

RESEARCH ON *DAUCUS* L. (UMBELLIFERAE)

by

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Abstract

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In the present paper, the genus *Daucus* L. (Umbelliferae) is studied on a world scale, by means of morpho-anatomical studies. Five sections and 20 species are recognized. *D. sect. Daucus* L.: *D. carota* L., *D. gracilis* Steinh., *D. guttatus* Sm., *D. involucratus* Sm., *D. jordanicus* Post., *D. sahariensis* Murb., *D. syrticus* Murb., *D. capillifolius* Gilli, *D. crinitus* Desf., *D. tenuisectus* Coss., *D. montevidensis* Link ex Sprengel and *D. pusillus* Michx. Five subspecies of the polymorphic species *D. carota* L. are recognized: subsp. *carota*, *maximus* (Desf.) Ball, *gummifer* Hooker fil., *hispanicus* (Gouan) Thell. and *maritimus* (Lam.) Batt. and a differential key is provided for them. Included in *D. sect. Platyspermum* DC. are *D. muricatus* L., *D. bicolor* Sm. and *D. littoralis* Sm. In *D. sect. Anisactis* DC.: *D. durieua* Lange, *D. glochidiatus* (Labill.) Fischer & al. and *D. montanus* Humb. & Bonpl. ex Schult. In *D. sect. Chrysodaucus* Thell.: *D. aureus* Desf. Finally in *D. sect. Meoides* Lange: *D. setifolius* Desf. Every taxon is described morphologically, with corresponding drawings, and chorological data about them are recorded. Lastly, a key to the species and an index of synonyms are included.

Resumen

SÁENZ LAÍN, C. (1981). Investigaciones en *Daucus* (Umbelliferae). *Actas III Congr. OPTIMA Anales Jard. Bot. Madrid* 37 (2): 481-534 (En inglés).

El presente trabajo recoge los resultados taxonómicos de un estudio morfo-anatómico realizado sobre el género *Daucus* L. (Umbelliferae) a nivel mundial. Se reconocen 20 especies distribuidas en cinco secciones: *D. sect. Daucus* L.: *D. carota* L., *D. gracilis* Steinh., *D. guttatus* Sm., *D. involucratus* Sm., *D. jordanicus* Post., *D. sahariensis* Murb., *D. syrticus* Murb., *D. capillifolius* Gilli, *D. crinitus* Desf., *D. tenuisectus* Coss., *D. montevidensis* Link ex Sprengel y *D. pusillus* Michx. Dentro de la polimorfa especie *D. carota* L. se reconocen las subsp.: *carota*, *maximus* (Desf.) Ball, *gummifer* Hooker fil., *hispanicus* (Gouan) Thell. y *maritimus* (Lam.) Batt., de las que se ha hecho una clave para diferenciarlas. Dentro de *D. sect. Platyspermum* DC. se incluyen: *D. muricatus* L., *D. bicolor* Sm. y *D. littoralis* Sm. En *D. sect. Anisactis* DC. reconocemos: *D. durieua* Lange, *D. glochidiatus* (Labill.) Fischer & al. y *D. montanus* Humb. & Bonpl. ex Schult. *D. sect. Chrysodaucus* Thell. está representada por *D. aureus* Desf. y *D. sect. Meoides* Lange por *D. setifolius* Desf. Cada taxon se describe morfológicamente, incluyendo los correspondientes dibujos, así como los datos corológicos conocidos. Finalmente se provee de una clave de diferenciación de las especies y de un índice de sinonimias.

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INTRODUCTION

The morphological, caryological and palynological study of this genus has been undertaken by a group of researchers, within a multidisciplinary program titled «*Recherches multidisciplinaires sur la systématique des angiospermes: Application aux Ombellifères*», of the Centre National de la Recherche Scientifique (France). Several papers regarding partial aspects of this study have been published by HEYWOOD (1971) CERCEAU-LARRIVAL & ROLAND HEYTACKER (1972), SÁENZ (1973), SÁENZ & HEYWOOD (1974), OWENS (1974), SÁENZ & *al.* (1977), and we now attempt to study the taxonomy of the genus, based on a deep and detailed morphologic and anatomic study.

The main papers dealing with the taxonomy of *Daucus* at a more general level are those of CALESTANI (1905), THELLUNG (1926a and 1926b), ONNO (1936), NEHOU (1961) and HEYWOOD (1968). Nevertheless, a complete study of the genus had not yet been undertaken.

The genus *Daucus* L. appears to have its center of dispersion in the Mediterranean Region, particularly in North Africa, where strong speciation has taken place. Apart from *D. carota* L., the common carrot, which is cultivated throughout the world, there is one Australian species, naturalized also in Europe, possibly by way of the sheep, and three other species in the American continent. The rest, as we said, are Mediterranean.

MATERIAL AND METHODS

For the morphologic study we have consulted the herbaria at BC, BM, E, GE, K, LINN, LISE, LISU, LD, MA, MAF, MP, P, RNG, W, and Idaho (USA) to the Directors of which we wish to extend our warm appreciation, for their help during our visits or the loan of material.

For the detailed work on the morphology and anatomy of the fruits, seed of known origin have been sown at the Reading glasshouse, and herbarium specimens have also been used. Micromorphologic features have been studied by means of the stereoscopic microscope and the Scanning Electron Microscope.

For the anatomic study, the technique of paraffin embedding and safranin-fast green double staining (JOHANSEN, 1940) has been used. The measurements contained in the descriptions are an average of the observations made. Special care has been taken in performing a wide enough sampling that the values might be representative. Care has also been exercised in avoiding mistakes in the results due to the variability of the species, both along its development and within a population.

MORPHOLOGIC FEATURES OF THE PLANT

The morphologic features that have been found useful for the classification of the species within the genus *Daucus* L. are:

Stem

The duration of the stem is generally of one or two years, but some are perennial, such as *D. setifolius*. The habit varies from erect, more or less branching and flexuous, to decumbent (*D. littoralis*, *D. syrticus*). The height is very variable, even within the same species, some being very short, such as *D. syrticus* and *D. durieua*, while others are longer, like *D. setifolius* and *D. carota* subsp. *maximus*. The indumentum evidences certain quantitative variability during the development of the plant, which frequently results in somewhat controversial descriptions. The type of indumentum is scabrid (*D. syrticus*), hispid (*D. muricatus*, *D. tenuisectus*, *D. montevicensis*, *D. guttatus*), or tomentose (*D. setifolius*).

Leaves

The leaves are alternately arranged, except in *D. setifolius* and *D. crinitus*, in which they appear to be pseudoverticillate. Their length varies, the longer ones being those of *D. capillifolius*. They are pinnatifid and glabrous (*D. capillifolius*, *D. gracilis*, *D. carota* subsp. *carota*), scabrid (*D. aureus*, *D. sahariensis*) or hispid (*D. muricatus*, *D. montanus*). The terminal lobe varies from linear (*D. capillifolius*, *D. gracilis*, *D. setifolius*) to lanceolate (*D. aureus*, *D. carota*, *D. sahariensis*, etc.) and ovate (*D. muricatus*, *D. carota* subsp. *gummifer*). The apex is generally acute, mucronate, sometimes obtuse (*D. sahariensis*).

Bracts

In *D. durieua*, *D. glochidiatus*, and *D. montanus* the bracts are leaf like. In the other species they acquire a different shape, varying from simple (*D. capillifolius*, *D. glochidiatus*, *D. littoralis*) to trifid (*D. sahariensis*) or pinnatifid (*D. carota*, *D. aureus*, *D. pusillus*, etc.). Their size varies from those much longer than the umbel, which is best seen at fruiting (*D. involucratus*), to those three times shorter, as *D. littoralis*, *D. setifolius* and *D. crinitus*. Lastly their indumentum reproduces the types described for stems and leaves.

Umbel

Except *D. durieua* and *D. glochidiatus*, in which the umbels are axillary, almost devoid of pedicel, the other species have terminal and axillary umbels with pedicels of variable length according to the size of the plant.

The diameter of the umbel, as well as its degree of contraction at fruiting and its number of rays, are usually rather stable characters for each species. The indumentum of the rays repeats the already described types: glabrous (*D. montanus*, *D. gracilis*), scabrid or muriculate (*D. tenuisectus*, *D. sahariensis*), hispid (*D. bicolor*), tomentose (*D. setifolius*).

Flowers

The maximum size of the outer petal is 4 mm in *D. muricatus*, and most others are about 1 mm, or frequently inconspicuous. The length of the styles protruding from the stylopodium varies from 3 mm in *D. crini-*

tus, *D. gracilis* and *D. jordanicus*, to 1 mm in the other species. The pedicels are glabrous, scabrid (including muriculate) in most species, hispid (*D. montevidensis*) and tomentose (*D. setifolius*).

MORPHOLOGIC AND ANATOMIC FEATURES OF THE FRUIT

General appearance

The size of the fruit is reflected by two measurements corresponding to the longitudinal and trasverse median axis of a mericarp, exclusive of the spines. The largest fruits are those of *D. muricatus* (6-7 × 3-4 mm) and the smallest, those of *D. carota* subsp. *maximus* (2-3 × 1,5-2 mm). Within the genus the variability of shape of the fruits may be reduced to two extremes with their intermediate forms: oblong and ovate. The latter is described by THELLUNG (1926) as «attenuated at the neck».

A generic character of *Daucus* is the dorsal compression of its mericarps, which varies only in its degree. Phylogenetically it appears that in *Umbelliferae* a strong compression represents a more advanced character (CERCEAU-LARRIVAL, 1962). We must nevertheless remark that along the same mericarp the compression varies from the apex to the center, the maximum being precisely on the latter. It also varies according to the ripeness of the fruit.

The stylopodium from which the longer of shorter styles emerge varies in size, being thickest in *D. aureus*. The surface of the fruit varies from smooth to papilose, except *D. setifolius*, in which it is densely tomentose.

Primary ridges

The primary ridges are inconspicuous in *D. aureus* and strongly prominent in *D. muricatus*, with several intermediate forms between them. The commissural ridges are usually at each vertex of the irregular polygon formed by the endosperm. The distance between them varies from *D. carota*, for example, to *D. muricatus*, in which it is very short.

The primary ridges have two (*D. carota*, *D. capillifolius*) or several (*D. durieua*, *D. sahariensis*) rows of hairs. The exception is *D. setifolius* which is tomentose. These hairs are usually simple and of equal size, except in some cases in which they are star-shaped (*D. sahariensis*) or of very unequal sizes, as in *D. tenuisectus*.

Vallecular spines

The secondary or vallecular ridges bear a row of simple spines, a generic character, with the exception of *D. setifolius* which has branched spines. The base of the spines is more or less dilated, from *D. crinitus* and *D. capillifolius*, in which they are almost filiform, to *D. muricatus*, in which they are strongly confluent at the base forming a crest. The latter may be regarded as more advanced phylogenetically. The surface of the

spines varies from smooth to scabrid or papillose, and in the case of *D. setifolius*, tomentose. The spines are glochidiate in all species except *D. crinitus* and *D. setifolius*, in which they are uncinulate.

The ratio of spine length to width of the mericarp is much used in the taxonomy of the genus, varying from *D. capillifolius* in which it is more than two, to *D. carota* and *D. pusillus* in which it is less than one.

Anatomic characters

The anatomic characters used are those observed on the median transverse section of a ripe mericarp.

All fruits of *Caucalideae* have secretory vesicles of essential oils or vittae, the shape of which varies in the median transverse section from ovate-circular (*D. durieua*) to triangular (*D. sahariensis*, *D. carota*). This character is fairly constant for each species, and discriminatory for the establishment of sections within the genus. The exception is *D. aureus*, in which the vittae are obliterated.

The shape of the commissural side of the mericarp may be flat or more or less convex. Each primary ridge has a vascular bundle, the cross-section of which varies from kidney-shaped to circular, but after considerable sampling, we have decided that this variation is due to the degree of destruction (caused by the laboratory techniques) of the phloematic portion of the bundle. We therefore record only its diameter by measuring its longest axis. The thickest (70 μm) are those of *D. muricatus* and *D. bicolor*; medium (40 μm) are those of *D. tenuisectus* for example, and thin (less than 40 μm), those of *D. aureus*. Phylogenetically, large vascular bundles are regarded as more advanced (SÁENZ & *al.*, 1977).

Apart from the vittae, the fruit of *Daucus* usually has a secretory vessel associated to the vascular bundle of the primary ridges. These oil vessels are morphologically identical to the ones present in the stem and branches of the plant. In regard to this we have met the problem that, apart from exceptions like *D. setifolius* and *D. carota* subsp. *maximus*, in which the vessels are conspicuous and their occurrence constant, in many species they appear or disappear depending on the ripeness of the fruit and the location of the sections, the latter due to the short and irregular shape of the vessels, and we therefore attribute little differential value to them.

SISTEMATICS

List of the classification of the genus *Daucus* proposed in this paper.

Daucus L.

D. sect. *Daucus*

D. carota L.

- subsp. *maximus* (Desf.) Ball
- subsp. *gummifer* Hooker fil.
- subsp. *hispanicus* (Gouan) Thell.
- subsp. *maritimus* (Lam.) Batt.

- D. gracilis* Steinh.
- D. guttatus* Sm.
- D. involucratus* Sm.
- D. jordanicus* Post
- D. sahariensis* Murb.
- D. syrticus* Murb.
- D. capillifolius* Gilli
- D. crinitus* Desf.
- D. tenuisectus* Coss.
- D. montevidensis* Link ex Sprengel
- D. pusillus* Michx.
- D. sect. Platyspermum* DC.
 - D. muricatus* L.
 - D. bicolor* Sm.
 - D. littoralis* Sm.
- D. sect. Anisactis* DC.
 - D. durieua* Lange
 - D. glochidiatus* (Labill.) Fischer & al.
 - D. montanus* Humb. & Bonpl. ex Schult.
- D. sect. Chrysodaucus* Thell.
 - D. aureus* Desf.
- D. sect. Meoides* Lange
 - D. setifolius* Desf.

DAUCUS L., Sp. Pl. 1:242 (1753).

Daucus sect. **Daucus** (Incl. sect. *Leptodaucus* Thell. Feddes Reprint: 23:147 (1926). *Typus*: *Daucus carota* L., Sp. Pl. 1:242 (1753).

Fruit quite dorsally compressed, the primary ridges inconspicuous, the commissural ones widely spaced, endosperm rather flat on the commissural face, vittae triangular in section, larger than the vascular bundles, mesocarp only parenchymatic.

1. **Daucus carota** L., Sp. Pl. 1:242 (1753) *sensu amplo*.

Annual or biennial, highly polymorphic; stems 10-150 cm, glabrous to hispid. Leaves 2-to 3-pinnate, the segments linear to lanceolate, glabrous or pubescent; upper leaves often bract-like. Umbels variable. Bracts pinnatisect, of variable length. Petals white to purplish, often with those of the central flower of the umbel dark red; styles very short. (Pls. 1, 2, 3, 4, 5).

Fruit *c.* 3 × 2 mm; primary ridges not prominent, with two rows of simple, straight and scattered hairs, the commissural ridges widely spaced; secondary ridges with a row of 12-20 spines not longer than the width of the fruit, somewhat widened at the base, slightly confluent; vascular bundles small; vittae triangular in section (Pl 25:2; 29:1).

Distribution: Throughout most of Europe and the Mediterranean region.

This species is extremely polymorphic, and within it a number of

taxa have been recognized. The main problem when attempting their delimitation is the high variability of the morphologic characters used (leaves, size of the umbels, colour of the flowers, etc.) and also the close similarity of the fruits, except in the case of *D. carota* subsp. *maximus*, in which their tiny size is usually constant.

THELLUNG (1926a) in his study of *Daucus* based on herbarium material recognizes: 1) *D. carota* L. subsp. *maximus* (Desf.) Thell. $\equiv$ *D. maximus* Desf., which had already been described as *D. mauritanicus* L., but the latter name has been used mistakenly in literature («*nomen confusum*») due to the existence of two original specimens, 2) *D. carota* L. subsp. *bocconei* (Guss.) Bonnier $\equiv$ *D. bocconei* Guss. = *D. polygamus* Gouan = *D. hispidus* Miller = *D. siculus* Ten., 3) *D. carota* L. subsp. *commutatus* (Paoletti) Thell., to which the other syntype specimens of the name *D. mauritanicus* L. belongs («*Pastinaca tenuifolia Sicula hirsuta crispa Boccone*»), 4) *D. carota* subsp. *hispanicus* (Gouan) Thell. $\equiv$ *D. hispanicus* Gouan, 5) *D. carota* L. subsp. *fontanesii* Thell. = *D. hispidus* Desf. 6) *D. lucidus* L. fil. intermediate form between *D. gummifer* Lam. and *D. hispanicus* Gouan, 7) *D. carota* L. subsp. *gummifer* (Lam.) Thell. $\equiv$ *D. gummifer* Lam. = *D. halophilus* Brot. 8) *D. carota* L. subsp. *maritimus* (Spreng. ap. Roem. et Schult.) Thell.

HEYWOOD (1968) recognizes within *D. carota* L. the following subspecies: 1) subsp. *carota*, 2) subsp. *maritimus* (Lam.) Batt., 3) subsp. *major* (Vis.) Arcangeli, 4) subsp. *maximus* (Desf.) Ball, 5) subsp. *sativus* (Hoffm.) Arcangeli, 6) subsp. *gummifer* Hooker fil., 7) subsp. *commutatus* (Paol.) Thell., 8) subsp. *hispanicus* (Gouan) Thell., 9) subsp. *hispidus* (Arcangeli) Heywood, 10) subsp. *gadecaei* (Rouy & Camus) Heywood, 11) subsp. *drepanensis* (Arcangeli) Heywood, 12) subsp. *rupestris* (Guss.) Heywood.

We have examined much dry and live material, as well as all the original publications, and we have concluded that the only way of clarifying this complex situation, in view of the wide variability within each taxon, as well as the numerous intermediate forms, is to accept only as subspecies those that are morphologically well recognizable, even within the said range of variability, and that have their own ecological niche.

— ***D. carota*** L. subsp. ***carota*** = *D. polygamus* Gouan, Obs. Bot.: 9 (1773) = *D. siculus* Tineo, Pl. Rar. Sic. Pug. 1: 6 (1817) = *D. bocconei* Guss., Fl. Sic. Prod. 1: 322 (1827) = *D. gaditanus* Boiss. & Reuter in Boiss. Diagn. Pl. Or. Nov. 2: 96 (1853) = *D. blanchei* Reuter in Boiss. Fl. Or. 2: 1077 (1872) = *D. drepanensis* Tod. ex Lojacono, Fl. Sicula 2: 298 (1891) = *D. carota* L. subsp. *commutatus* (Paol.) Thell., Feddes Rept. 22: 312 (1926).

Typus: LINN 340/1 (photo!).

Stems rough; leaves much divided, the segments elongated, slender, lanceolate, acute; bracts 3-fid or pinnatisect, the segments linear, much

shorter than the umbel; bracteoles with linear segments, longer than the umbellule (Pl. 1).

Distribution: Cultivated fields, spontaneous over most of Europe.

- ***D. carota*** L. subsp. ***maximus*** (Desf.) Ball, J. Linn. Soc. London (Bot.) 16: 476 (1878) $\equiv$ *D. maximus* Desf., Fl. Atl. 1: 241 (1798) = *D. mauritanicus* L., Sp. Pl. ed. 2, 1: 348 (1762).

Typus: Algeria, ad limites agrorum, Desfontaines (P).

Stems up to 1 m; lower leaves widely ovate; bracts pinnatisect, the segments linear-lanceolate; umbels large, with numerous rays; petals larger than those of subsp. *carota*; fruit small (less than 2 mm), spines lax, not confluent, slightly longer than the width of the mericarp (Pl. 2).

Distribution: Spain, Algeria, Cyprus, Aegean Island, Lebanon, Syria, Turkey, Israel.

- ***D. carota*** L. subsp. ***hispanicus*** (Gouan) Thell., Feddes Repert. 22: 312 (1926) $\equiv$ *D. hispanicus* Gouan, Obs. Bot.: 9 (1773).

Stout, suffruticose plant; stems grooved, rough, but not hairy; leaf segments triangular, very mucronate, glabrous, leathery; bracts 3-fid or pinnatisect, as long as or shorter than the umbel; umbels long-pedunculate, large rays c. 60, subequal, not contracted (Pl. 5).

Distribution: Mediterranean shores, France (Colliure), Spain (Mallorca, Cabrera, Cataluña, Gibraltar), Algeria (Orán).

- ***D. carota*** L. subsp. ***gummifer*** Hooker fil., Stud. Fl. Brit. Is. ed. 3, 185 (1884) $\equiv$ *D. gummifer* Lam. non All. Encycl. Méth. Bot. 1: 634 (1785) = *D. gingidium* L., Sp. Pl. 1: 242 (1753) = *D. hispidus* Desf., Fl. Atl. 1: 243 (1798) = *D. halophilus* Brot., Phyt. Lusit. ed. 3, 2: 198 (1827) = *D. carota* L. subsp. *fontanestii* Thell., Feddes Repert. 22: 315 (1926).

Stems hispid; leaves membranous, the segments ovate; bracts lanceolate, 3-fid, shorter than the umbel, sometimes with hyaline lateral winglets; umbels much contracted at fruiting, the rays subequal (Pl. 3).

Distribution: Atlantic coasts, bathed by the sea breeze. Britain, France, NW of Spain, Portugal.

- ***D. carota*** L. subsp. ***maritimus*** (Lam.) Batt. in Batt. & Trabut, Fl. Alger (Dicot.) 382 (1889) $\equiv$ *D. maritimus* Lam., Encycl. Méth. Bot. 1: 634 (1785).

Typus: In ora maritima Montpellensis, Lammarck (P).

Stems long, very slender; leaf segments linear, long; bracts linear-acuminate; umbels with long and slender penduncles, small, c. 3 cm across, the rays unequal, delicate (Pl. 4).

Distribution: Mediterranean coasts. Spain (Cataluña, Baleares). Turkey?

Key to the subspecies of *D. carota*:

1. Fruit 3-4 mm, the vallecular spines somewhat confluent at base; stems 30-100 cm..... 2
1. Fruit 2 mm, the spines not confluent at base; stems 100 cm.....
 - subsp. **maximus**
 2. Stems slender; leaf segments linear, long, umbels less than 3 cm across
 - subsp. **maritimus**
 2. Stems more or less stout; leaf segments ovate or ovate-lanceolate; umbels 3-6 cm across..... 3
 3. Stems hispid; leaves membranous, the segments ovate, wide; vallecular spines usually incurvate..... subsp. **gummifer**
 3. Stems glabrescent; leaves much divided, the segments ovate-lanceolate; vallecular spines straight..... 4
 4. Umbels contracted at fruiting, with 20-30 rays; stems erect..... subsp. **carota**
 4. Umbels not contracted at fruiting, up to 60 rays; plant somewhat suffrutescent..... subsp. **hispanicus**

Selected specimens: Bulgaria (RNG). Czechoslovakia: Prague, *Nitka* 5, 1958 (K). Denmark: Moesgaard, *Larsen* 80, 1964 (K). France: Montpellier, *Gz. Albo* 2, 1932 (MA 89180). France: Garonne, *Schultz* 265 (P). France: Savoie (RNG). France: La Manche, *Onno* 1977 (P). France: Colliure, *H. van Meurek* 1830 (P). France: Antibes, *Theret* 1869 (P). France: Plorano (RNG). France: Finistère (RNG). France: *Sanberg* 1939 (K). Great Britain: Pembrokeshire, *Blewett* 204, 1958 (K). Great Britain: Wight, *Lacaita* 380, 1921 (K). Great Britain: Cornwall, *White* 1912 (K). Great Britain: Glasgow (RNG). Great Britain: Caddington (RNG). Ireland: Framore, *Ferguson* 1057, 1964 (K). Israel: Jerusalem, *Dinsmore* 8065, 1911 (RNG). Italy: Naples, *Fellandia* 1912 (P). Italy: Corsica, *Onno* 1937 (P). Morocco: El Araix, *Font Quer* 493 (MA 89121). Portugal: *Lisboa* (RNG 2803). Roumania: Bucarest (RNG). Spain: Galicia, *Merino* (MA 89176). Spain: Logroño, *Zubia* (MA 89203). Spain: Madrid, *Vicioso* 1912 (MA 89197). Spain: Mallorca, *Palau Ferrer* 620 (1954). Spain: Valencia, *Vicioso* 1914 (MA 89177). Spain: Cáceres, *Ladero*, 1976 (MA 208258). Spain: Barcelona, *Sennen* 1925 (MA 89227). Spain: Barcelona, *Sennen* 3944, 1920 (BC). Spain: Castellón, *Pau* 1879 (BC). Spain: Isla Cabrera, *Palau* 1948 (MA 89108). Spain: Gerona, *Sennen* 5958 (MA 89116). Jaén, *Cuatrecasas* 1925 (MA 89136).

2. *Daucus gracilis* Steinh., Ann. Sci. Nat. Bot. Sér. 2, 9:203 (1838).

Typus: Algeria, *Gay* 80145, 1838 (K).

Annual, stems up to 40 cm, erect, little branched, glabrous. Leaves, alternate, glabrous, 2-to 3-pinnate, the segments linear, acute. Umbels long-pedunculate, contracted at fruiting, small; rays few, unequal, glabrous. Bracts pinnatisect, linear, shorter than the umbel, glabrous. Petals yellowish or rosy-white, unequal; styles long; pedicels glabrous. (Pl 6).

Fruit yellowish, 3.5 × 2 mm, markedly compressed dorsally; primary ridges inconspicuous, with two rows of short simple and stellate hairs,

the commissural ones widely spaced; secondary ridges with a row of spines, 1.5-2 times as long as the width of the fruit, slightly widened at the base but not confluent, vascular bundles very small; vittae large, triangular in section. (Pls. 27:2; 29:9).

Distribution: Algeria.

Selected specimens: Algeria: Philippeville, *Munby* 51, 1855 (K). Algeria: Bône, *Romieux* 684, 1906 (MA 89242).

3. ***Daucus guttatus*** Sm., Fl. Graec. Prodr. 1:184 (1806) = *D. setulosus* Guss. ex DC., Prodr. 4:211 (1830) = *D. microsciadius* Boiss., Diagn. Pl. Or. Nov. 10:47 (1849) = *D. speciosus* Cesati, Linnaea, 9:322 (1837) = *D. arenicola* Pančić ex Boiss., Fl. Or. 2:1075 (1872).

Typus: Greek Islands and Asia Minor, Sibthorp (OXF, n.v.).

Annual; stems up to 30 cm, erect, branched, hispid to glabrous. Leaves 2-to 3- pinnatisect, the segments much divided, linear, slightly hispid. Umbels pedunculate, very small, with up to 7 rays. Bracts divided, linear, longer than the umbel. Petals yellowish-white, very small; styles very short (Pl. 7).

Fruit oblong, 2-3 × 1-2 mm; primary ridges with numerous multisebate hairs, the commissural ridges widely spaced; secondary ridges with a row of white spines, longer than 1-1.5 times the width of the fruit, fine, stiff, slightly confluent at the base, scabrid or smooth, glochidiate; vascular bundles small; vittae large, triangular in section (Pls. 26:5, 29:7).

Distribution: Italy, Greece, Romania, Bulgaria, Yugoslavia, Aegean Islands, Lebanon, Syria, Turkey, Palestine, Egypt, Abyssinia.

Selected specimens: Cyprus: Larnaca, *Lindberg* 1939 (K.) Macedonia: *Adamovic* 1906 (K).

4. ***Daucus involucratus*** Sm., Fl. Graec. Prodr. 1:184 (1806) = *Durieu graeca* Boiss. in Ann. Sc. Nat. Bot. Sér. 3,2:51 (1844).

Typus: Kythraea, in montibus Ciria (Cyprus), majus 1880, Sibthorp (OXF, n.v.).

Annual; stems up to 20 cm, erect, glabrous or scabrid. Leaves alternate, 2-to 3- pinnate, the segments lanceolate, acute, scabrid or slightly hispid. Umbels pedunculate, small, with 4-6 glabrous rays. Bracts not deflexed, pinnatisect, scabrid, with linear segments much longer than the umbel. Petals purplish-white, up to 1 mm; styles short; pedicels scabrid. (Pl. 8).

Fruit 3.5 × 2 mm; primary ridges inconspicuous, with two rows of scattered hairs, the commissural ones widely spaced; secondary ridges with a row of somewhat reddish spines, 1.5-2 times as long as the width of the fruit, slightly dilated at the base, but not confluent, glochidiate, scabrid or glabrous; vascular bundles oval; vittae triangular in section. (Pls. 26:4; 29:5).

Distribution: Greece, Cyprus, Aegean Islands, Turkey.

Selected specimens: Cyprus: Kythraea, 1880 (K). Syriae: in collibus acidis 1842, type of *Duriaea graeca* (G). Cyprus: Akhna, *Meston* 820, 1952 (K). Greece: Hymetto, *Heldreich* 123, 1896 (MA 89146).

5. ***Daucus jordanicus*** Post, J. Linn. Soc. Bot. 24:431 (1888).

Typus: Beirut (n.v.).

Annual; stems up to 50 cm, erect, branched, glabrescent. Leaves alternate, 2- to 3- pinnate, the segments linear-oblong, acute. Umbels terminal, pedunculate, contracted at fruiting; rays about 8-12, subequal, scabrid. Bracts simple, linear-subulate, very short. Petals white, very small; styles long, about 2 mm, divergent. (Pl. 9).

Fruit 4.5×2 mm; primary ridges not prominent, with two rows of numerous hairs, the commissural ridges widely spaced; secondary ridges with a row of about 12 spines, twice as long as the width of the fruit, not dilated at the base, lax; vascular bundles small, vittae triangular. (Pls. 27:1; 29:3).

Distribution: Palestine.

Selected specimens: Transjordan (RNG).

6. ***Daucus sahariensis*** Murb., Contrib. Connaiss. Fl. Nord-Ouest Afrique, 1:88 (1897).

Typus: Balansa Pl. d'Alger 986, Biskra, 10 mai 1853 (K).

Biennial; stems up to 30 cm, somewhat decumbent, branched, flexuous, hispid. Leaves alternate, very scabrid, sometimes hispid, 2- to 3- pinnate, the segments lanceolate, with the obtuse apex. Umbels terminal, small, somewhat contracted at fruiting, pedunculate; rays 10-14, subequal, scabrid, slightly hispid. Bracts 3-fid, much shorter than the umbel, very scabrid. Petals white, very small; styles long; pedicels scabrid. (Pl. 10).

Fruit $3-4 \times 2$ mm; primary ridges not prominent, with abundant multiseriate hairs, the commissural ridges widely spaced; secondary ridges with a row of about 10 stiff, light yellow spines, 1-1.5 times as long as the width of the fruit, not confluent at the base; vascular bundles small; vittae triangular in section (Pls. 27:6; 29:8).

Distribution: Algeria, Egypt, Tunisia, Morocco.

Selected specimens: Morocco: Melias, *Pittard* 3374, 1913 (P.) Algeria: Biskra, *Chavalier* 1902 (P.) Algeria: El Golea, *Chevalier* 1902 (P.) Morocco: Aine Yolou, *Pittard* 3373, 1913 (P.) Algeria: Biskra, *Murbeck* 1903 (P.) Algeria: Djebel Gronz, *Pittard* 3372, 1913 (P.) Algeria: Djebel Antar, *Humbert* 1925 (P).

7. ***Daucus syrticus***. Murb., Contrib. Connaiss. Fl. Nord-Ouest Afrique, 1:87 (1897).

Typus: Kralik Pl. Tunetanae 237, avril 1854 (K).

Annual; stems up to 20 cm, decumbent, slightly scabrid. Leaves alternate, 2- to 3- pinnate, the segments lanceolate, acute, scabrid. Umbels

terminal, pedunculate; rays few, subequal, scabrid, contracted at fruiting. Bracts pinnatisect, as long as or longer than the umbel, the segments linear, slightly scabrid. Petals very small, rosy-white; styles short; pedicels glabrous. (Pl. 11).

Fruit yellow, 2×1.5 mm; primary ridges not prominent, with irregular multiseriate hairs, the commissural ridges widely spaced; secondary ridges with a row of 6 yellow spines, 1-1.5 times as long as the width of the fruit, not confluent at the base, scabrid; vascular bundles small; vittae triangular in section. (Pls. 26;6; 29:4).

Distribution: Egypt, Tripolitania, Tunisia.

Selected specimens: Libya: *Davies* 19860 (RNG). Tripolitania, Ain Jana, *Bornmüller* 1933 (P). Libya: Souk el Djenaa, *Maire & Weiller* 1938 (P.) Egypt: Mersa Matruh, 1945 (MA 169473). Tunisia: Gabes, *Pittard* 1909 (MA 89239).

8. ***Daucus capillifolius*** Gilli, *Osterr. Bot. Z.* 104: 574 (1958).

Typus: Tripolitania, 24. VII. 1956, Elfrid Gerhart (W).

Biennial; stems c. 50 cm, erect, glabrous. Leaves alternate, 3-pinnate, glabrous, very long, the segments linear. Umbels 8-10 cm across; rays 10-20, slightly unequal, glabrous. Bracts simple, linear, deflexed, shorter than the umbel. Petals yellowish, the outer up to 1 mm; styles short, protruding slightly from the stylopodium; pedicels glabrous. (Pl. 12).

Fruit cylindrical, 5×1.5 mm; primary ridges not prominent, with two rows of scattered hairs, the commissural ridges widely spaced; vallicular spines 4 times as long as the width of the fruit, very fine, not dilated at base; mericarps with flat commissural face, vascular bundles small; vittae large and triangular in section. (Pls. 26:2; 29:2).

Distribution: Morocco, Libya.

Selected specimens: Mc Collum 1976, cultivated material from Libya (Idaho Agricultural Experimental Station, USA).

9. ***Daucus crinitus*** Desf., *Fl. Atl.* 1:242 (1798) = *Daucus meifolius* Brot., *Phyt. Lusit.* i. 82.t. 36 (1804).

Typus: In collibus incultis prope Mascar et Tlemsen, (P).

Perennial; stems erect, more than 50 cm, glabrous. Leaves 10-20 cm, apparently pseudoverticillate, the segments linear-lanceolate, scabrid. Umbels long-pedunculate; rays about 30, unequal, scabrid. Bracts 3-fid, subulate, deflexed, much shorter than the umbel, glabrous. Petals small, yellowish; styles long, divergent; pedicels scabrid. (Pl. 13).

Fruit linear-ovoid, 5×1.5 mm, primary ridges with two rows of short and scattered hairs; secondary ridges with a row of lax spines, often purple-violet, longer than the width of the mericarp, fine and not confluent at the base, uncinulate, commissural ridges widely spaced; mericarps markedly compressed dorsally, the commissural face flat, vascular bundles not as big as the vittae, large, triangular in section. (Pls. 25:5; 29:6).

Distribution: Morocco, Algeria, Spain, Portugal.

Selected specimens: Portugal: Hort. Coimbra (RNG). Spain: Córdoba, *Sandwith*, 1963 (K). Spain: Córdoba, *Borja* 1964 (MA 186173). Spain: Salamanca, *Rivas* 1959 (MA 200794). Spain: Sevilla, *Silvestre* 1967 (MA 198326). Spain: Jaén, *Galiano* 1963 (MA 195975). Spain: Cáceres, *Ladero* 1966 (MAF 80386).

10. ***Daucus tenuisectus*** Coss. ex Battand., Contrib. Fl. Atlant. 40 (1919).

Typus: Herb. Cosson, Djebel Afongueur au Sud-Ouest de la ville de Maroc, Ibrahim, 8 juin 1875 (P).

Biennial; stems up to 50 cm, erect, little branched, glabrescent or slightly hispid. Leaves alternate, glabrous, 2- to 3- pinnate, the segments linear-acute. Umbels terminal and axilar, pedunculate, contracted at fruiting; rays 10-20, subequal, glabrescent. Bracts pinnatisect, glabrous, about as long as the umbel. Petals yellowish, radial; styles short; pedicels glabrous. (Pl. 14).

Fruit 3-4 × 2 mm; primary ridges not prominent, with irregular multiseriate, stellate hairs, the commissural ridges widely spaced; secondary ridges with a row of about 6 light yellow, stiff spines, as long as the width of the fruit, strongly dilated at the base forming a crest; vascular bundles small; vittae triangular in section. (Pls. 27:4; 29:10).

Distribution: Morocco.

Selected specimens: Morocco: Asni Le Chokak, Balls 1936 (K).

11. ***Daucus montevidensis*** Link ex Sprengel, Syst. Veg.: 119 (1827) = *Daucus hispidifolius* Clos in C. Gay, Fl. Chil. 3:135 (1847).

Typus: Montevideo (Argentina), Sprengel 1826.

Biennial; stems up to 60 cm, erect, not branched, hispid. Leaves alternate, hispid, 2- to 3- pinnate, the segments linear-lanceolate, acute. Umbels terminal, small; peduncles up to 20 cm; rays up to 20, hispid. Bracts 3-fid, linear-lanceolate, hispid, shorter than the umbel. Petals yellowish, very small; styles short; pedicels slightly hispid. (P. 15).

Fruit ovoid, 3-4 × 2 mm; primary ridges not prominent, with two or several rows of abundant hairs, the commissural ridges widely spaced; secondary ridges with a row of about 12 spines, slightly shorter than the width of the fruit, dilated at the base, slightly confluent into a crest; vascular bundles small; vittae triangular, large. (Pls. 25:1; 30:2).

Distribution: Uruguay, Chile, Argentina.

Selected specimens: Chile austral, *Gay* 126 (P, type of *D. hispidifolius*). Chile: La Serena, *Worth & Morrión* 1938 (K). Argentina: Buenos Aires, *Eyerdam* 1938 (K). Argentina: Buenos Aires, *Huydobro* 1436 (W). Argentina: Candelaria, *Montes* 1230 (W). Uruguay: Concepción, *Lorentz* 919, 1876 (W). Argentina: Isla Martín García, *Palacios* 4 (W). Argentina: Córdoba, *Balegne* 924 (W). Uruguay: *Saint-Hilaire* 2276 (P). Chile: *Gay* 125 (P). Uruguay: Sta. Lucía, *Alvarez* 1882 (P).

12. **Daucus pusillus** Michx., Fl. Bor. Amer. 1:164 (1803) = *Daucus brevifolius* Rafin., New Fl. Am. 4:26 (1836).

Tipus: In campestribus Carolinae, Michaux (P).

Annual; stems 3-9 cm, erect, little-branched, hispid or scabrid. Leaves alternate, 2- to 3- pinnatisect, the segments linear, acute somewhat hispid. Umbels less than 4 cm across, the rays subequal, slightly scabrid, contracted at fruiting. Bracts pinnatifid, linear, as long as the umbel, slightly hispid. Petals white, very small; styles very small. (Pl. 16).

Fruit ovoid, 2-3 × 2 mm; primary ridges not prominent, with two rows of hairs, the commissural ridges widely spaced; secondary ridges with a row of about 8 spines, shorter than the width of the fruit, stiff, dilated and slightly confluent at the base, glochidiate; vascular bundles slightly smaller than the vittae; vittae triangular in section, large. (Pls. 28:2; 30:1).

Distribution: U. S. A., Mexico, Chile.

Selected specimens: U. S. A.: Texas, *Heller* 1438, 1894 (K). U. S. A.: Arizona, *Crosswhite* 822 (K). U. S. A.: M. Co. Cale Utte, *Abbott* 1889 (P). U. S. A.: Yolo Country, California, *Jack Maze* 16, 1963 (MA 179153).

Daucus sect. **Platyspermum** DC. Prodr. 4:210 (1830) (incl. sect. *Pseudoplatyspermum* Thell., Feddes Repert. 123:147 (1926).

Styles short, fruit large compressed dorsally, primary ridges larger than the secondary ones, vallecular spines dilated at base forming a crest, vittae oval, small, vascular bundles large.

13. **Daucus muricatus** (L.) L., Sp. Pl. ed. 2: 349 (1762) ≡ *Artemisia muricata* L., Sp. Pl. 242 (1753) ≡ *Caucalis muricata* (L.) Crantz (nec Bischoff), Cl. Umb. Emend. 114 ≡ *Platyspermum muricatum* Hoffm., Gen. Umbell. 64 — *Daucus muricatus* var. *genuinus* Burnat, Fl. Alpes Marit. 4:243 (1906), nom. inval.

Typus: LINN 340/10 (photo!).

Biennial, stems up to 50 cm, erect, branched, hispid; leaves alternate, 2- to 3- pinnate, hispid, the segments ovate, acute. Umbels 6-8 cm across, contracted at fruiting, pedunculate; rays 10-15, unequal, glabrous. Bracts pinnatisect, linear, glabrous, much shorter than the umbel, numerous and deflexed. Petals yellowish, large, the outer one up to 4 mm; styles short, pedicels glabrous. (Pl. 17).

Fruit about 7 × 3 mm; primary ridges thick, with two rows of hairs, the commissural ridges close together; secondary ridges with a row of about 5 silvery spines longer than the width of the fruit, strongly widened at the base, confluent into a crest; vascular bundles thick, rounded; vittae ovate, very small. (Pls. 28:3; 30:3).

Distribution: Spain, Portugal, Corsica, Sardinia, Sicily, Italy, Algeria, Aegean Islands, Turkey.

Selected specimens: Spain: Jerez de la Frontera, *Borja* 1961 (MAF

72147). Spain: Jaén, *Borja* 1963 (MA 179152). Spain: Málaga, *Font Quer* 1919 (MA 89074). Spain: Huelva, *Gros*, 1931 (MA 89076).

14. ***Daucus bicolor*** Sm., Fl. Graec. Prodr. 1:184 (1806) = *Daucus broteri* Ten., Fl. Nap. 4, Syll. App. 3:4 (1830) = *Daucus michelli* Caruel, Prod. Fl. Tosc.: 292 (1860).

Typus: Greece, Sibthorp, (OXF).

Annual; stems up to 40 cm, erect, branched, hispid or glabrescent. Leaves alternate, 2- to 3- pinnatisect, the segments linear-oblong, acute, sometimes hispid. Umbels terminal, pedunculate, c. 3 cm across, with 10-20 rays. Bracts sometimes longer than umbels, trifid, linear, hispidule. Flowers yellowish-white, minute; styles short; pedicels glabrous. (Pl. 18).

Fruit 3-4 × 2-3 mm; primary ridges thick, prominent, with multiseriate hairs, the commissural ridges widely spaced; secondary ridges with a row of yellowish spines, as long as the width of the fruit, straight, hard, with the base widened and confluent into a crest, the surface smooth or scabrid; vascular bundles big; vittae small, ovate in section. (Pls. 27:5; 30:4).

Distribution: Italy, Kriti, Aegean Islands, Egypt, Tripoli, Lebanon, Syria, Turkey, Palestine.

Selected specimens: Cilicia: Mersina, *Balansa* 565, 1885 (K). Balkans, 1971, (BM). Cyprus: Famagusta, *Lindberg* (K). Lebanon: Brummana, *Bornmüller* 1897 (P). Syria: Smirna, *Balansa*, 1854 (P). Greece: Rodas, *Bourgeau*, 1870 (P). Cilicia: Anamour, *Jeromin*, 1872 (P). Syria: *Gaillardoti* 2762 (P). Tripoli: 1865 (P). Greece: Phrygia, Ouchak, *Balansa* 1857 (P). Syria: Amano prope Beilan, *Kotschy* 1862, (P). Cilicia: Boulouki, *Balansa*, 1855 (P).

15. ***Daucus littoralis*** Sm., Fl. Graec. Prodr. 1:185 (1806) = *Daucus pubescens* Koch, Pl. Umbell. 12:77 (1824) = *Caucalis glabra* Forssk., Fl. Aeg. Arab.: 206 (1775) = *Orlaya anisopoda* Boiss., Diagn. Pl. Or. Nov. 10:46 = *Daucus gaillardoti* Boiss., Fl. Or. 2:1074 (1872).

Typus: Cyprus, Sibthorp (OXF, n.v.).

Annual or biennial; stems up to 20 cm, procumbent, branched, hispid, sometimes glabrous. Leaves alternate, 2- to 3- pinnate, the segments lanceolate, acute, scabrid. Umbels terminal and axilar, pedunculate, contracted at fruiting; rays 6-10, markedly unequal, scabrid. Bracts simple, scabrid, 3 times shorter than the umbel. Petals yellowish-white; styles short; pedicels glabrous. (Pl. 19).

Fruit 5-6 × 3 mm; primary ridges prominent, with several rows of numerous hairs, the commissural ridges somewhat close together, secondary ridges with a row of 7-8 yellowish spines, not longer than the width of the fruit, dilated at the base, confluent into a crest; vascular bundles large; vittae oval. (Pls. 27:3; 30:5).

Distribution: Cyprus, Syria, Lebanon, Palestine, Iran, Iraq, Egypt, Turkey, Aegean Islands.

Selected specimens: Israel: Hadeira (RNG), Syria: Saida, *Cosson* 18, 1857 (P). Israel: Tel-Aviv, *Eig & Grizzi*, 1935 (P). Palestine: Haifa, *Bornmüller*, 1897 (P).

Daucus sect. **Anisactis** DC. Prodr. 4:214 (1830).

Bracts leaf-like, umbels generally axillar, petals inconspicuous, styles very short, fruit rather compressed dorsally, with the endosperm sulcate, vittae oval, vascular bundles as big as or smaller than the vittae, mesocarp only parenchymatic.

16. **Daucus durieua** Lange in Willk. & Lange, Prodr. Fl. Hisp. 3:23 (1874). $\equiv$ *Caucalis hispanica* Lam., Enc. I. 658 (1783) = *Durieua hispanica* Boiss. & Reuter, Diagn. Pl. Hisp. 14 (1842) = *D. subsessilis* Boiss., Fl. Or. Suppl.: 272 (1882) = *Daucus hochstetteri* Braun ex Engler, in Engler & Drude, Die Veg. Erde 832 (1921) = *Caucalis abyssinica* Hochst., Pl. Schimp. Abyss. 2:338 (1841) $\equiv$ *Durieua abyssinica* Boiss., Ann. Sci. Bot. Nat. Sér. 3, 2:51 (1844) = *D. abyssinicus* Hochst. ex Rich., Tent. Fl. Abyss. 1:311 (1847).

Typus: *Caucalis hispanica*, Spain, Herb. Isnard (P).

Annual; stems up to 30 cm, erect, branched, hispid. Leaves alternate, 2-to 3-pinnate, the segments lanceolate, acute. Umbels axillary, subsessile, small; rays few, markedly unequal, scabrid. Bracts very leaf-like, shorter than the umbel, scabrid. Petals very small, yellowish-white; styles very short; pedicels scabrid (Pl. 20).

Fruit ovoid, 4×2 mm; primary ridges inconspicuous, with several rows of simple hairs, the commissural ridges widely spaced; secondary ridges with yellowish spines, 1.5-2 times as long as the width of the fruit, dilated at the base but not confluent, very scabrid; commissural face grooved, vascular bundles average sized; vittae oval. (Pls. 26:3; 30:6).

Distribution: Spain, Morocco, Algeria, Cyprus, Palestine, Lebanon, Syria.

Selected specimens: Portugal: Coimbra (RNG). Spain: Almería, *Rivas* 1965 (MAF). Canary Islands: Tenerife, *Armitag* 1902 (K).

Palestine: Bethaniam, 1846, type of *D. subsessilis* Boiss (G). Abyssinia: Scholoda 1837 type of *Caucalis abyssinica* Hochst (P). Palestine: *Dawud* 132 (RNG). Abyssinia: Woina, *Schimper* 794, 1853 (P). Abyssinia: Adoam, *Schimper* 1914, 1842 (P). Spain: Cáceres, *Caballero*, 1949 (MA 89024). Spain: Ciudad Real, *Borja*, 1958 (MA 198335). Spain: Tarragona, *Font Quer*, 1954 (MA 168161). Morocco: Targuist, *Font Quer* 1927 (MA 89035).

17. **Daucus glochidiatus** (Labill.) Fischer & al., IX Sem. Horti. Petrop. Suppl.: 11 (1843) $\equiv$ *Scandix glochidiata* Labill., Nov. Holl. Plant. Spec. 1:75 (1805) $\equiv$ *Caucalis glochidiata* (Labill.) Poirlet in Lam., Encycl. Méth. Bot. Suppl. 2:137 (1812) = *Daucus brachiatus* Sieber ex DC., Prodr. 4:214 (1830).

Typus: Australia, Van Diemen, Labillardière (P).

Biennial; stems up to 50 cm erect, flexuous, branched or hispid. Leaves alternate, 2 - to 3- pinnate, the segments lanceolate, acute, hispid. Umbels axillary, subsessile; rays few, markedly unequal, glabrous. Bracts leaf-like, shorter than the umbel. (Pl. 21).

Fruit oblong-ovoid, the apex attenuate, $2-3 \times 1.5$ mm; primary ridges with two rows of numerous short hairs; secondary ridges with spines tipped by large glochidia, as long as the width of the fruit, the commissural ones widely spaced; commissural face somewhat grooved; vascular bundles average sized, vittae large, oval in section (Pls. 25:3; 30:7).

Distribution: Australia, Tasmania, New Zealand.

Selected specimens: *Daucus brachiatus* type: Exs. Nov. Holl., Sieber 115 (K). Australia: Adelaide 1967 (RNG). Australia: Northern Flinders Range, Eichler 1956 (K). Australia, Hayllard 1910 (K).

18. ***Daucus montanus*** Humb. & Bonpl. ex Schult., Syst. Veg. 4:482 (1820) = *Daucus australis* Poepp. ex DC., Prod. 4:214 (1830) = *Daucus toriloides* DC., Prod. 4:214 (1830).

Typus: Silla de Caracas, Herb. Humb. & Bonpland (P).

Biennial, stems up to 50 cm, erect, little-branched, slightly hispid. Leaves alternate, 2-to 3- pinnatisect, the segments lanceolate, acute, hispid. Umbels pedunculate, not contracted at fruiting, the rays markedly unequal. Bracts leaf-like, pinnatisect, lanceolate, hispid, extremely shorter than the umbel. Petals and styles very small; pedicels very long and unequal (Pl. 22).

Fruit ovoid, $2-3 \times 1-2$ mm; primary ridges slightly prominent, with two rows of hairs, the commissural ridges widely spaced; secondary ridges with a row of about 14 spines, 1-1.5 times as long as the width of the fruit, dilated at the base but not confluent; commissural face grooved; vascular bundles slightly smaller than the vittae; vittae oval, large (Pls. 28:1; 30:8).

Distribution: Colombia, Venezuela, Chile, Perú, México.

Selected specimens: Colombia: Boyaca, Grub 230 (K). Ecuador: Lago San Marcos, Pennington 5457, 1961 (K). Venezuela: Mérida, Funck & Schlin 1207, 1964 (P). Chile: Tierra del Fuego, 1968. Moore 2234 (RNG). Perú: Cuzco, Vargas 21399, 1969 (MA 195977).

Daucus* sect. *Chrysodaucus Thell., Feddes Repert. 23:147 (1926).

Bracts segments linear, very short, stylopodium very thick, fruit little compressed, commissural ridges very close together, vittae obliterated, endosperm sulcate, mesocarp with sclerenchyma.

19. ***Daucus aureus*** Desf., Fl. Atl. 1:242 (1798).

Typus: Inter segetes, circa Mascar, Desfontaines (P).

Biennial golden coloured plant; stems up to 50 cm erect, glabrous or

scabrid. Leaves alternate, 2-to 3- pinnate, the lobes lanceolate to linear-lanceolate, acute, scabrid. Umbels long-pedunculate, somewhat contracted at fruiting, 8-10 cm wide; rays numerous, slightly unequal, scabrid or slightly hispid. Bracts shorter than the umbel, deflexed, pinnatifid, filiform, scabrid. Petals yellow, unequal, the outer 1-2 mm; styles short; pedicels scabrid (Pl. 23).

Fruit elliptic-ovate, 4×2 mm, with thick stylopodium; primary ridges inconspicuous, the commissural ones very close together, with widely spaced uncinulate hairs; secondary ridges with a row of 7-8 yellow spines shorter than or as long as the width of the fruit, covered with conical papillae, slightly confluent into a crest. Vascular bundles small, vittae absent, commissural face of the mericarp occupied by sclerenchyma (Pls. 26:1; 30:9).

Distribution: Spain, Italy, Sicily, Morocco, Algeria, Palestine, Syria, Lebanon.

Selected specimens: Spain: Albacete, 1891 (P). Spain: Jaén, *M. Rivas* (MAF). Spain: Alcaraz, 1891 (P). Israel: Nachsholm, 1971 (RNG). Israel: Jordán, *Davud* (RNG). Spain: Seville, *Silvestre*, 1968 (MA 200851). Algeria: Orán, *Faure*, 1933 (MA 89217). Israel: Balfouria, *Feinbrun & Zohary*, 1879 (MA 169474). Algeria: Lalla-Maghinia, *Maire* 1933 (MA 89218). Spain: Jaén, *Bolós*, 1950 (BC 115194). Spain: Sierra Mágina, *Cuatrecasas*, 1925 (BC 24361).

Daucus sect. **Meoides** Lange in Willk. & Lange, Prodr. Fl. Hisp. 3:19 (1874).

Leaves apparently subverticillate, bracts 3-fid, styles long, the whole plant tomentose, including the fruit, vallecular spines fasciculate, ending in an uncinula.

20. **Daucus setifolius** Desf., Fl. Atl. 1:244, t. 65 (1798) = *Durieuva juncea* Willk., Sert. Fl. Hisp. 57 = *Daucus brachylobus* Boiss., Voy. Bot. Midi Esp. 2 (1839).

Typus: Mascar, in collibus incultis, Herb. Desfontaines, (P).

Perennial; stems up to 1 m erect, branched, glabrous. Leaves apparently subverticillate, linear, pubescent. Umbels terminal and axilar, pedunculate, 2-5 cm across, contracted at fruiting; rays about 20, subequal, tomentose. Bracts 3-fid, subulate, tomentose, much shorter than the umbel. Petals very small; styles long; pedicels tomentose (Pl. 24).

Fruit cylindric-ovoid, 6×1.5 mm, dark grayish due to a dense tomentum; primary ridges more prominent than the secondary ones, the commissural ones widely spaced; secondary ridges with lax, irregular fasciculate spines, not longer than the width of the fruit, uncinulate; vascular bundles as large as the vittae; vittae ovate-triangular in section (Pls. 25:4; 30:10).

Distribution: Spain, Morocco, Algeria, Portugal.

Selected specimens: Algeria: *Battandier & Trabut* 92 (K). Spain: Jaén, *Ri-*

vas & *Galiano*, 1951 (MA 166100). Algeria: Terny, *Faure*, 1932 (MA 89071). Portugal: Extremadura, *Silva*, 1961 (MA 194199). Spain: Cáceres, *Ladero*, 1969 (MAF 80391). Spain: Badajoz, *Pérez Chiscano*, 1971 (MAF 80294).

21. ***Daucus conchitae*** Greuter, Willdenowia 8: 574 (1979).

When I had almost completed the present paper, I received from Prof. W. Greuter a specimen of his species *D. conchitae*, for the undeserved dedication of which I am very grateful. The plant has no fruit, and I have only examined one specimen; I am therefore unable to establish with certainty its taxonomic position. It is nevertheless evident that it has morphologic characters that differentiate it from the more closely related species: *D. bicolor* Sm. and *D. guttatus* Sm., because its bracts are simple; *D. littoralis* Sm. because the bracts are longer than the umbel. As to the pollen of *D. conchitae* Greuter, it is subrectangular, bone-shaped, with $P = 26 \mu\text{m}$ and $E = 12.5 \mu\text{m}$, the exine thickness in the polar region being about $4 \mu\text{m}$, and at the equator, about $2 \mu\text{m}$. The related species have somewhat different pollen (CERCEAU-LARRIVAL 1965). That of *D. guttatus* is clearly different because of its equatorially constricted shape. It differs from that of *D. bicolor* in size and in the relative thickness of the exine. It is closer to the pollen of *D. littoralis*, in shape and exine thickness, but it is smaller in size, as in *D. littoralis* $P = 44.8$ and $E = 18.4$.

We have also examined the ovary, for the structure of vascular bundles and vittae appears early in the ovary. The result is that its anatomic characters seem to relate the new species to *D. littoralis*. In short, it appears to be a taxon close to *D. littoralis* Sm. but without a deeper study of its morphologic variability and particularly of its mature fruits, I cannot make a decision on its precise taxonomic position.

KEY TO THE GENUS *DAUCUS* L.

1. Umbels axilar, subsessile, bracts leaf-like, pinnatisect..... 2
1. Umbels axilar and terminal, pedunculate, bracts usually differing from the leaves..... 3
2. Fruits 4×2 mm with the spines $1-1\frac{1}{2}$ times longer than the width of the mericarp, glochids small terminal..... (16) ***D. durieua***
2. Fruit $2-3 \times 1.5$ mm, the spines shorter than the width of the mericarp, glochids thick, terminal..... (17) ***D. glochidiatus***
3. Fruit with a very thick stylopodium, without vittae, commissural mesocarp with sclerenchyma, primary hairs uncinulate..... (19) ***D. aureus***
3. Fruit with a thin stylopodium, with vittae of oval or triangular section, mesocarp with parenchyma only, primary hairs straight..... 4
4. Tomentose plant (leaves, rays, bracts, pedicels and fruit); leaves apparently subverticillate, fruit with fasciculate velveteen spines..... (2) ***D. setifolius***

4. Hispid or glabrescent plant; leaves alternate, fruit with two or more rows of stiff hairs on the primary ridges, and simple spines on the vallecular ridges 5
5. Styles always short; fruit with vittae of oval section..... 6
5. Styles short or long; fruit with vittae of triangular section..... 9
6. Umbels not contracted at fruiting, pedicels very unequal and long, bracts leaf-like; fruit with spines not confluent into a crest, and the vittae larger in section than the bascular bundles, commissural face grooved ..(18) **D. montanus**
6. Umbels contracted at fruiting, pedicels short, subequal, bracts differentiated; fruit with spines confluent into a crest, and the vittae smaller in section than the vascular bundles..... 7
7. Fruit 7 × 3 mm, with 5 vallecular spines per ridge, stems very hispid, leaf segments ovate..... (13) **D. muricatus**
7. Fruit 4-5 × 3 mm, with 6-8 vallecular spines per ridge, stems slightly hispid or glabrescent, leaf segments linear-lanceolate..... 8
8. Bracts 3-fid, as long as or longer than the umbel; central umbel red, lateral ones white (14) **D. bicolor**
8. Bracts simple, shorter than the umbel; petals yellowish-white (15) **D. littoralis**
9. Fruit with the spines not dilated at base 10
9. Fruit with the spines somewhat dilated at base..... 16
10. Basal leaves apparently subverticillate, spines uncinulate (9) **D. crinitus**
10. Basal leaves alternate, spines glochidiolate..... 11
11. Leaf segments lanceolate; styles short..... 12
11. Leaf segments linear or linear-ovate; styles long or short..... 14
12. Bracts 3-fid, shorter than the umbel, stem and leaves hispidule, with the apex obtuse (6) **D. sahariensis**
12. Bracts pinnatisect, longer than the umbel, stem and leaves glabrescent, with the apex acute..... 13
13. Plant decumbent, fruit yellowish..... (7) **D. syrticus**
13. Plant erect, fruit brown..... (4) **D. involucratus**
14. Styles long..... 15
14. Styles short, fruit with simple primary hairs..... (8) **D. capillifolius**
15. Bracts simple, linear-subulate..... (5) **D. jordanicus**
15. Bracts pinnatisect, linear; fruit with stellate primary hairs..... (2) **D. gracilis**
16. Fruit with spines slightly confluent into a crest, not longer than the width of the mericarp..... 17
16. Fruit with the spines strongly confluent into a crest, 1-1½ times longer than the width of the mericarp..... 19
17. Bracts 3-fid, lanceolate..... (11) **D. montevidensis**
17. Bracts pinnatisect..... 18
18. Annual, slender, umbel less than 4 cm across; stems little branched; leaf segments linear..... (12) **D. pusillus**

18. Usually biennial; umbel more than 4 cm across; stems branched; leaf-segments variable..... (1) **D. carota**
19. Biennial; umbels with 10-20 rays; fruit 3-4 × 2 mm, with stellate primary hairs..... (10) **D. tenuisectus**
19. Annual, umbels with less than 7 rays; fruit 2-3 × 2 mm, with simple primary hairs..... (3) **D. guttatus**

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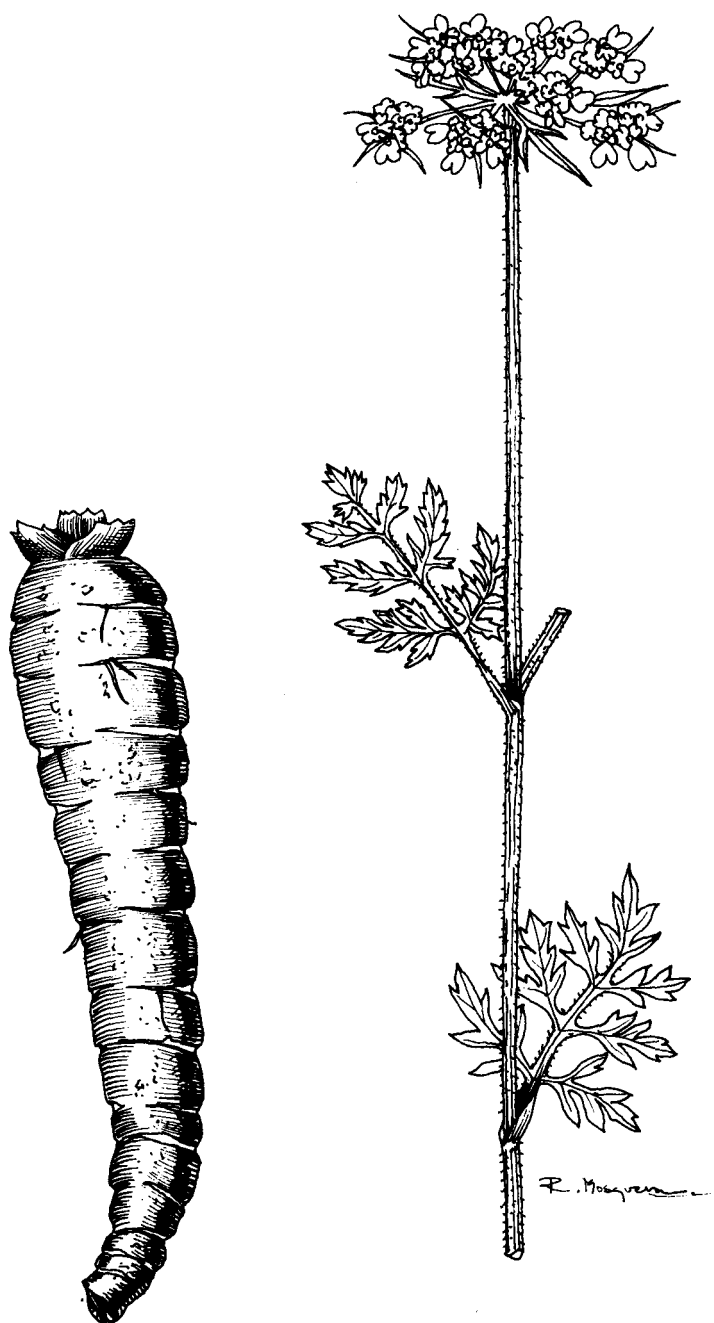
ACKNOWLEDGEMENTS

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Plate 1.—*D. carota* subsp. *carota*.

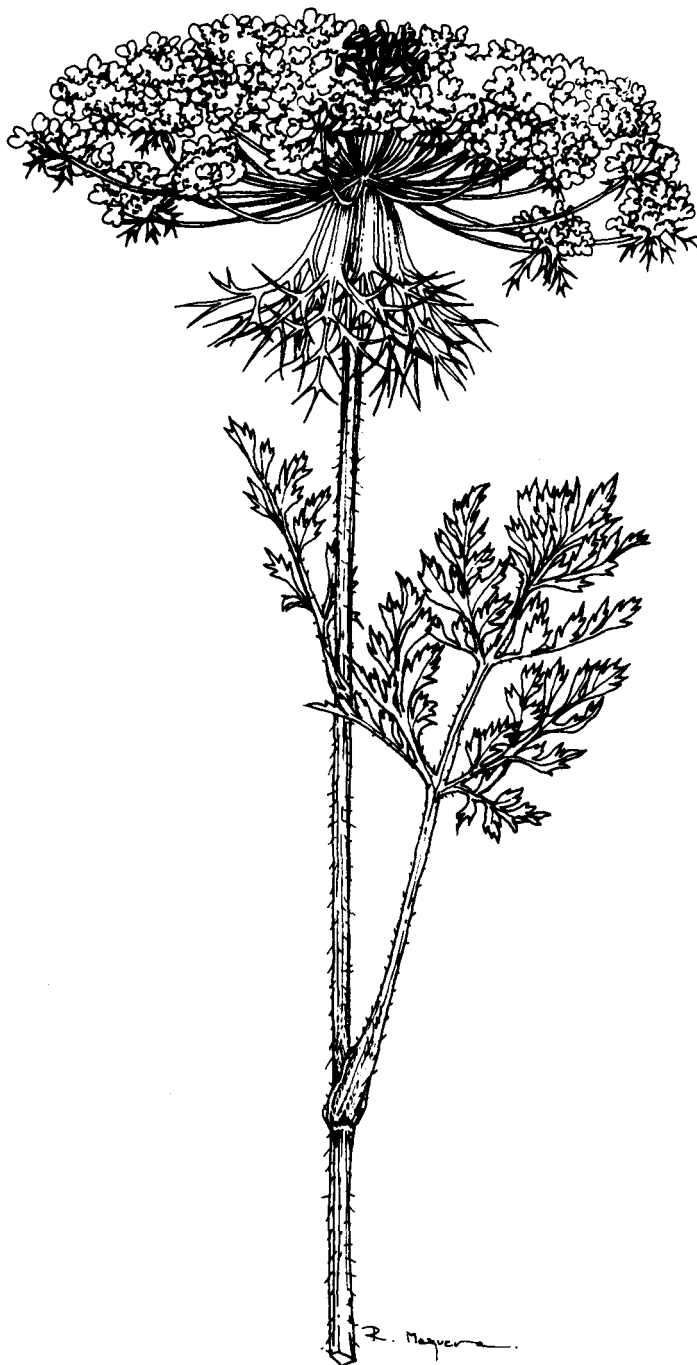


Plate 2.—*D. carota* subsp. *maximus*.

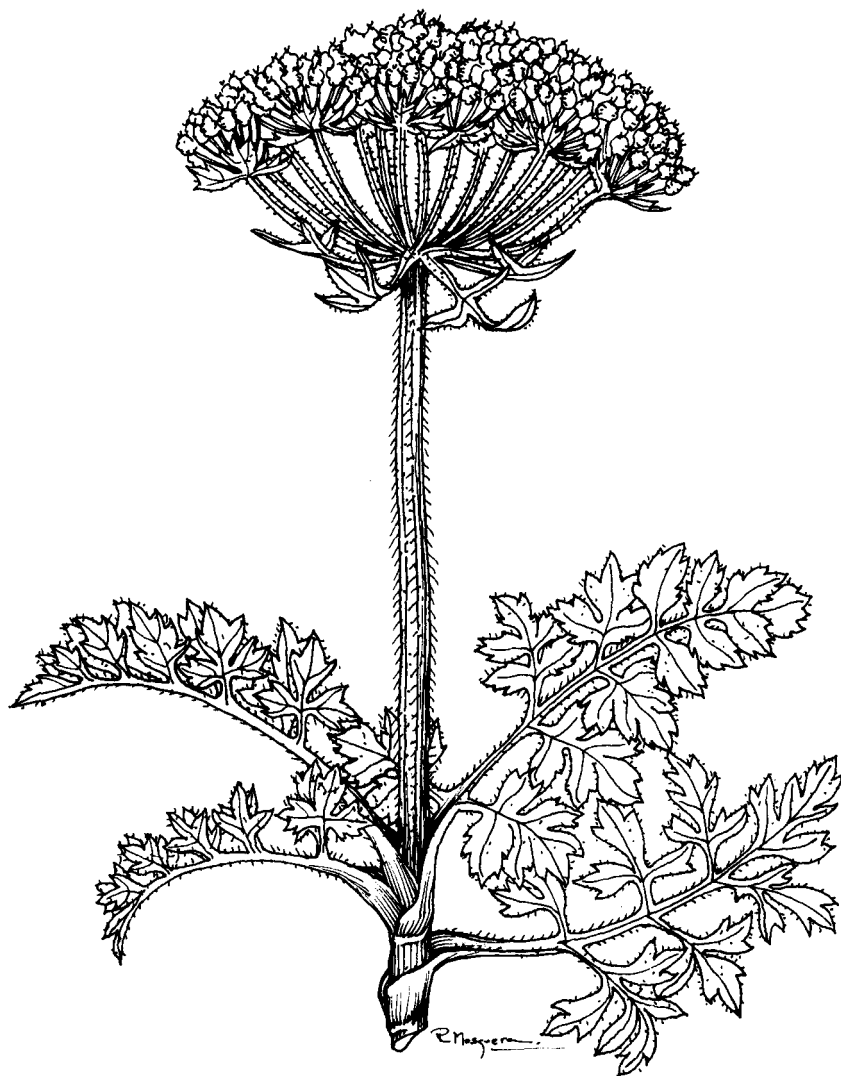


Plate 3.—*D. carota* subsp. *gummifer*.



R. Mayr Plate 4.—*D. carota* subsp. *maritima*.

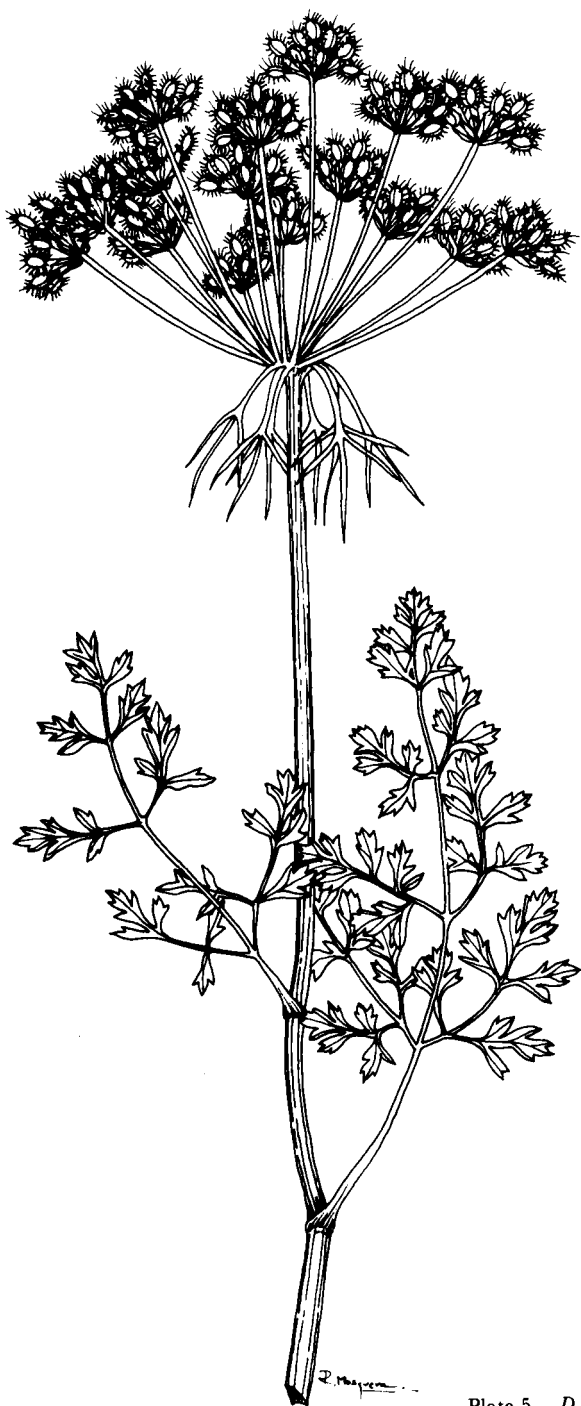


Plate 5.—*D. carota* subsp. *hispanicus*.

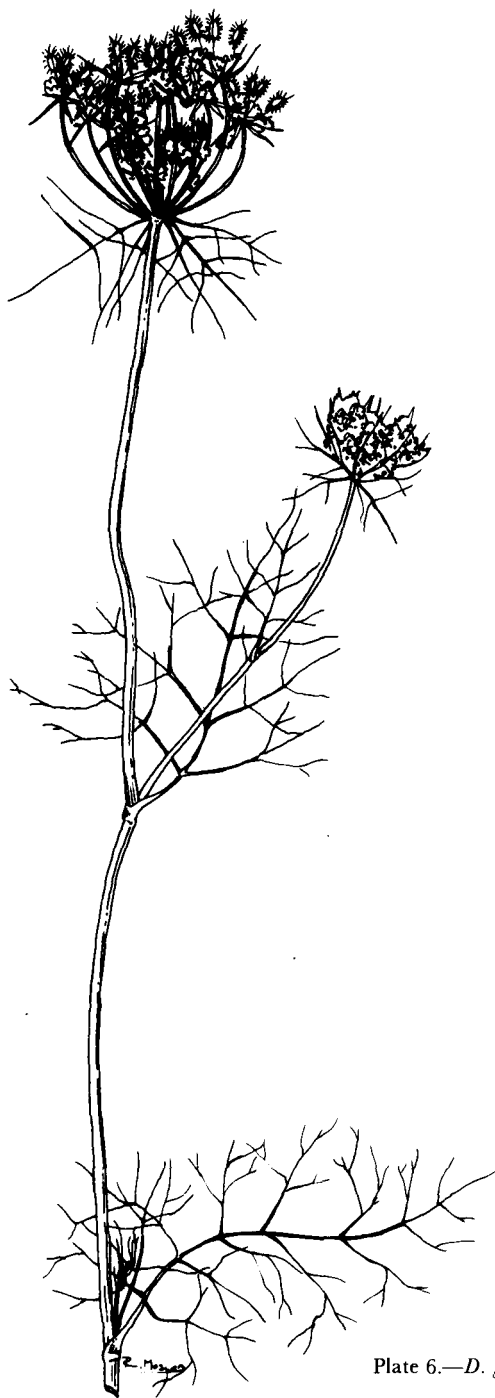
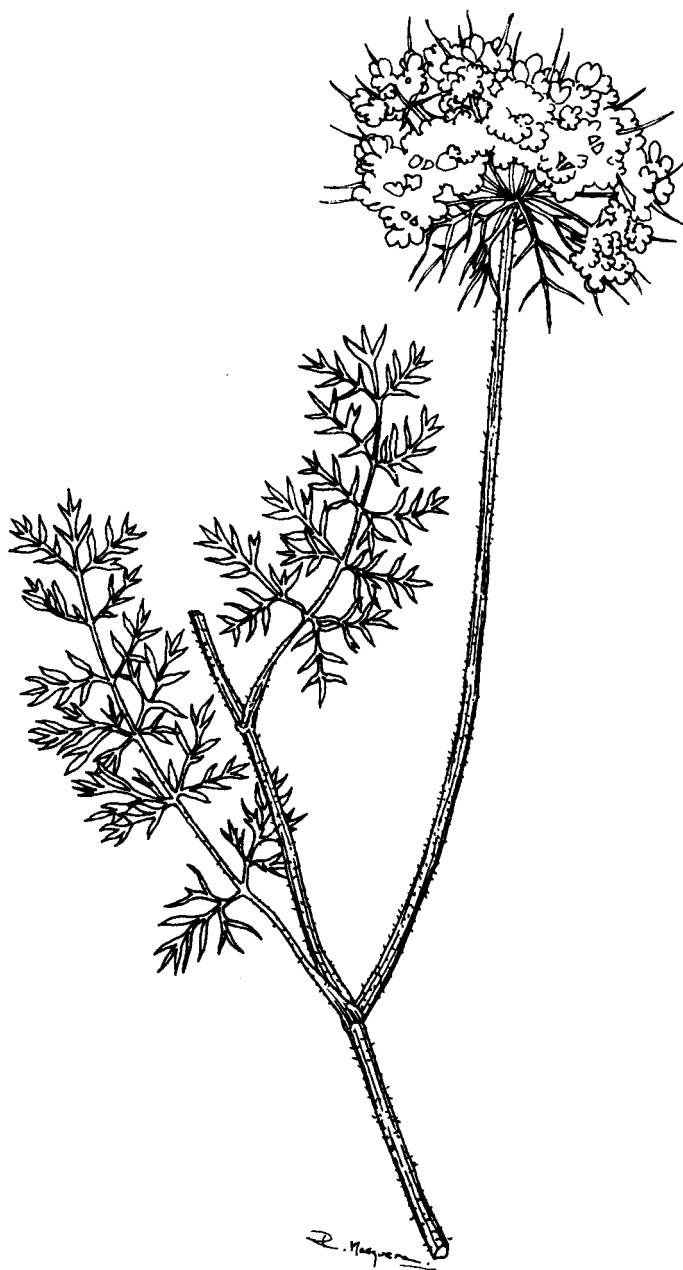


Plate 6.—*D. gracilis*.

Plate 7.—*D. guttatus*.

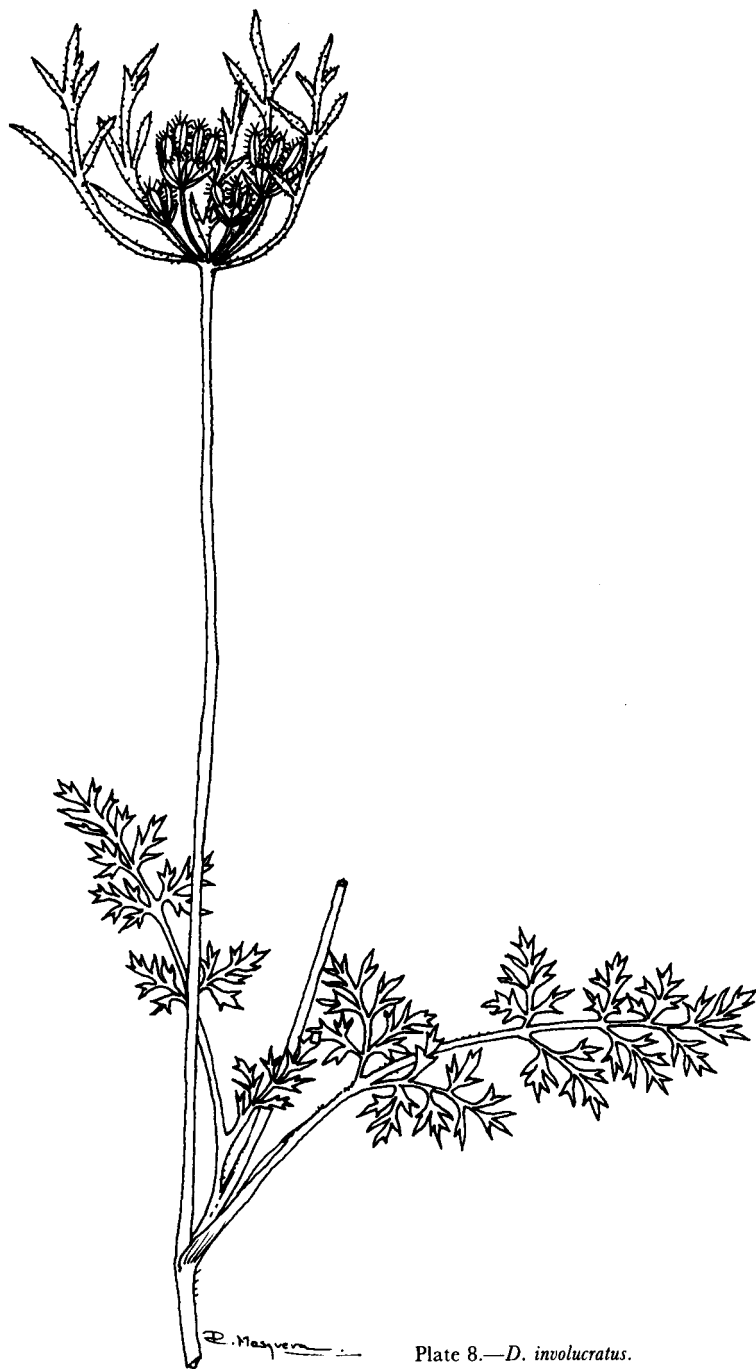


Plate 8.—*D. involucratus*.



Plate 9.—*D. jordanicus*.

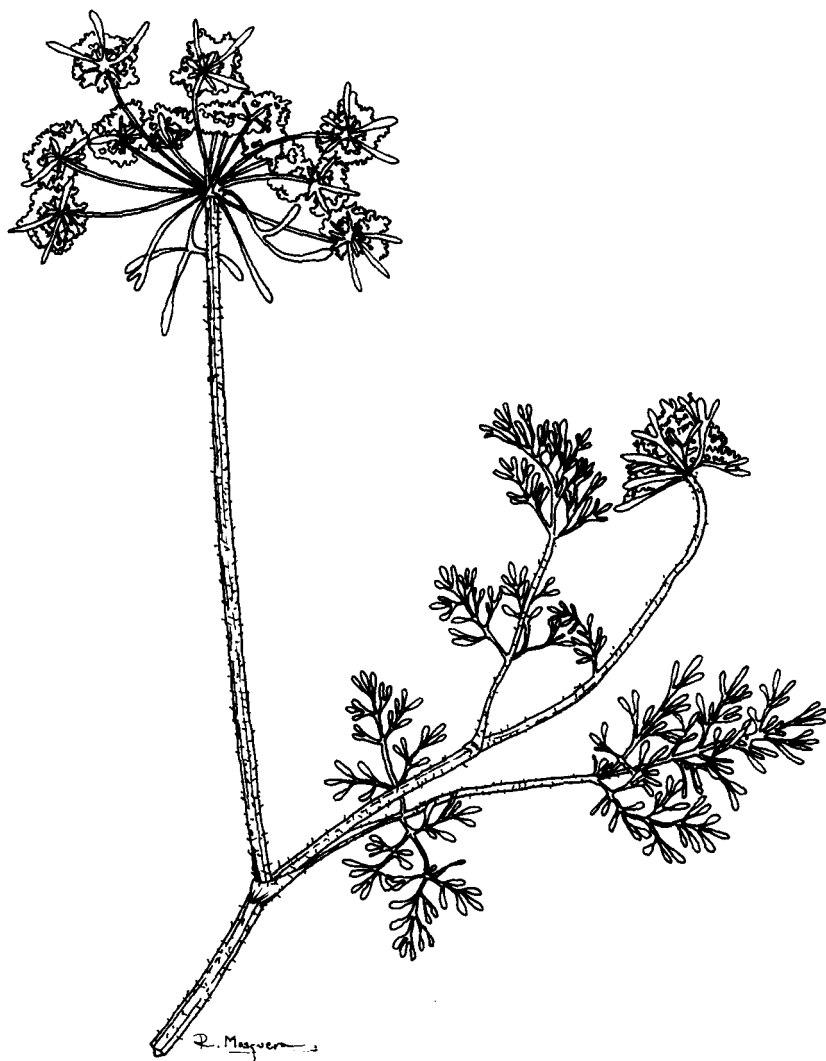
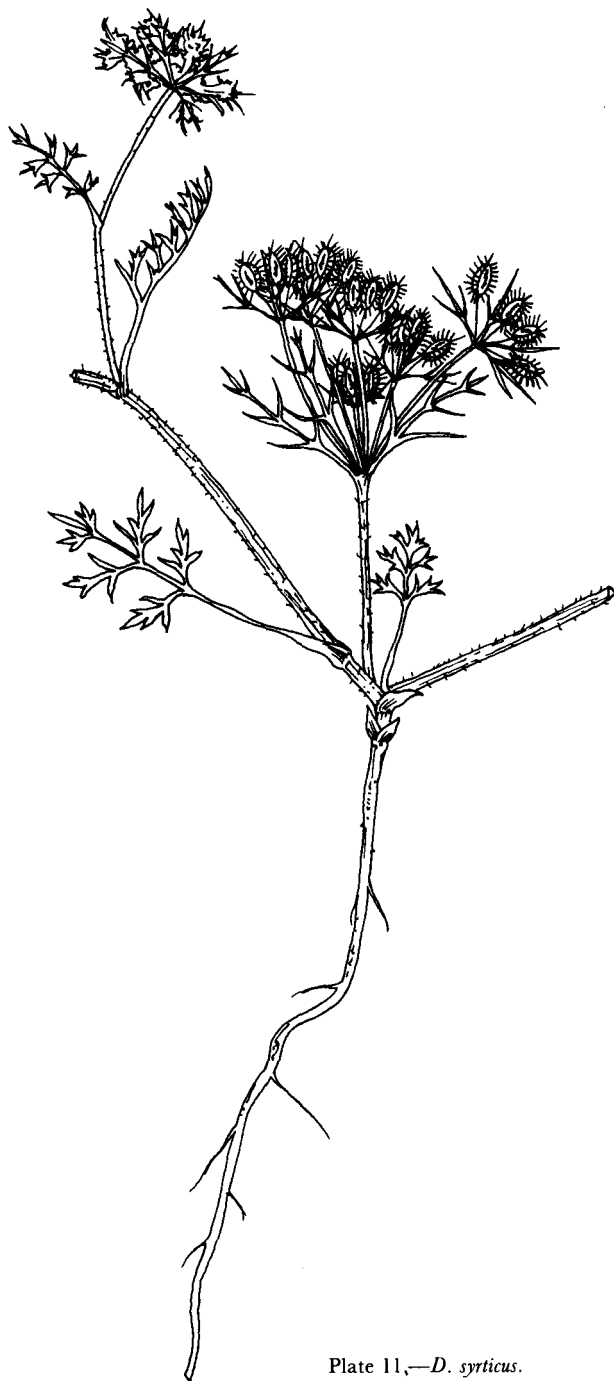


Plate 10.—*D. sahariensis*.

Plate 11,—*D. syrticus*.

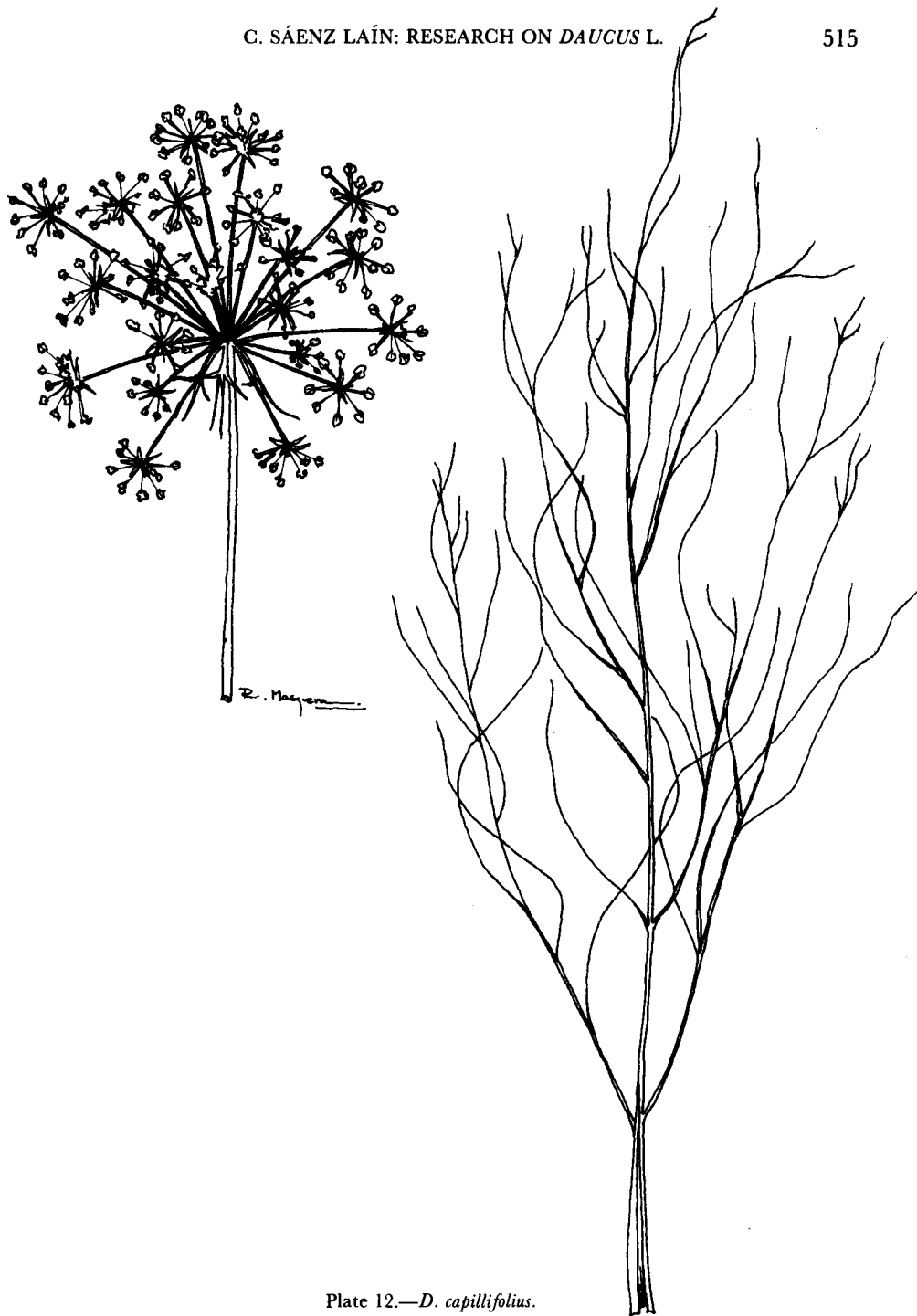
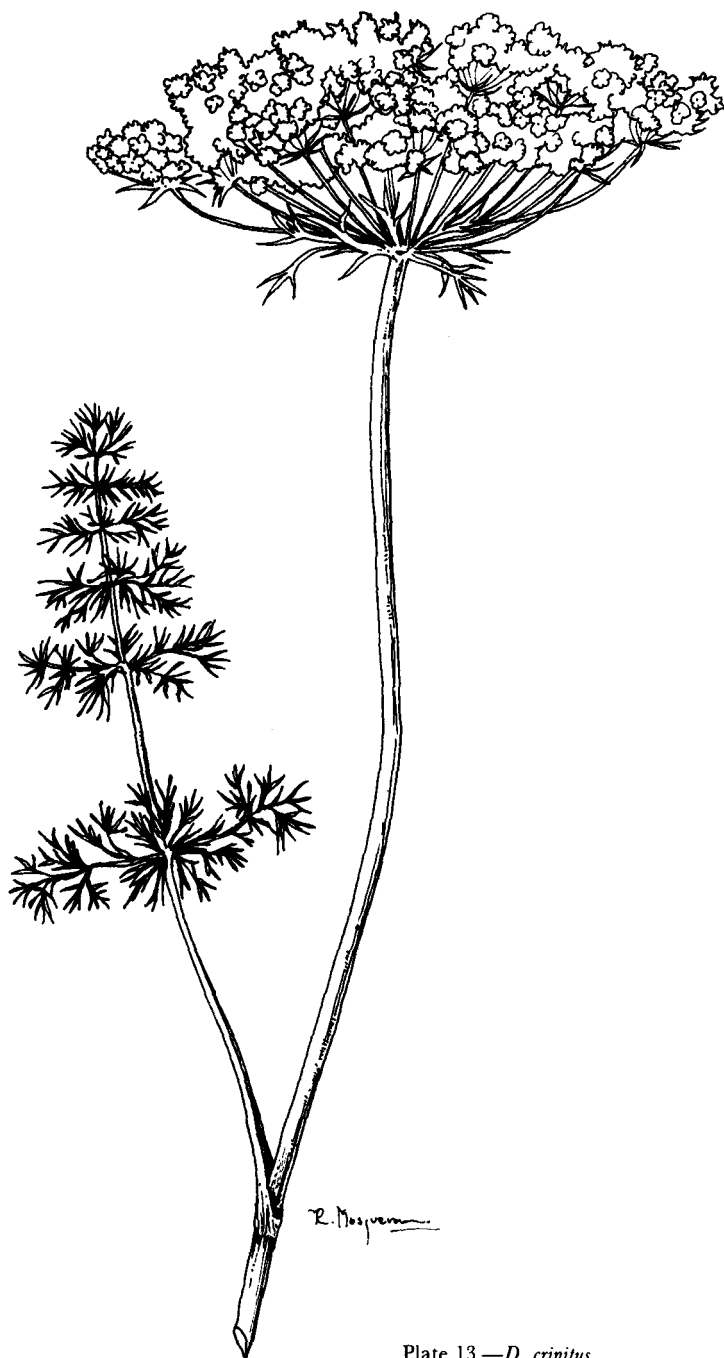


Plate 12.—*D. capillifolius*.

Plate 13.—*D. crinitus*.

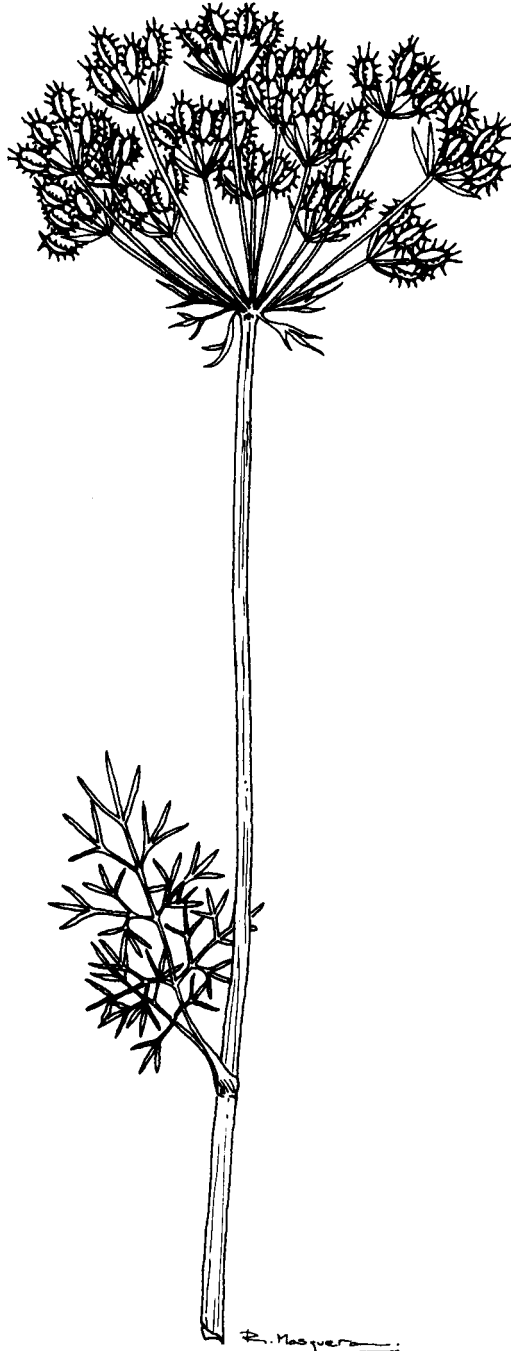


Plate 14.—*D. tenuisectus*.



Plate 15.—*D. montevidensis*.

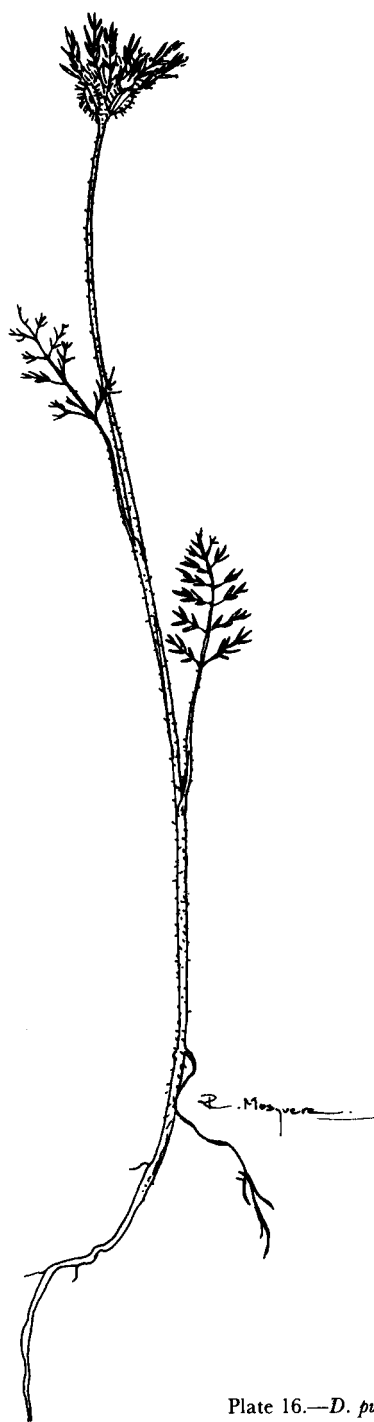


Plate 16.—*D. pusillus*.

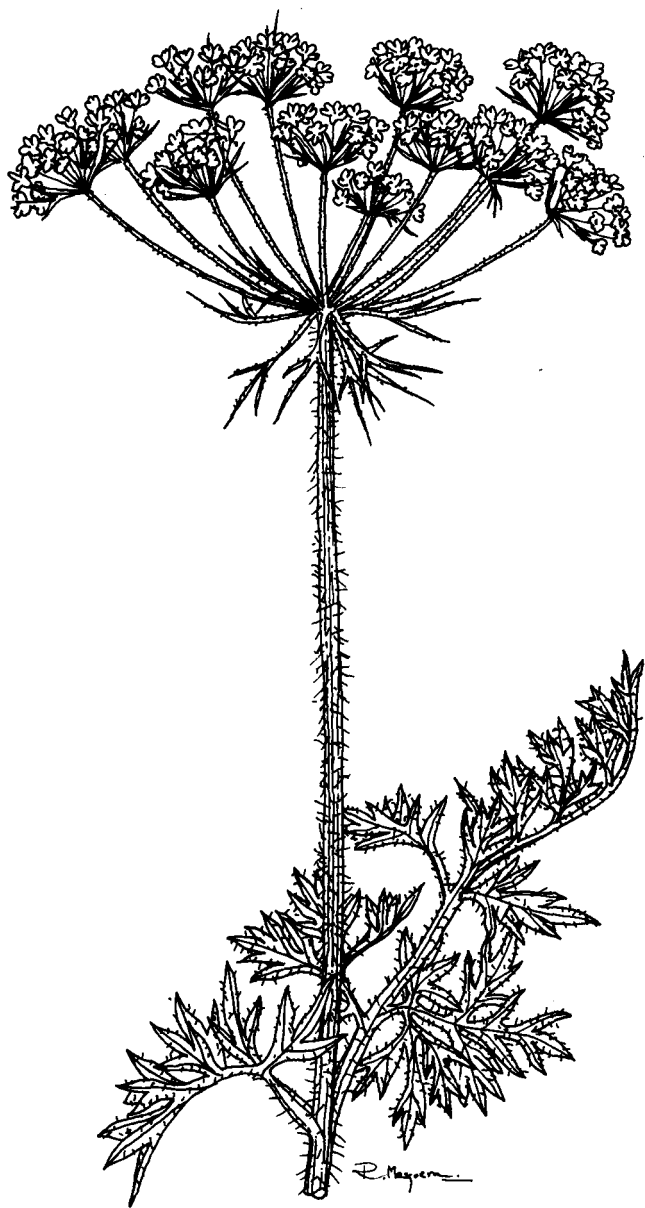
Plate 17.—*D. muricatus*.

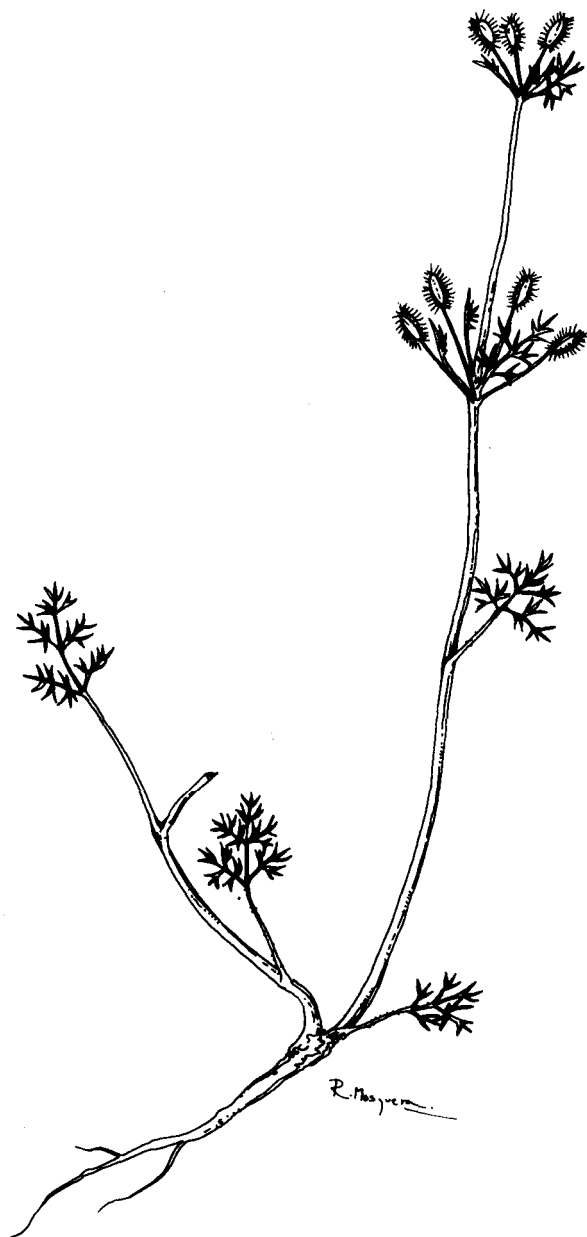


Plate 18.—*D. bicolor*.

Plate 19.—*D. littoralis*.



Plate 20.—*D. durieu*.

Plate 21.—*D. glochidiatus*.

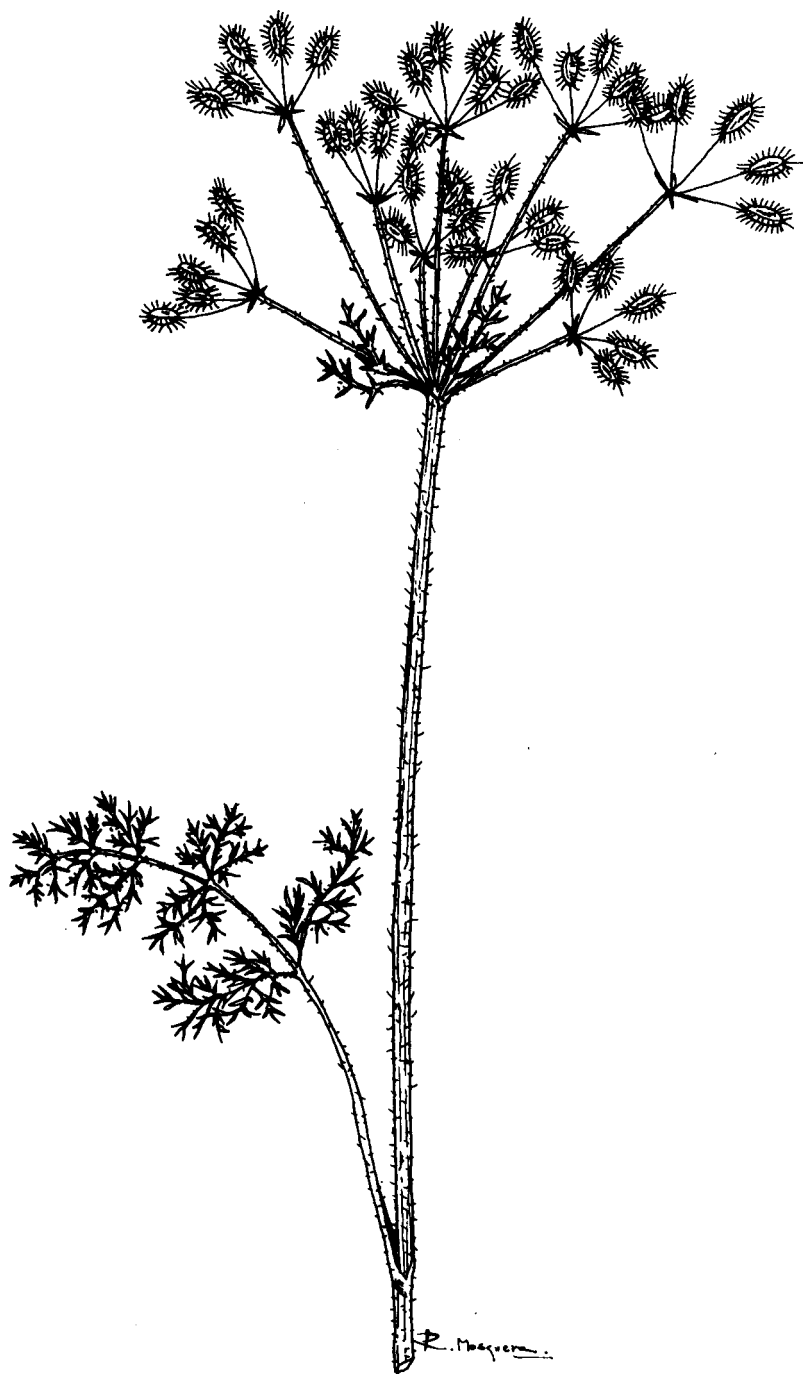


Plate 22.—*D. montanus*.

Plate 23.—*D. aureus*.

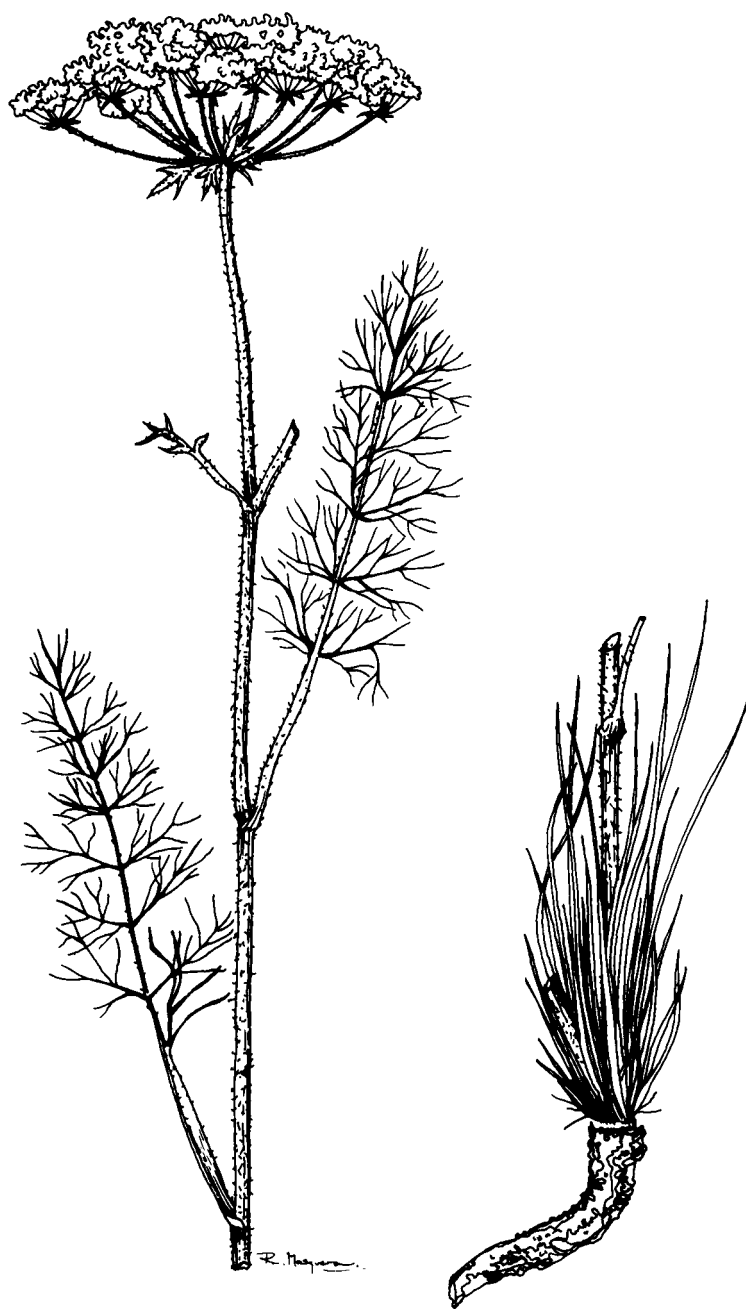


Plate 24.—*D. setifolius*.

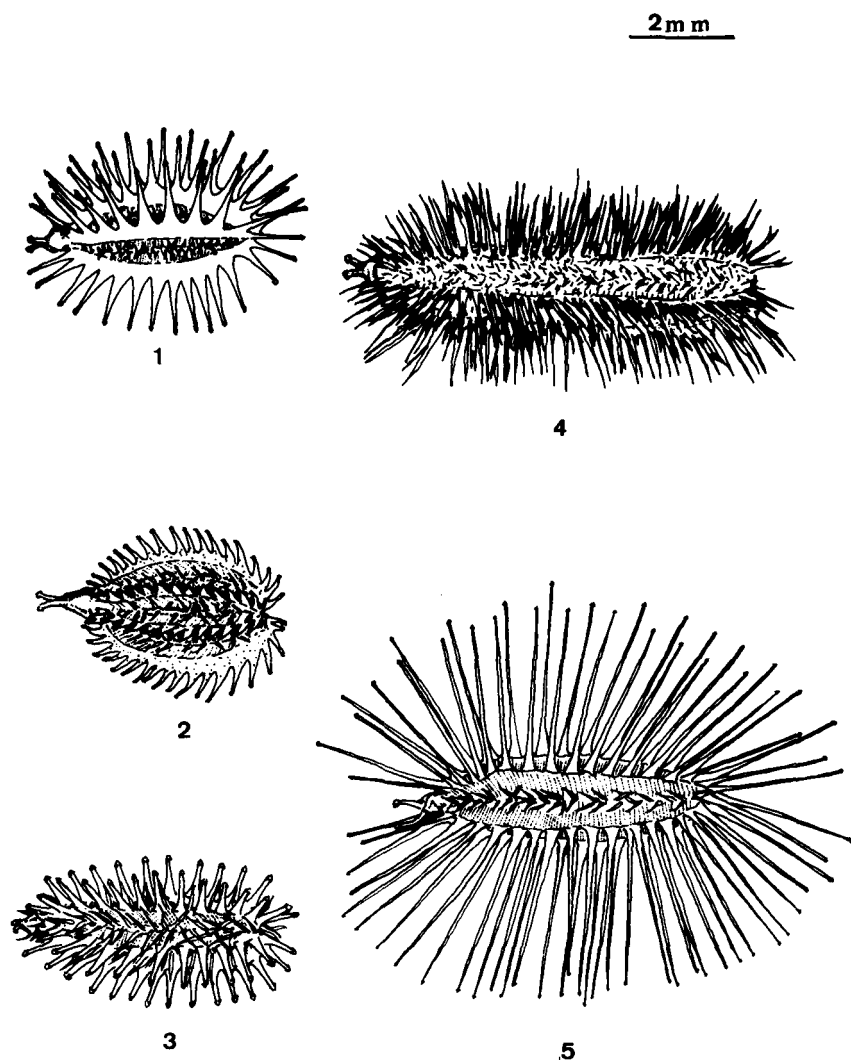


Plate 25.—Fruits of: 1, *D. montevidensis*; 2, *D. carota*; 3, *D. glochidiatus*; 4, *D. setifolius*; 5, *D. crinitus*.

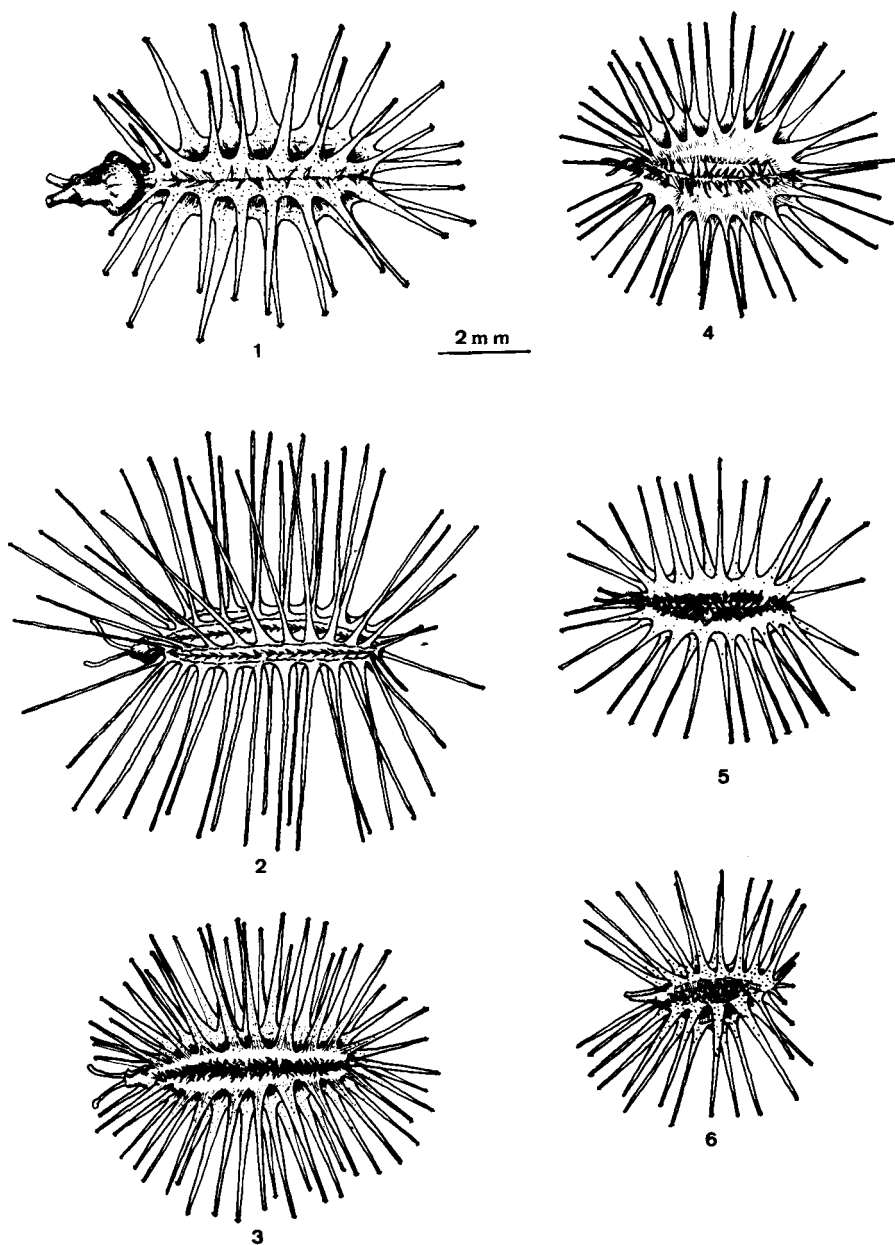


Plate 26.—Fruits of: 1, *D. aureus*; 2, *D. capillifolius*; 3, *D. durieua*; 4, *D. involucratus*; 5, *D. guttatus*; 6, *D. syrticus*.

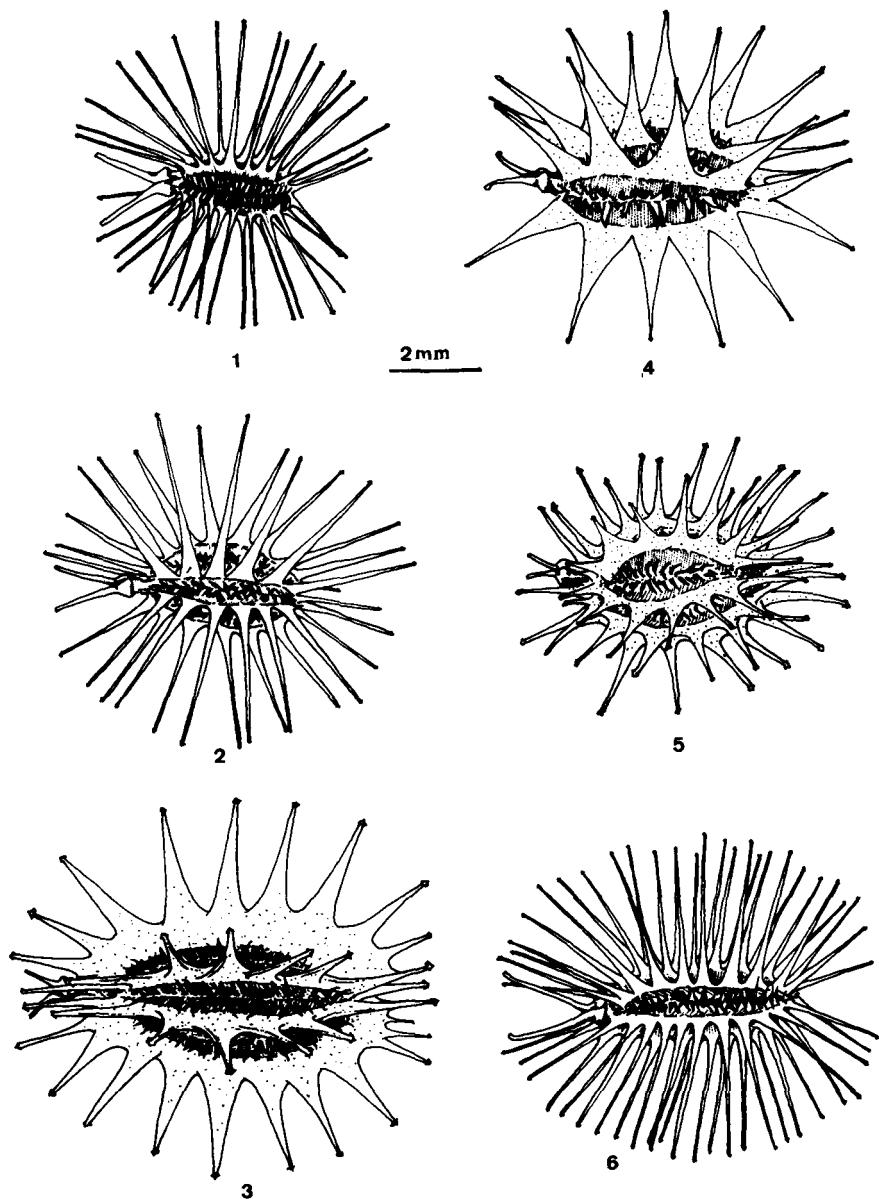


Plate 27.—Fruits of: 1, *D. jordanicus*; 2, *D. gracilis*; 3, *D. littoralis*; 4, *D. tenuisectus*; 5, *D. bicolor*; 6, *D. sahariensis*.

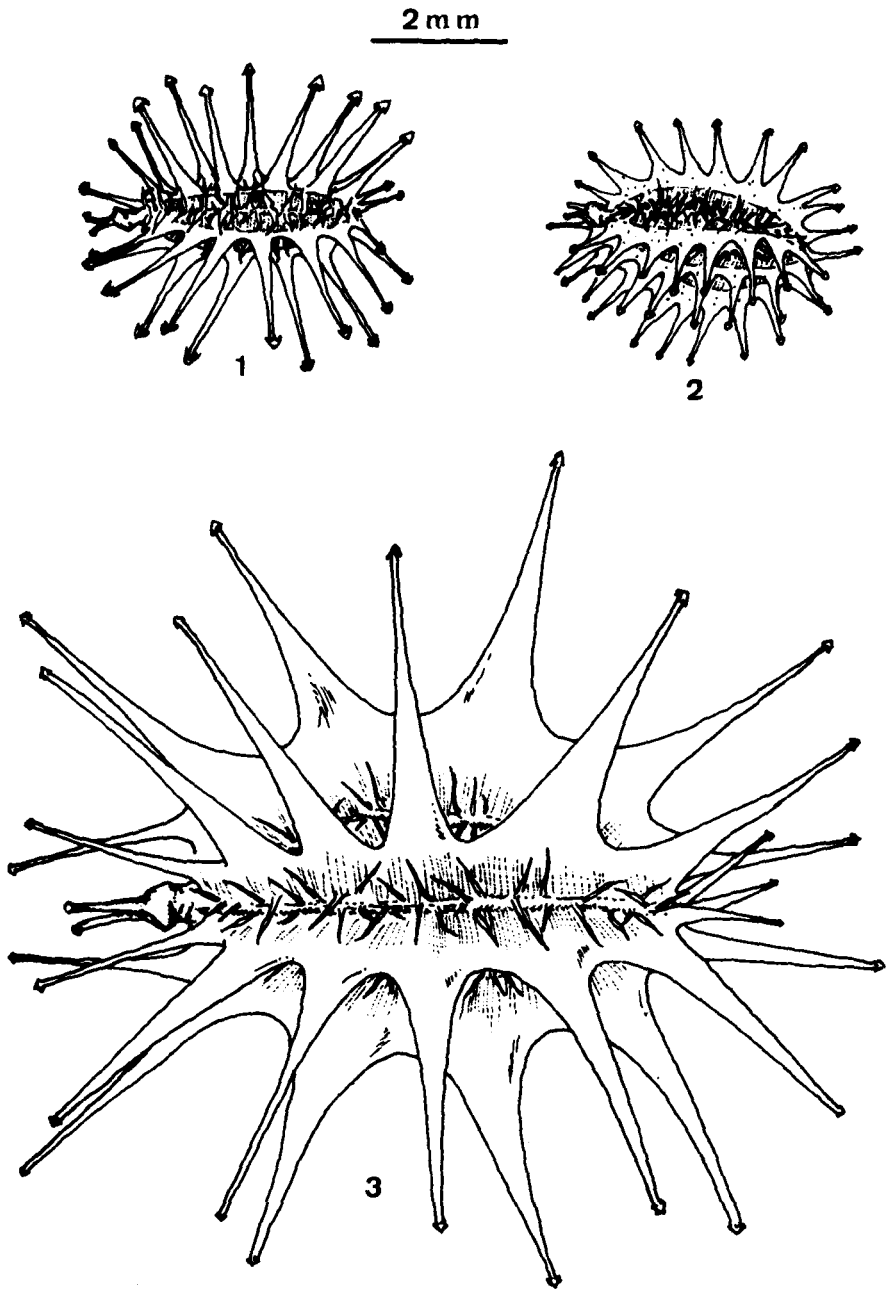


Plate 28.—Fruits of: 1, *D. montanus*; 2, *D. pusillus*; 3, *D. muricatus*.

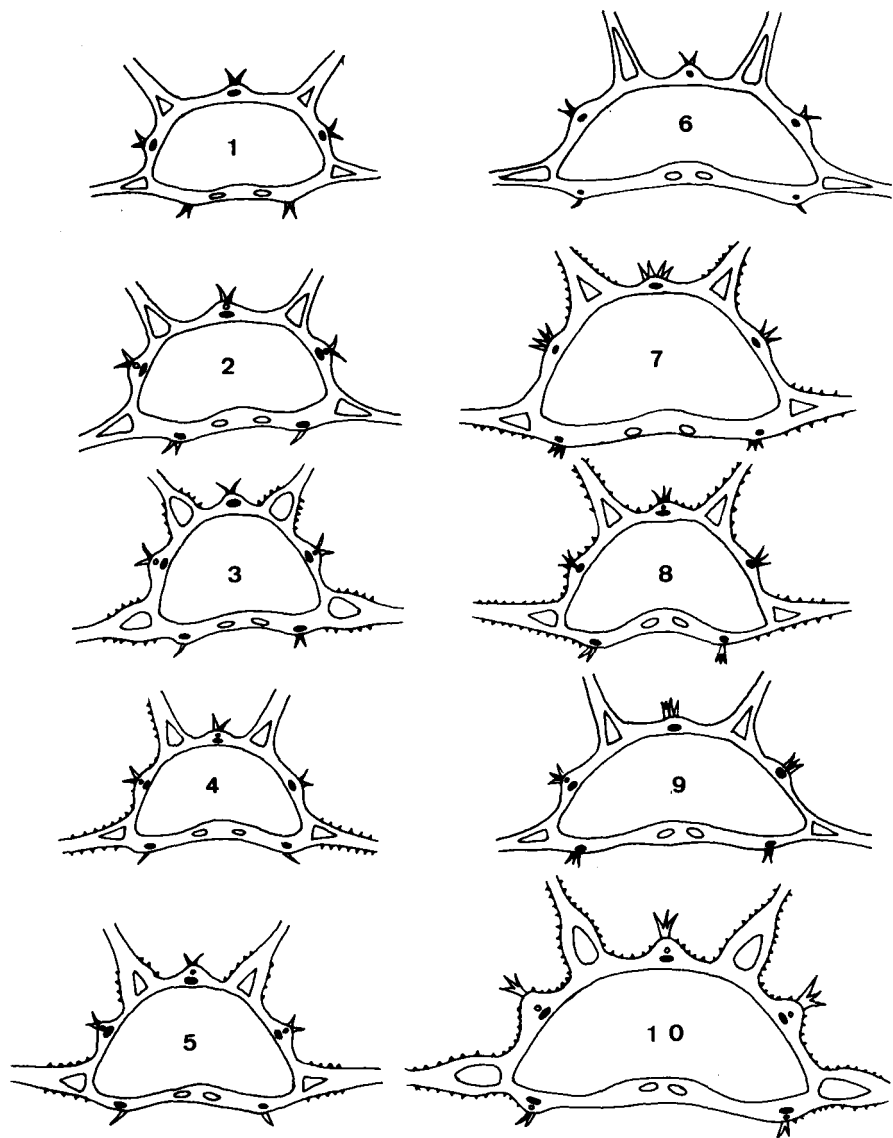


Plate 29.—Median transverse sections of the mericarps of mature fruits of: 1, *D. carota*; 2, *D. capillifolius*; 3, *D. jordanicus*; 4, *D. syrticus*; 5, *D. involucratus*; 6, *D. crinitus*; 7, *D. guttatus*; 8, *D. sahariensis*; 9, *D. gracilis*; 10, *D. tenuisectus*.

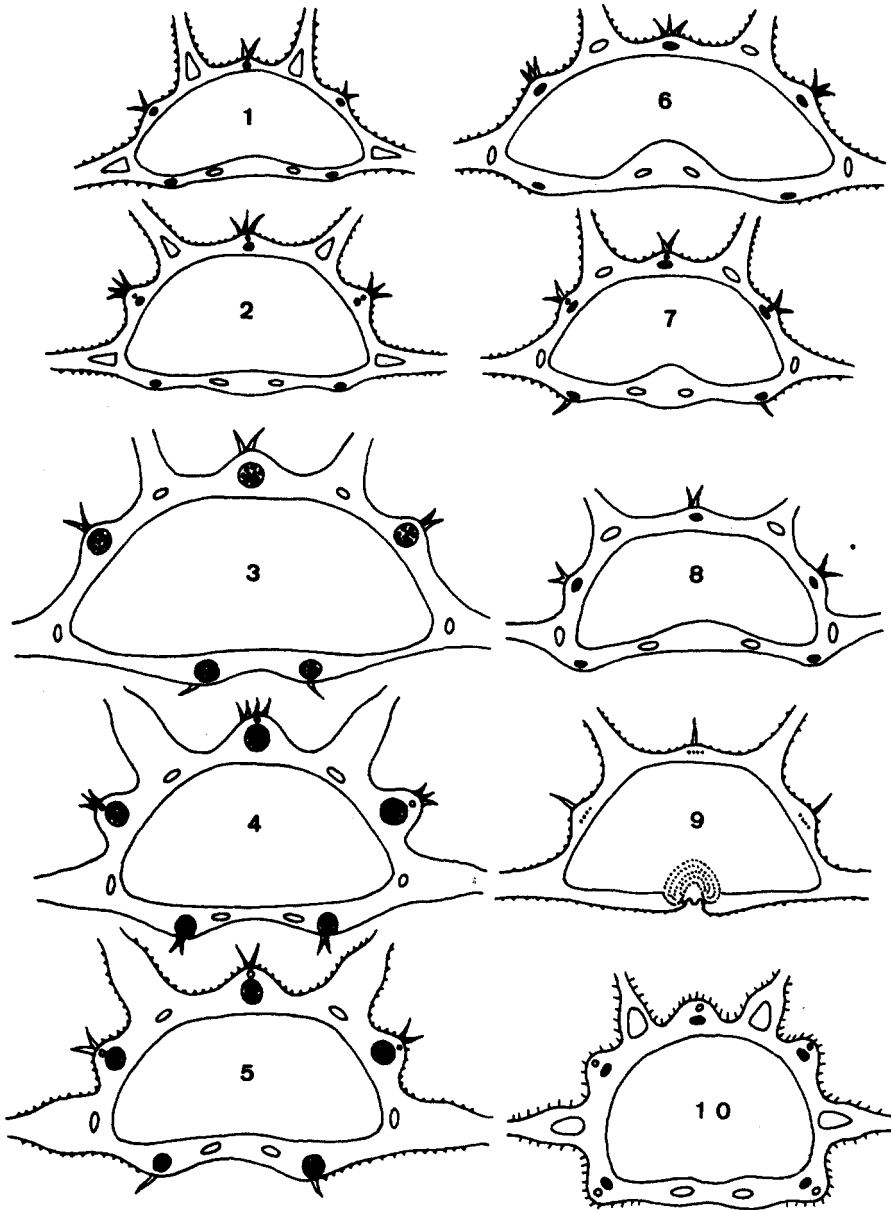


Plate 30.—Median transverse sections of the mericarps of mature fruits of: 1, *D. pusillus*; 2, *D. montevidensis*; 3, *D. muricatus*; 4, *D. bicolor*; 5, *D. littoralis*; 6, *D. durieua*; 7, *glochidiatus*; 8, *D. montanus*; 9, *D. aureus*; 10, *D. setifolius*.