA). Málaga: Pizarra to Alhaima, 14.IV.1969, Gibbs, Silvestre & Valdés 1076.69 (E, SEV); Torre del Mar, 1.V.1925, Lacaita 132.25 (BM); Almoja, 29.III.1966, Smythies 54 (E); near Vélez Málaga, 25.III.1966, Smythies 47 (E); San Diego, W of Estepona, 11.IV.1965, Smythies 82 (E); Benhavis, «La Romera», 28.IV.1931, C. Vicioso (MA); Manilva, 9.V.1932, C. Vicioso (MA). Sevilla: near Carmona, 27.V.1967, Chater, Moore & Tutin (LTR); Lora del Río to Constantina, 7.IV.1969, Gibbs 69.114 (E, SEV); Morón de la Frontera, 25.IV.1933, C. Vicioso (MA). Cádiz: Puerto de Santa María, 29.III.1849, Bourgeau 385 (K); c. Cádiz, Fauché Hb. (K); Montegil, nr. Jerez de la Frontera, 27.III.1969, Galiano, Gibbs, Silvestre & Valdés 433.69 (E, SEV); Jerez de la Frontera, 10.IV.1925, Gros 16 (BM); San Roque, IV.1880, Mathews (E); Grazalema, 14.VI.1890, Reverchon (MANCH); Medina Sidonia, 18.IV.1966, Smythies (E); Arcos to Bornos road, 2.III.1966, Smythies 26a (E); Río Guadiano, nr. San Pablo, 11.V.1908, Tutin (LTR); Algeciras, 19.V.1907, B. Vicioso (MA); near Algeciras, 17.IV.1961, Walker (BM). Huelva: Ermita del Rocío, 25.V.1967, Chater, Moore & Tutin (LTR); Ayamonte, 8.V.1943, C. Vicioso (MA). Baleares: Mallorca: Marratxi, 24.XI.1947, Ferrer (MA); Menorca: c. Mahón and Cala Serja, Bowden & Sims 688 (BM); Mahón, Isla del Rey, 16.III.1910, Font Quer (MA); Cala de San Esteban, 19.V.1913, Font Quer (MA); Ibiza: Santa Eulalia, 5.V.1968, Bowden & Sims 1630 (BM); San Antonio Abad, VII.1954, Hedge 57.54 (E); San Juan, Ferrer (MA).

The name Echium lycopsis has been used by some authors, eg. Dandy (1958) and Klotz (1960) for this species. Echium lycopsis L. was originally published without a description in Flora Anglica 12 (1754) but with the figures «227.2» which are a reference to Ray, Syn. Meth. Stirp., ed. 3, 227 (1724). Now circumstantial evidence suggests that the plants which Ray referred to are the same as were later described under the name Echium plantagineum L., for Ray recognised his lycopsis as different from the common British Echium (ie. E. vulgare) and he recorded it as growing at St. Hillary, Jersey (Channel Islands).

However, Ray likewise did not provide a description but simply listed several references; for one of these references, Echii altera species Dod. p. 680, Ray noted, «cujus icon banc nostram bene representat» so that the plant figured by Dodonaeus is the obvious choice as lectotype. Unfortunately,
tre figure in Dodonaeus Stirp. Hist. Pempt. 630 (l. c. not 680 (1616), which is merely a reproduction of a plate in Lobel Stirp. Observ. 312 (1576) titled Lycopsis altera anglica), depicts a plant which fairly clearly resembles Echium vulgare, particularly by the corollas with four long-exserted stamens. Thus, a strict attempt to typify Echium lycopsis L. leads to the conclusion that the name must be referred to a figure in Dodonaeus or Lobel which almost certainly depicts E. vulgare L.

In the Mantissa, Linnaeus cited a single reference to «Barr. rar. 145, t. 1025». This illustration certainly depicts a plant with plantagineum-facies and has been chosen as lectotypus for E. plantagineum.


Icon. Fig. nostra no. 4.

Procumbent, ascending or erect, hispid biennial 15-50 cm., usually with several to many flowering stems. Indumentum of whitish setae and an underlayer, of short, spreading hairs. Basal leaves c. 25-60 x 11-15 mm, obovate to ovate; cauline leaves oblanceolate to spatulate, attenuate and subpetiolate at the base; all leaves with more or less dense, whitish, appressed to spreading setae. Inflorescence more or less branched, laxly paniculate. Calyx 12-25 mm., broadly infundibuliform, uniformly hairy, dark blue to pinkish-to bluish-purple, usually with 1-2 exserted stamens; filaments sometimes sparsely hairy, pollen bluish. Nutlets 2.3 x 1.5-2.5 mm., triquetrous, brown or greyish, tuberculate.


Distribution. W Mediterranean region; coastlands.

Gerona: North of Puerto de la Selva, 17.VI.1959, Chamberlain 814 (BM); Cadaqués, 19.IV/27.V.1907, Sennen & Septimin 328 (MANCH); Rosas, 22.VI.1905, Sennen (MA); Puerto de la Selva, 11.V.1966, Smythies 87 (E); Llansá near Figueras, 10.IV.1884, Thompson (E). Valencia: Sagun-
Fig. 4.—*Echium sabulicolum* Pomel. A: corolla (x 1.4); C: stem; D: calyx (x 1.4). Murcia: Cartagena. Bourgeois.

This species has commonly been referred to as Echium maritimum Willd. Unfortunately, this name must be rejected since Willdenow (1798) commented that he had only seen a single specimen of his E. maritimum and according to Coinky (1900a) the specimen in question in Willdenow's herbarium is a fragment of Echium plantagineum. Thus, E. maritimum Willd. must be referred to this latter species, and another name must be found for E. maritimum sensu auct. On this basis Coinky (1900a) substituted the new name E. confusum and this epithet has been taken up by a number of authors, eg. Sauvage & Vinndt (1954b) and Fernandes (1969). However, the name E. sabulicolum must also be taken into account since Coinky considered E. sabulicolum to be synonymous with his E. confusum (according to Sauvage & Vinndt, 1954b). Likewise, Kl.ottz (1962c) has recently presented a detailed revision of this species complex in which he unites a number of infra-specific taxa under the name E. sabulicolum Pomel.
Sauvage & Vindt (1954a & b) have questioned whether E. confusum Coiney and E. sabulicolum Pomel are in fact conspecific and they cited two differential characters, viz. the nature of the coronal scales and the type of indumentum of the stems and leaves. However, although Sauvage & Vindt certainly examined type specimens of E. sabulicolum from the Pomel herbarium they otherwise studied little material and these authors concluded their observations with the comment: «Mais nous ne pouvons prendre parti au sujet d'une plante que nous connaissons trop mal».

I have dissected corollas from a number of specimens referable to E. confusum - E. sabulicolum from the coastlands of S & SE Spain and Algeria and have found the degree of fusion of the coronal scales to be very variable, as is the nature of the indumentum, ie. the prominence of the tubercules and degree of harshness of the setae. There does not seem to be any clear-cut morphological discontinuity in these characters correlated with geographical distribution which would warrant the separation of E. confusum from Europe and E. sabulicolum from North Africa as distinct species. The present account therefore follows Klotz (1962c) in using the name E. sabulicolum Pomel for the species E. maritimum auct. non Willd. sens. str.

    E. grandiflorum Desf., Fl. Atl. 1: 166 (1798).
    E. macranthum Roem. & Schult., Syst. 4: 20 (1819).

    Icon. Fig. nostra no. 5.

Erect, hispid biennial, 25-90 cm. with 1- several flowering stems; indumentum of sparse to dense, patent setae and an underlayer of short, appressed, uniformly deflexed hairs. Basal and lower cauline leaves 60-180 x 10-25 mm., narrowly oblanceolate; cauline leaves usually narrowly elliptic or oblong. Inflorescence branched. Calyx 7-9 mm. at anthesis, 12-18 mm. infruct. Corolla 15-40 mm., infundibuliform, uniformly hairy, persistently reddish-purple, or pink-carmine turning bluish, or bluish-purple, with 1-2 exserted stamens; some or all of the filaments usually sparsely hairy, pollen blue-grey.

Type. Specimen no. 191.21 in the Linnaean herbarium (LINN) lectotypus according to Fernandes (1969).
Fig. 5.—*Echium creticum* L. A: corolla (x 1,4); C: stem; D: calyx (x 1,4).
Distribution. W Mediterranean region and S Portugal. Roadsides and grassy slopes (Map 7).

Two subspecies are recognised:
corolla 23-38 mm., usually reddish-purple; all stamen filaments usually sparsely hairy (a) subsp. creticum.
corolla 15-26 mm., bluish-purple or pink-carmine turning bluish; stamen filaments scarcely hairy (b) subsp. coincyanum.

(a) subsp. creticum.
E. grandiflorum Desf., Fl. Atl. 1: 166 (1798).
E. macranthum Roem. & Schult., Syst. Veg. 4: 20 (1819).

Corolla 23-38 mm., reddish-purple (colour often persisting in dried specimens); all stamen filaments more or less sparsely hairy.

Distribution. S France, NE Spain, Corse, Sardinia & N Africa.

Gerona: North of Puerto de la Selva, 17.VI.1959, Chamberlain 814 (BM); Cadaqués, 19.IV/27.V.1907, Sennen & Septimin 328 (MANCH); Rosas, 22.VI.1905, Sennen (G, MA); Puerto de la Selva, 11.V.1966, Smythies 87 (E); Cadaqués, IV.1883, Tremols (MA); Station at Llansa, near Figueras, 10.VI.1884, Thompson (E).

Echium argentae Pau, Not. bot. fl. Esp. 1: 22 (1887) non E. argenteum L.
E. norbetii Sennen, Plantes d'Espagne exsic. no. 6438 (1927).
MAP 7
DISTRIBUTION OF ECHIUM CRETICUM
- subsp. creticum
- additional records from Klotz 1962 a
- subsp. coinceyanum
- additional records from Fernandes 1970
Corolla 15-26 mm., bluish-purple or pink-carmine turning bluish; only the ventral stamen filaments with sparse, straggling hairs or sometimes all filaments glabrous.

Type. Málaga, Tajo de Ronda, 29.VI.1849, Bourgeau 334 (G); Granada, Sierra de S. Felipe de Játiva, 28.V.1852, Bourgeau 1625 (E, G); Sierra de Segura, 1850, Bourgeau 989, syntypes.

Distribution. E, SE & S Spain, S Portugal.

Barcelona: near Barcelona, 9.VIII.1851, Ball (E); Artés, 18.VI.1912, Font Quer (MA); Montroig, 12.V.1926, Font Quer 26 (BM). Castellón: Segorbe, 6.VII.1924, Pau (BM, MA, MANCH); Segorbe, Reverchon (MANCH). Valencia: Corbera de Alcira, V.1945, Borja (MA); Játiva, in monte castelli, 19.IV.1896, Pau (MA); supra Calpe, V.1891, Porta & Rigo 142 (K, MANCH); prope Valencia, 8.V.1841, Willkomm (E); Murviedo, castle walls, V.1844, coll. unknown (K). Cáceres: Jerte, 24.V.1923, Lacaita 164/23 (BM); Sierra de Guadalupe, near Guadalupe, 26.VI.1927, Wilmott (BM). Ciudad Real: 7 km. south of Valdepeñas, 2.VI.1927, Wilmott (BM). Albacete: Villaverde de Guadalimar to Fábricas de Riópar, 18.VI.1969, Gibbs 69.334 (E, SEV); nacimiento del Río Mundo, 18.VI.1969, Gibbs 69.381 (E). Alicante: Castillo de Santa Bárbara, 12.VII.1970, Escarré (E); San Vicente del Raspeig, 16.VI.1970, Escarré (E). Murcia: Cartagena, El Gorguela, Esteve 1260 (GDA); San Félix, V.1953, Esteve 1671 (GDA); Moratella to Caravaca, 19.VI.1969, Gibbs 69.397 (E); Cartagena, Huelva, 6.VI.1931, Gros (MA); Sierra de Espuña, Coto de Santa Eulalia, 18.VI.1927, Jerónimo (BM, MA); Cartagena, Cerro de San Julián, 10.V.1928, Lacaita 99/28 (K); Fuensanta, V.1891, Porta & Rigo 142 (K, MANCH); Cartagena, IV.1890, Porta & Rigo (K); Puerto Lumbreras, 14.III.1966, Smythies 45 (E). Almería: Sierra de Cabo de Gata, Barranco del Sabinar, 2.VI.1967, Ball, Chater, Ferguson & Valdés (LTR, SEV); sands 15 mls. E of Almería, 30.V.1924, Ellman & Hubbard 929 (K); between El Ejido and Dálías, 13.IV.1969, Gibbs, Silvestre & Valdés 961.69 (E, SEV); Sierra de Enix, 12.V.1932, Hno. Jerónimo (BM); Rambla del Moromoro, 16.V.1928, Lacaita 163/28 (BM); Cabo de Gata, 17.V.1928, Lacaita 185/28 (BM); Aguadulce, IV.1890, Porta & Rigo (MANCH). Granada: Guadix to Granada, 20.VI.1969, Gibbs 69.417 (E); between Purullena and Diezma, 4.VI.1927, Lacaita 187/27 (K); Baza, 13.VI.1927, Lacaita (K, MA); Motril - Almería road, nr. Castell de Ferro, 11.IV.1967, Smythies 176 (E); Parque de Invieiro, above Alham-
Echium creticum is yet another species which has been a source of considerable taxonomic and nomenclatural confusion. Fortunately, however, Fernandes (1969) in a recent lucid paper has considerably clarified the situation and rehabilitated the Linnaean name for this species; the present writer is in complete agreement with the nomenclatural argument put forward by Fernandes (loc. cit.).

As accepted in the present revision, Echium creticum L. is a very variable W Mediterranean species with two widely distributed subspecies: the typical element, subsp. creticum which occurs in the coastlands of SE
France and NE Spain, Corsica, Sardinia and North Africa from Morocco to Tunisia; and a second taxon, subsp. *coincyanum* which occurs in E, SE and S Spain and S Portugal. *FERNANDES* (loc. cit.) has described a third subspecies, *algarbiense* which is restricted to S Portugal and Morocco.

It is the second, predominantly Spanish taxon, subsp. *coincyanum* which is particularly variable and which has caused most taxonomic confusion, as is reflected in the synonymy listed above. Thus, although *WILLKOMM* (1870) correctly used the name *E. creticum* L. for this species, *COINCY* (1900b) referred the Spanish populations to *E. australe* Lam. and used the name *E. grandiflorum* Desf. for the southern French and North African populations. *LACAITA* (1919, 368 et seq.) attempted to correct Coincy's error by distinguishing the Spanish plants under a new name, *E. coincyanum*, and he restored the name *E. australe* Lam. for the populations from the catalan coastlands of France and Spain and from North Africa. In fact, however, Lacaita further confused the situation since, on the one hand he rejected on very dubious grounds the name *Echium creticum* L. as a nomen confusum, and on the other he introduced a superfluous species name since two epithets (*E. argentae* Pau and *E. granatense* Coincy) were already available for the Spanish forms of *E. creticum* if it was considered necessary to recognise then as a distinct species.

*KLOTZ* (1962a) partially restored the taxonomy of the group by recognising *coincyanum* at the subspecies level, but he further confused the nomenclature of the group by accepting Lacaita's rejection of *E. creticum* L. and proposing instead of *E. australe* Lam. the obscure name *E. spinescens* Medikus. On this view, the plants from S France, NE Spain, Corsica, Sardinia and North Africa were referred to *E. spinescens* subsp. *spinescens*, and the Spanish and Portuguese plants to *E. spinescens* subsp. *coincyanum* (Lacaita) Klotz. *FERNANDES* (1969) has pointed out that there are no strong grounds for rejecting the original Linnaean name *E. creticum* for this species, whilst in comparison the nomenclatural claims of the name *E. spinescens* Medikus are in fact considerably more suspect.

With the nomenclature of this species now clarified it is hoped that future studies will be able to concentrate on the problem of the variability of the plants referred in this revision to *E. creticum* subsp. *coincyanum*. Examples of this taxon are very variable in such characters as corolla size and colour, degree of exsertion of the stamens, degree of hairiness of the stamen filaments and morphology of the leaves. Detailed field studies on subsp. *coincyanum* in S & SE Spain would make a welcome contribution to the taxonomy of this species complex.
Fig. 6.—*Echium gaditanum* Boiss. A: corolla (x 1.4); C: stem; D: calyx (x 1.4). Huelva: near La Rábida, *Gibbs* 69.128 (E).

*Icon.* Fig. nostra no. 6.

Erect or ascending, roughly hispid biennial 20-75 cm. with several to many usually robust flowering stems arising from a more or less distinctly woody stock. Indumentum of rather sparse, harsh setae, often with conspicuous white tubercles, and an underlayer of fine, deflexed, appressed hairs. Basal and lower cauline leaves 30-110 × 5-30 mm., lanceolate to oblanceolate, attenuate at the base and long petiolate; upper cauline leaves ovate to lanceolate, sessile. Inflorescence rather laxly branched. Calyx 6-8 mm. at anthesis, scarcely enlarging in fruit. Corolla 11-20 mm., clear blue to bluish-violet, infundibuliform, rather abruptly dilated and obliquely cut towards the apex, uniformly hairy, with 3-4 exserted stamens; filaments glabrous, pollen bluish-grey. Nutlets c. 2.5-3 × 2 mm., triquetrous, brownish, irregularly tuberculate.

*Type.* See discussion below.

*Distribution.* S Spain and S. Portugal, Morocco. Usually coastal sands (Map. 8).

**Málaga:** Marbella to Fuengirola, 20.V.1919, Gros (MA). *Cádiz:* c. Gades, 1849, Boissier & Reuter (K); arenasales prope Puerto de Santa María, IV.1961, Borja & Rodríguez (MA); sands at Santa Catalina near Puerto de Santa María, 8.VIII.1853, Bourgeau (E); in arenosis Torregorda prope Cádiz, 29.V.1921, Font Quer (K, MA); Barbate de Franco, sands, 2.V.1969, Galiano, Gibbs, Silvestre & Valdés 1676.69 (E, SEV); inter Cádiz et San Fernando, 12.V.1925, Lacaita (MANCH); Medina Sidonia, hillside below the town, 13.V.1925, Lacaita 266/25 (K); Chipiona, 8.IV.1968, Smythies (E, LTR). **Huelva:** Sandy areas beside the new road to the Coto Doñana, 28.VII.1969, Galiano, Gibbs & Silvestre 2307.69 (E); La Rábida, sandy areas beside the new road to the oil refinery, 9.V.1969, Gibbs 69.128 (E).

Sauvage & Vindt (1956) have examined the material of *Echium gaditanum* in the Boissier herbarium and they have chosen a specimen collected by Haeneler «Prov. Malacitana» as lectotype for this species. Sauvage & Vindt (*loc. cit.*) point out that Boissier cited some six collections in the original circumscription of *E. gaditanum* but they rejected these other specimens on the grounds that they consist of fragments which do not allow
for an accurate impression of the species. In any case the HAENSELER collection(s) were given prominence by BOISSIER and they would normally represent first choice of specimens for the purposes of lectotypification.

According to SAUVAGE & VINDT, the HAENSELER specimen has the localities «circa Gaucín, Casares etc.» written in another hand (which tallies with BOISSIER's note: «In sterilibus regionis calidae, circa Gaucín, Casares, Isat, legit. cl. Haenseler») but these authors do not say whether the additional localities were in fact written by BOISSIER. The localities on the HAENSELER specimen pose a problem because *Echium gaditanum* is a species of maritime sands and only one specimen from an inland locality (*Lacaita 266/25*) has been seen. The *LACAITA* specimen is from below Medina Sidonia and is this a lowland area although some 20 km. from the coastal region near San Fernando where *E. gaditanum* is fairly plentiful. However, Gaucín and Casares are montane localities in the Serranía de Ronda and Sierra Bermeja, and until the occurrence of *E. gaditanum* in these areas can be validated it must be open to doubt as to whether the localities cited on the HAENSELER specimen are in fact those in which the plants were originally collected.


Erect, hispid perennial, 30-70 cm., with 1- several flowering stems which arise from beneath the basal rosette of leaves. Leaves 20-80 x 5-25 mm., ovate to lanceolate, sessile, with appressed to patent setae. Inflorescence laxly branched, often with conspicuous leaf-like bracts. Calyx 6-9 mm. at anthesis, 10-14 mm. in fruit. Corolla 11-20 mm., infundibuliform, pinkish-violet, uniformly hairy, with 3-4 exserted stamens; filaments pale, pollen bluish-grey. Nutlets c. 2 x 1 mm., brownish, irregularly rugose.

*Type.* Spain, Galicia, Cobas, 16.IX.1851-52, *Lange* (COI, K).

*Distribution.* C & N Portugal; NW Spain. Meadows and sandy fields (Map 8).

*La Coruña:* Cape Finisterre, 12.VII.1926, *Lacaita* 611.28 (BM, G); La

On the basis of the very few specimens which they had available, Willkomm (1893) and Sampaio (1935) referred E. rosulatum to E. gaditanum. Fernandes (1970) has recently studied these two species and drawn attention to some of their differential characters; however, Fernandes (loc. cit.) has also pointed out the specimens of E. rosulatum from Cangas de Tineo in the Asturias (which were cited by Willkomm under E. gaditanum) do indeed approach E. gaditanum in corona size and shape, and degree of ejection of the stamens.

Very little material of E. rosulatum from Spain has been available during the preparation of this revision, and it is obviously desirable that this species should be studied in detail throughout its geographical range in Spain and Portugal. Until such studies are undertaken, the status of E. rosulatum in NW Spain must remain rather problematical.


Icon. Fig. nostra no. 7.

Hispid annual (?) or biennial, 10-25 cm., with several to many ascending flowering stems. Basal and lower cauline leaves 30-60 x 5-14 mm., spatulate, long petiolate; upper cauline leaves spatulate or elliptic or oblong, sessile; stems and leaves with whitish, short, more or less appressed setae and an underlayer of fine hairs. Inflorescence little branched. Calyx 5-7 mm. at anthesis, up to 10 mm. in fruit, with the segments remaining narrow. Corolla 6-11 mm., dark blue, uniformly hairy, with all stamens included. Nutlets 2-2.5 x 2 mm., triquetrous, brownish, rugose.

Type. Not traced.

Distribution. E Mediterranean area and some W Mediterranean islands. Dunes and sandy fields near the sea.

Baleares: Mallorca: Cala Ratjada, northernmost beach, 4.VI.1961, Bowden & Sims 351 (BM); entre Valldemossa y El Estrecho, 22.II.1947, Ferrer (MA); Etablimentos, 6.III.1947, Ferrer (MA); Ibiza: Town, cathedral
Fig. 7.—*Echium arenarium* Guss. A: corolla; B: dissected corolla; C: stem; D: calyx; E: fruiting calyx (All x 2). Crete, Kissamos, Reverchon 113 (E).
and fortress yard, 11.V.1968, Bowden & Sims 1951 (BM); «Ibiza», IV.1899, Pau (MA); Formentera: La Mola, 24.IV.1918, Font Quer (BM).


*Icon.* Fig. nostra no. 8.

Hispid annual or biennial 10-40 cm., with several to many ascending or erect flowering stems. Basal and lower cauline leaves 55-120 x 5-25 mm., spathulate to oblanceolate, long petiolate; cauline leaves obovate or oblong, the uppermost sessile; with sparse to dense, appressed setae and a dense underlayer of fine hairs. Inflorescence scarcely branched. Calyx 6-8 mm. at anthesis, up to 15 mm., with broad segments, 4-5 mm. wide at the base, in fruit. Corolla 10-13 mm., infundibuliform, dark blue, uniformly hairy, with all the stamens included. Nutlets 3-3.5 x 2.5-3 mm., brownish, with anastamosing tubercles.

*Type.* Not traced; see discussion below.

*Distribution.* Mediterranean region. Pathsides, dry slopes.

**Barcelona:** Esparraguera près Montserrat, 6.V.1847, Bourgeau 510 (K); Costas de Garraf, 16.V.1929, Sennen 7044 (MA); Premier Ocata, bords de la mer, 29.III.1932, Sennen 8216 (BM, MA). **Tarragona:** Tarragona, 3.IV.1917, Sennen (MA). **Castellón:** Benicarló et Peñíscola, IV.1909, Sennen (E, MA, MANCH). **Valencia:** Sagunto, 23.IV.1895, Pau (MA); Sagunto, IV.1894, Reverchon (MANCH). **Alicante:** Denia, track leading to Cabo de San Antonio, 17.V.1928, Ellman & Sandwith 1200 (K); Jávea, VI.1898, Pau (MA, MANCH). **Murcia:** Champs à Cartagena, 21.IV.1850, Bourgeau 793 (E, MA); bords des chemins à Cartagena, 6.IV.1851, Bourgeau 1313 (K); Cartagena, Barrio de Perol, IV.1951, Esteve (MA); Cartagena, 19.IV.1901, Jiménez (MA); Elche, IV.1903, Prat & Sylva 19 (BM). **Baleares:** Mallorca: Sóller, 3 km. along footpath from Bin iarai x to L’Ofre, 1.VI.1966, Bowden & Sims 127 (BM); Puig Mayor, Sóller - Pollensa road, 2.VI.1966, Bowden & Sims 284 (BM); Pollensa, 26.III.1931, Edmons (K); Deyá, 29.III.1929, Edmonds 64 (K); Bellver, 25.VI.1943, coll. unknown (GDA); Menorca: Mahón to Ciudadela, 4 km. from Mahón, 4.IV.1967, Bowden & Sims 870 (BM); Mahón, Isla de Rey, 16.IV.1913, Font Quer 888 (MA); Mahón, Villa-
Fig. 8.—Echium parvisflorum Moench. A: corolla; B: dissected corolla; C: stem; D: calyx; E: fruiting calyx (All x 1.4). Murcia: Cartagena, Bourgeau 1628 (E).
Greuter (1967) has maintained that the name *Echium parviflorum* Moench is illegitimate since the original circumscription of the species included the type of *E. lycopsis* L. Thus, according to this reasoning, since in the protologue of *E. parviflorum* Moench included the synonym «*E. italicum* Linn. β», and since this latter and *E. lycopsis* L. can both be interpreted as being based on the *Lycopsis* of C. Bauhin (*Pinax* 255, 1671), then it can be argued that Moench effectively included the type of an earlier name at the same rank; under Art. 63 of the International Code of Botanical Nomenclature this would render *E. parviflorum* illegitimate.

However, although it is certainly possible to argue a case for typifying both *E. lycopsis* L. and *E. italicum* L. β by the *Lycopsis* of C. Bauhin, this is not the only option available. An alternative line of reasoning is as follows: For his *E. italicum* β Linnaeus cited the single synonym *Lycopsis* Bauhin, and since the latter lacks a description, *E. italicum* β must be typified by one of the five elements cited by C. Bauhin under his *Lycopsis*. These were as follows: «*Cynoglossum Matth.* Lac. Lugd.; *Echii altera species* Dod.; *Lycopsis, vel Lycopsis degener Anchusa, Aeginetae, Lob. Ad.; Lycopsis altera Anglica, Lob., Lugd.; Echion, Caes.». As noted in the discussion under *E. plantagineum* L., *Echium lycopsis* L. must be typified via the elements cited by Ray (Syn. Meth. Stirp., ed. 3, 227, 1724) which are: «*Lycopsis* C. B. Pinax 255; Park. 519; *Lyc. Dioscoridis quibusdam* J. B. III 584; *Echii altera species* Dod. p. 680».

Thus it can be seen that the elements cited by Ray for *E. lycopsis* do not include all the elements cited by C. Bauhin under *Lycopsis*. It would be possible, for example, to attempt to typify *E. lycopsis* sensu Ray with J. Bauhin's *Lycopsis Dioscoridis quibusdam*. Dandy (British Museum, Natural History) has clearly expressed the situation (*in litt.*) in the following terms: «A name is either legitimate or illegitimate at the time of its publication: it cannot become illegitimate later because of some decision, say, about typification». Consequently, in the present revision the view has been taken that the name *Echium parviflorum* Moench is not illegitimate under Art. 63 of the Code and that it must be maintained.
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