

**TAXONOMICAL REVISION OF THE GENUS *DITTRICHIA*
(*ASTERACEAE*)**

Salvatore Brullo¹ & Giovanni de Marco²

¹Dipartimento di Botanica, Università di Catania, Via A. Longo 19, I - 95125 Catania.

²Dipartimento di Biologia, Università di Roma Tre, Via Ostiense 173, I - 00154 Roma.

Brullo, S. & de Marco, G. (2000). Taxonomical revision of the genus *Dittrichia* (*Asteraceae*). *Portugaliae Acta Biol.* **19**: 341-354.

The genus *Dittrichia* (*Asteraceae*), distributed mainly in the Mediterranean area, is revised. Herbarium and field investigations have shown that five species can be recognised, of which two are new to science; they are *D. graveolens*, *D. viscosa*, *D. revoluta*, *D. orientalis* and *D. maritima*. A formal taxonomical treatment is presented including correct nomenclature, typification, description, ecology and distribution.

Key words: Taxonomy, *Dittrichia*, Mediterranean area, revision.

Brullo, S. & de Marco, G. (2000). Révision taxonomique du genre *Dittrichia* (*Asteraceae*). *Portugaliae Acta Biol.* **19**: 341-354.

Revê-se o género *Dittrichia* (*Asteraceae*), de distribuição essencialmente mediterrânea. Os estudos realizados em herbário e as novas herborizações mostraram a existência de cinco espécies, duas delas novas para a ciência. As espécies são: *D. graveolens*, *D. viscosa*, *D. revoluta*, *D. orientalis* e *D. maritima*. Apresenta-se um tratamento taxonómico clássico incluindo a nomenclatura correcta, a tipificação, a descrição, a ecologia e distribuição.

Palavras chave: Taxonomia, *Dittrichia*, região Mediterrânea, revisão.

INTRODUCTION

The genus *Dittrichia*, described by GREUTER (1973), has a widespread Mediterranean distribution, marginally penetrating in the Atlantic European territories and in Middle East. According to literature data, it is well defined and

homogeneous in its proposed circumscription, showing close relationships with the genus *Inula* L., from which it differs in some features regarding the achenes and pappus-hairs. In particular, the genus *Dittrichia* has achenes cylindrical abruptly contracted below the pappus, and the pappus-hairs are connate near base, while *Inula* is characterized by achenes angled and not abruptly contracted below the pappus; and by simple and free pappus-hairs.

Up to now within genus *Dittrichia*, three taxa have been noted: *D. graveolens* (L.) Greuter and *D. viscosa* (L.) Greuter represented by the subsp. *viscosa* and subsp. *revoluta* (Hoffmanns. & Link) P. Silva & Tutin. (cf. BALL, 1976; FRANCO, 1984).

Herbarium investigations allowed to point out that *D. viscosa* is a species complex and therefore a taxonomical revision was necessary. Further extensive field investigations have proved that some populations, previously attributed to *D. viscosa*, are well differentiated from the typical ones.

The taxonomical treatment has shown that there are remarkable morphological differences among the various examined populations, which allow to distinguish four taxa within *D. viscosa* s.l., separated to specific level. On the whole, these species result characterized by several morphological features, regarding the indumentum, the size and shape of the leaves, bracts, flowers, cypselas and receptacle pits; besides they have also a typical allopatric distribution.

The genus *Dittrichia* was described by GREUTER (1973) in the place of *Cupularia* Godron & Gren., being the latter an illegitimate name. In fact, GRENIER & GODRON (1851) have well defined the morphological circumscription of this genus, but unfortunately they have chosen a name previously used by LINK (1833) for treating other taxa. It is not even possible to utilize the generic name *Paniopsis*, proposed by RAFINESQUE-SCHMALTZ (1837), because this genus is as well illegitimate, since it includes, apart from *Erigeron viscosus* L., *E. graveolens* L. and *E. glutinosus* L., also *E. foetidus* L., type of the genus *Nidorella* Cass.

In the past the taxa belonging to the genus *Dittrichia* were included also in other genus, for instance LINNÉ (1753, 1755) referred them to *Erigeron*, MONNET DE LA MARCK (1779) to *Solidago*, AITON (1789) and DESFONTAINES (1799) to *Inula*, and finally NYMAN (1855) to *Pulicaria*.

RESULTS

On the bases of this investigation, the genus *Dittrichia* is represented by the following species:

DITTRICHIA Greuter, Exsicc. Genav. 4: 71 (1973)

Syn.: *Cupularia* Godron & Gren. in Grenier & Godron, Fl. France 2: 180 (1851), non Link (1833)

Paniopsis Raf., Fl. Tell. 2: 49 (1837), p.p.

Type: *Dittrichia viscosa* (L.) Greuter

1) *Dittrichia graveolens* (L.) Greuter, Exsicc. Genav. 4: 71 (1973). Fig. 1E, 2E, 3E, 4E, 5E, 6E.

Syn.: *Erigeron graveolens* L. in Juslenius, Cent. I. Pl.: 28 (1755)

Solidago graveolens (L.) Lam., Fl. Franç. 2: 145 (1779)

Inula graveolens (L.) Desf., Fl. Atlant. 2: 275 (1799)

Panicopsis graveolens Raf., Fl. Tell., 2: 49 (1837)

Cupularia graveolens (L.) Godron & Gren. in Grenier & Godron, Fl. France 2: 180 (1851)

Pulicaria graveolens (L.) Nyman, Syll. Fl. Eur.: 19 (1854-1855)

Type: LINN 994/4

Plant annual, herbaceous erect, densely glandular and hairy, 20-50 cm high. Lower leaves 15-50 (75) x 2-8 (13) mm, linear-lanceolate, normally curved, remotely denticulate, soft, opaque, obtuse to subacute at apex. Peduncles generally naked. Capitulum involucre subcylindrical 4-7 mm long, 3-5 mm in diameter, with bracts totally herbaceous and densely glandular bordered by a hyaline margin; outer bracts 2.5-4 x 0.5-1.2 mm, linear-triangular, curved outwards; inner bracts 4-7 x 0.7-1 mm, linear-lanceolate, erect bordered by hyaline margin. Female flowers ligulate with tube 2.5 mm long and ligule 3.5-4 x 1.3-1.5 mm, scarcely exceeding the involucre. Hermaphrodite flowers tubular, 4.5 mm long, 0.3-0.6 mm in diameter, with teeth triangular, erect, 0.3-0.5 mm long. Ovary elliptical to obovate-cylindrical, 1.3-1.5 mm long, with pappus in the female flowers covering 1/2 of the ligule, and in the hermaphrodite flowers equalling the tube. Achenes 1.8-2 mm long, obovate-cylindrical, hairy with glands in the upper part; pappus c. 4 mm long. Receptacle piths with coronule irregularly dentate-incised.

Ecology

D. graveolens is a nitrophilous species, linked to cultivated land, abandoned fields, road-sides, ruderal places and other anthropic habitats. It occurs mainly on arid and well nitrified soils, where it grows during the summer and autumn period.

Distribution

D. graveolens is widespread in the all Mediterranean territory, penetrating marginally in the Western Atlantic European coast and Middle East (Iran, Iraq, Afghanistan, NW India) (Fig. 7E).

2) *Dittrichia viscosa* (L.) Greuter, Exsicc. Genav. 4: 71 (1973). Fig. 1A, 2A, 3A, 4A, 5A, 6A.

Syn.: *Erigeron viscosum* L., Sp. Pl.: 863 (1753)

Senecio littoralis Scop., Fl. Carniol, ed. 2, 2: 162 (1772)

Solidago viscosa (L.) Lam., Fl. Franç., 2: 144 (1779)

Inula viscosa (L.) Aiton, Hort. Kew., 3: 223 (1789)

Paniopsis viscosum Raf., Fl. Tell., 2: 49 (1837)

Pulicaria viscosa (L.) Koch, Syn. Fl. Germ., ed. 1: 361 (1837)

Cupularia viscosa (L.) Godron & Gren. in Grenier & Godron, Fl. Franç. 2: 181 (1851)

Type: LINN 994/2

Plant perennial, woody at base, erect, densely glandular and hairy, 40-130 cm high. Lower leaves 30-70 x 2-30 mm, oblong-lanceolate to linear triangular, flat, manifestly serrulate to remotely denticulate, soft, upper sessile, semiamplexicaul, opaque, obtuse, rarely subacute at apex. Peduncles covered with scattered leaf-like scales 1-2.5 mm long. Capitulum involucre subconic 6-8 mm long, 5-6 mm in diameter with bracts herbaceous and densely hairy-glandular in the upper and central part, in the remaining parts cartilaginous and hairy; outer bracts 1-2 x 0.5-0.7 mm, linear-triangular, appressed; inner bracts 3.5-7 (8) x 0.6-1 mm, linear-lanceolate, erect. Female flowers ligulate with tube 4-4.5 mm long and ligule 8-12 x 2.5-2.8 mm, long exceeding the involucre. Hermaphrodite flowers infundibular, 6-7.5 mm long, 1.2-1.5 mm in diameter, with teeth triangular, divaricated 0.7 mm long. Ovary elliptical to obovate-cylindrical, 1.8-2 mm long, with pappus in the female flowers covering 1/10 of the ligule, and in the hermaphrodite flowers lightly shorter than the tube. Achenes 2-2.2 mm long, subcylindrical, hairy with glands in the upper part; pappus c. 6 mm long. Receptacle piths with coronule minutely dentate.

Ecology

In the natural habitats, corresponding to primary habitats, *Dittrichia viscosa* is localized on gravel riverbeds, mountain screes and volcanic scorias, sometimes on sandy soils and rocky coasts. *D. viscosa* occurs also in the secondary habitats, represented by road-sides, abandoned fields and walls. On the whole, *D. viscosa* shows a remarkable pioneer character and therefore it colonizes places where there is no or hardly any competition among the plants.

Distribution

Dittrichia viscosa is mainly distributed in the Western Mediterranean areas (Morocco, Algeria, Tunisia, Yugoslavia, Albania, Sicily, Italy, Corse, Sardinia, Balears, France, Spain, Portugal, except SW part) with penetration in W Greece and Bulgaria, while it is adventitious in the Macaronesian countries (Fig. 7A).

3) *Dittrichia revoluta* (Hoffmanns. & Link) Brullo & De Marco, comb. nov. Fig. 1C, 2C, 3C, 4C, 5C, 6C.

Syn.: *Inula revoluta* Hoffmanns. & Link, Fl. Portug. 2: 290 (1825)

Inula viscosa subsp. *revoluta* (Hoffmanns. & Link) P. Silva in Mem. Soc. Brot. 21: 368 (1971)

Dittrichia viscosa subsp. *revoluta* (Hoffmanns. & Link) P. Silva & Tutin
in Bot. J. Linn. Soc. 67: 282 (1973)

Type: Portugal, En Algarve, entre Lagoa e Villanova, *Hoffmannsegg* (not seen).

Plant perennial, woody at base, erect, densely glandular, subglabrous to sparsely hairy, 30-100 cm high. Lower leaves 25-60 (70) x 1-3 (4) mm, linear, strongly revolute at margin, absolutely entire, rigid, sessile, semiamplexicaul, shining, subobtusate to rounded at apex. Peduncles covered with scattered small leaves, 2.5-4 mm long. Capitulum involucre shortly subconic, 5-6 mm long, 3-3.5 mm in diameter with bracts herbaceous densely hairy-glandular in the top and central part, cartilaginous in the remaining parts, subglabrous to sparsely glandular; outer bracts 1-2 x 0.4-0.6 mm, linear-triangular, appressed; inner bracts 2.5-5.5 x 0.4-0.6 mm, linear-lanceolate, erect. Female flowers ligulate with tube 2-2.5 mm long and ligule 5-5.5 x 1-1.2 mm, long exceeding the involucre. Hermaphrodite flowers tubular-hypocrateriform, 5-6 mm long, 0.4-0.5 mm in diameter, with teeth linear-triangular, divaricated 0.7-0.8 mm long. Ovary elliptical 1.3-1.5 mm long, with pappus in the female flowers covering 1/3 of the ligule, and in the hermaphrodite flowers covering the tube up to tooth base. Achenes 1.4-1.6 mm long, subcylindrical, hairy with glands in the upper part; pappus c. 5 mm long. Receptacle piths with coronule provided with 5-6 short teeth.

Ecology

Dittrichia revoluta is a synanthropic species, occurring along the road-sides or more rarely in the uncultivated fields.

Distribution

Dittrichia revoluta is exclusive of SW Portugal, where it occurs mainly in the coastal zones (Fig. 7C).

4) *Dittrichia orientalis* Brullo & De Marco, sp. nov. Fig. 1B, 2B, 3B, 4B, 5B, 6B.

Syn.: *Inula viscosa* var. *angustifolia* Béguinot in Bull. Soc. Bot. Ital. 1912: 222 (1912)

Type: Crete, Alikianos, near Chania, along road-sides, 20.07.1999, *Brullo & Giusso s.n.* (holotype CAT).

Planta erecta lignosa basin versus, glandulosa, pilosa. Folia 20-60 x 2-8 (10) mm linearia vel lineari-lanceolata, plana breviter serrulata, rare integra, subrigida, sessilia, nitida, acuta apice. Capitula subcylindrica 7-8 mm longa, 4-4,5 mm diametro, bracteis lineari-lanceolatis, dense glandulosis, cartilagineis et subglabris margine, exterioribus 3-5 x 0,6-1 mm, interioribus 3-7,5 x 0,3-0,8 mm. Flores femineae ligulati, tubo 2,5-3 mm longo, ligula 6-8 x 1,5-1,6 mm.

Flores hermaphroditi tubulosi, 5-6 mm longi, leviter urceolati apice. Ovarium ellipticum, 1,4-1,5 mm longum. Achenia 1,7-2 mm longa, subcylindrica vel ellipsoidea, pilosa, glandulosa superne. Foveae receptaculis coronula minute dentata et dentibus papillatis apice.

Plant perennial, woody at base, erect, densely glandular, sparsely to densely hairy, 30-100 cm high. Lower leaves 20-60 x 2-8 (10) mm, linear to linear-lanceolate, flat, remotely and shortly serrulate, rarely entire, subrigid, sessile, semiamplexicaul, shining, acute at apex. Peduncles covered with sparse leaves, 4-9 mm long. Capitulum involucre subcylindric 7-8 mm long, 4-4.5 mm in diameter with bracts densely glandular in the top and central part, cartilaginous in the remaining parts, subglabrous; outer bracts 3-5 x 0.6-1 mm, linear-lanceolate, erect, not appressed; inner bracts 3-7.5 x 0.6-0.8 mm, linear-lanceolate, erect. Female flowers ligulate with tube 2.5-3 mm long and ligule 6-8 x 1.5-1.6 mm, long exceeding the involucre. Hermaphrodite flowers tubular-conic, lightly urceolate at apex, 5-6 mm long, 1-1.2 mm in diameter, with teeth triangular, divaricated, 0.7-0.8 mm long. Ovary elliptical 1.4-1.5 mm long, with pappus in the female flowers covering 1/3-2/5 of the ligule, and in the hermaphrodite flowers covering the tube up to tooth base. Achenes 1.7-2 mm long, subcylindrical to ellipsoid, hairy with glands in the upper part; pappus 5-5.5 mm long. Receptacle piths with coronule minutely dentate and teeth provided with a papilla at apex.

Ecology

The natural habitat of *Dittrichia orientalis* is represented by gravel riverbeds, where it grows on pebbles along the more peripheric stretches. It occurs also in the synanthropic places as road-sides, abandoned fields and walls, which represent its secondary habitat.

Distribution

Dittrichia orientalis is distributed in the East Mediterranean area and in particular in Cyprus, Syria, Lebanon, Israel, Jordan, Egypt, Libya, Aegean Islands, E Greece and the Western and Southern coast of Turkey (Fig. 7B). It has to be considered the eastern vicariant of *D. viscosa*. Hybrids between these two species are frequent in the contact zones (Greece and Aegean area).

5) *Dittrichia maritima* Brullo & De Marco, sp. nov. Fig.1D, 2D, 3D, 4D, 5D, 6D.

Type: Portugal, Algarve, Vila do Bispo, El - Castelejo, 24.09.1995, *Brullo & De Marco s.n.* (holotype: CAT).

Planta prostrata, fruticosa, dense glandulosa, subglabra vel sparsim pilosa. Folia 15-35 x 2-8 mm, lineari-elliptica, leviter revoluta, integra, rigida, sessilia,

incurvata, nitida, obtusa vel subobtusa apice. Capitula cylindrico-subconica 6-8 mm longa, 3,5-4,5 mm diametro, bracteis dense glandulosis, cartilagineis et subglabris margine, exterioribus triangularis vel lineari-triangularis 1-1,5 x 0,5-0,6 mm, interioribus lineari-lanceolatis 2,5-7,5 x 0,5-0,6 mm. Flores feminei ligulati, tubo 3-3,5 mm longo, ligula 5,5-6 x 2-2,3 mm. Flores hermaphroditi tubulosi, 5-5,5 mm longi. Ovarium ellipticum, 1,6-1,8 mm longum. Achenia 1,8-2 mm longa, ellipsoidea, omnino pilosa et glandulosa. Foveae receptaculis coronula 6-7 brevibus dentibus praedita.

Plant perennial, dwarf shrub, with many woody caudicles, prostrate, densely glandular, subglabrous to sparsely hairy, 10-30 cm high. Lower leaves 15-35 x 2-8 mm, linear-elliptical, slightly revolute at margin, entire, rarely with some sporadic hairs at margin, rigid, curved, sessile, semiamplexicaul, shining, obtuse to subobtuse at apex. Peduncles covered with leaf-like scales 0.8-1.2 mm long. Capitulum involucre long cylindrical-subconic 6-8 mm long, 3.5-4.5 mm in diameter with bracts densely glandular in the top and central part, cartilaginous in the remaining parts, subglabrous; outer bracts 1-1.5 x 0.5-0.6 mm, triangular to linear-triangular, appressed; inner bracts 2.5-7.5 x 0.5-0.6 mm, linear-lanceolate, erect. Female flowers ligulate with tube 3-3.5 mm long and ligule 5.5-6 x 2-2.3 mm, long exceeding the involucre. Hermaphrodite flowers tubular, 5-5.5 mm long, 0.5-0.6 mm in diameter, with teeth triangular, divaricated 0.5-0.6 mm long. Ovary elliptical 1.6-1.8 mm long, with pappus in the female flowers covering 1/5 of the ligule, and in the hermaphrodite flowers covering almost totally the tube. Achenes 1.8-2 mm long, ellipsoid, totally hairy and glandular; pappus c. 6 mm long. Receptacle piths with coronule provided with 6-7 short teeth.

Ecology

Dittrichia maritima is a subhalophyte, linked to rocky coastal places, where it grows on siliceous substrata, rarely limestone. There, it is a member of a very specialized pulvinate shrub communities.

Distribution

Dittrichia maritima is localized on a very short coastal stretch of SW Portugal and exactly between Cape S. Vincente and Cape de Sines (Fig. 7D). Populations showing intermediate characters between *D. maritima* and *D. revoluta* occur in ruderal places into the distribution area of *D. maritima*.

DISCUSSION

The genus *Dittrichia* can be considered as a well differentiated and isolated taxon, showing some morphological relations with the genera *Inula* and *Pulicaria*. The differences regard mainly the pappus hairs, which in the genus *Inula*, like *Dittrichia*, are arranged in one whorl, but the hairs are free at the base,

while in the genus *Pulicaria* they are arranged in two whorls with the outer row more or less connate at the base.

Within genus *Dittrichia* the most ancestral species is clearly *D. maritima*, which differs from all the others in the habit prostrate and pulvinate, rootstock woody robust and well developed, leaves heavily rigid and obtuse, peduncles covered with dense and short leaf-like scales, capitula cylindric-subconic, achenes totally hairy and glandular, receptacle piths with coronule provided with 6-7 short teeth. Besides, *D. maritima* shows a very narrow distribution, occurring in a extremely specialized natural habitat, where it is a member of *Crithmo-Limonietea* communities, rich of rare and endemic species. For this reason, this species represents a very old taxon, probably the nearest one to the ancestors of the genus *Dittrichia*. *D. viscosa* and *D. orientalis* have, instead, a widespread distribution and are quite related among each other, clearly showing a more recent origin. The habitat of these species is represented by gravel riverbeds, where they are members of a natural pioneer vegetation belonging to *Thlaspietea rotundifolii*; they occur also in the subnitrophilous synantrophic places such as the road sides. As regards *D. revoluta*, it shows a narrow relation with *D. maritima*, mainly for the receptacle shape, from which it is probably originated on account of the colonization of ruderal habitats. Finally *D. graveolens*, which is the only strictly annual anthropochore species, arisen more recently, probably during the last Glacial periods. It is linked to synantrophic places, characterizing nitrophilous communities of *Stellarietea mediae*.

For the identification of the species of the genus *Dittrichia* the following key is given:

- 1 – Annual plant; capitulum bracts with a hyaline margin; outer bracts curved outwards; ligulate flowers scarcely exceeding the involucre.....**D. graveolens**
- 1 – Perennial plant; capitulum bracts without a hyaline margin; all bracts appressed; ligulate flowers long exceeding the involucre.....**2**
- 2 – Leaves soft, opaque, oblong-lanceolate to linear-triangular, generally manifestly serrulate, up to 3 cm wide; capitulum involucre 5-6 mm in diameter; ligule 8-12 x 2.5-2.8 mm; hermaphrodite flowers with corolla infundibular 6-7.5 mm long.....**D. viscosa**
- 2 – Leaves rigid or subrigid, shining, linear to linear-elliptical, entire or remotely serrulate, up to 8 mm wide; capitulum involucre 3.5-4.5 mm in diameter; ligule 5-8 x 1-2.3 mm; hermaphrodite flowers with corolla tubular to tubular-conic 5-6 mm long.....**3**
- 3 – Dwarf shrub, with many woody prostrate caudicles; peduncles with numerous scales 0.8-1.2 mm long; leaves linear-elliptical; ligule 2-2.3 mm wide; achenes with glands at apex.....**D. maritima**

- 3 – Plant herbaceous or woody at base, with herbaceous and erect stems; peduncles with scattered scales 1-9 mm long; leaves linear to linear-lanceolate; ligule 1-1.6 mm wide; achenes totally glandular.....4
- 4 – Leaves up to 8 mm wide, revolute, entire, acute at apex; capitulum involucre 5-6 mm long; ligule 5-5.5 x 1-1.2 mm.....**D. revoluta**
- 4 – Leaves up to 3 mm wide, flat, shortly serrulate, subobtuse or rounded at apex; capitulum involucre 7-8 mm long; ligule 6-8 x 1.5-1.6 mm **D. orientalis**



Fig. 1 - Capitula of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E).

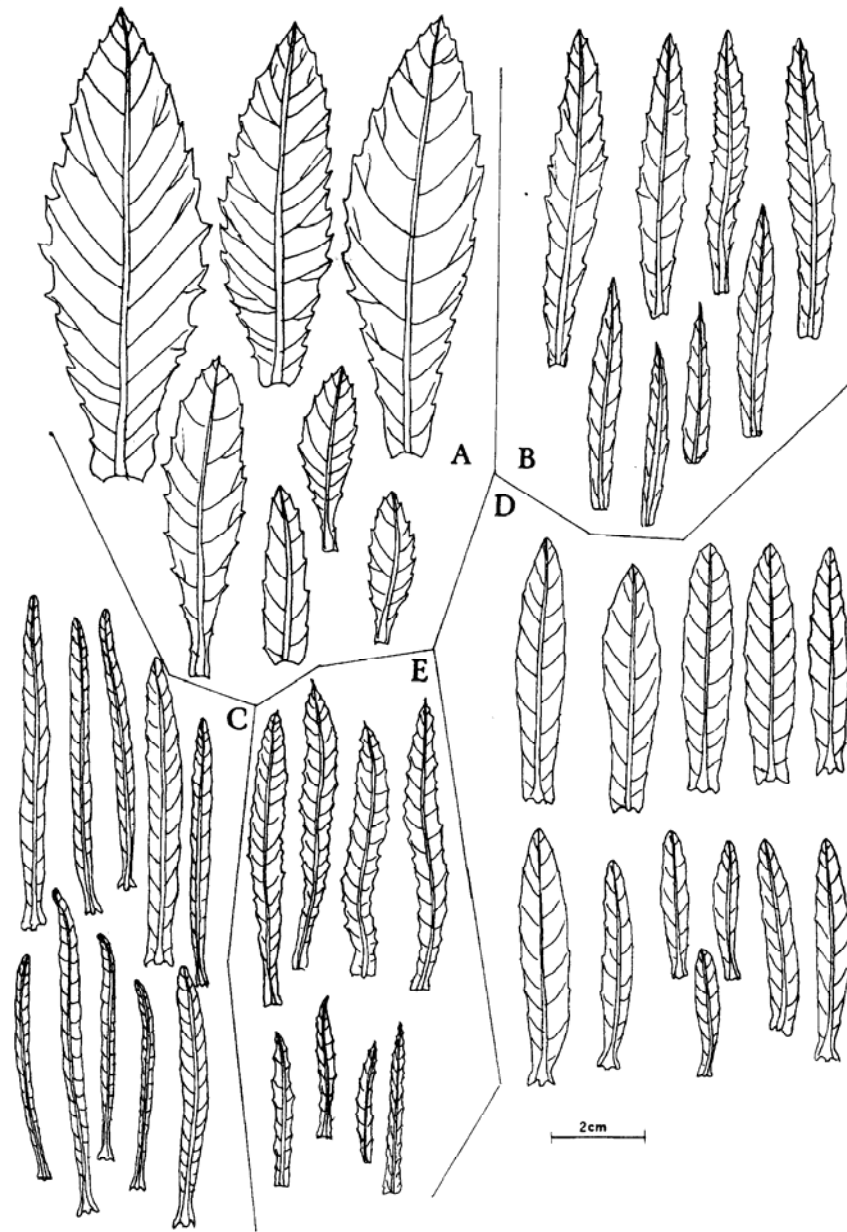


Fig. 2 - Leaves of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E).

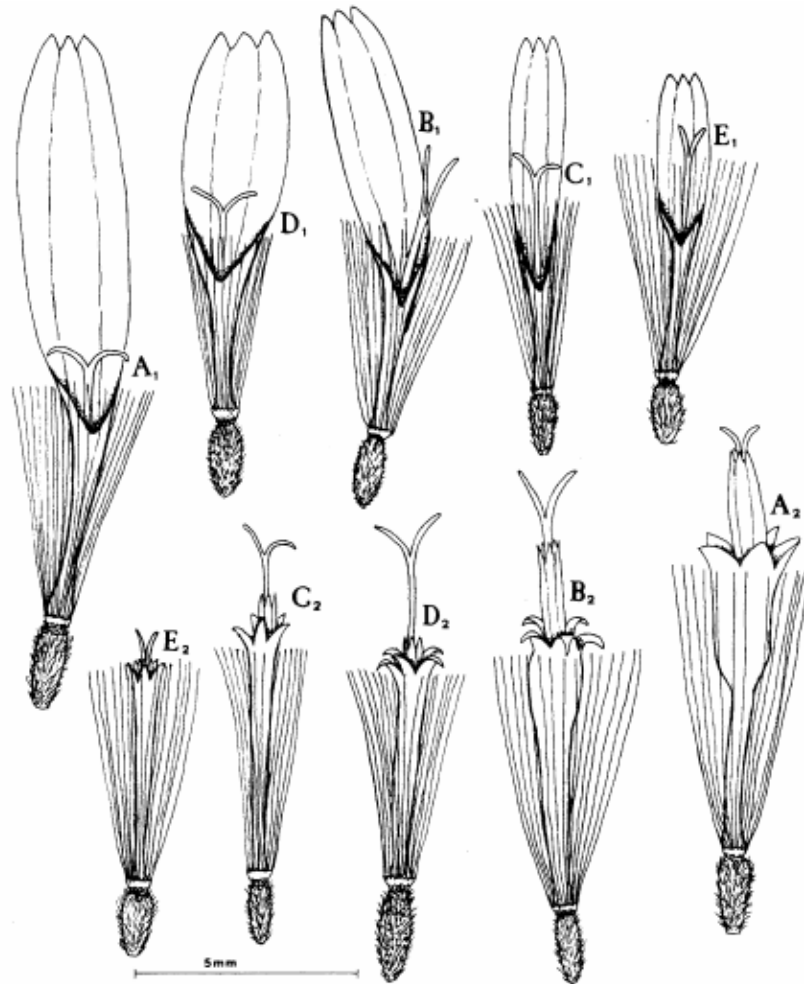


Fig. 3 - Female flowers (1) and hermaphrodite flowers (2) of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E).

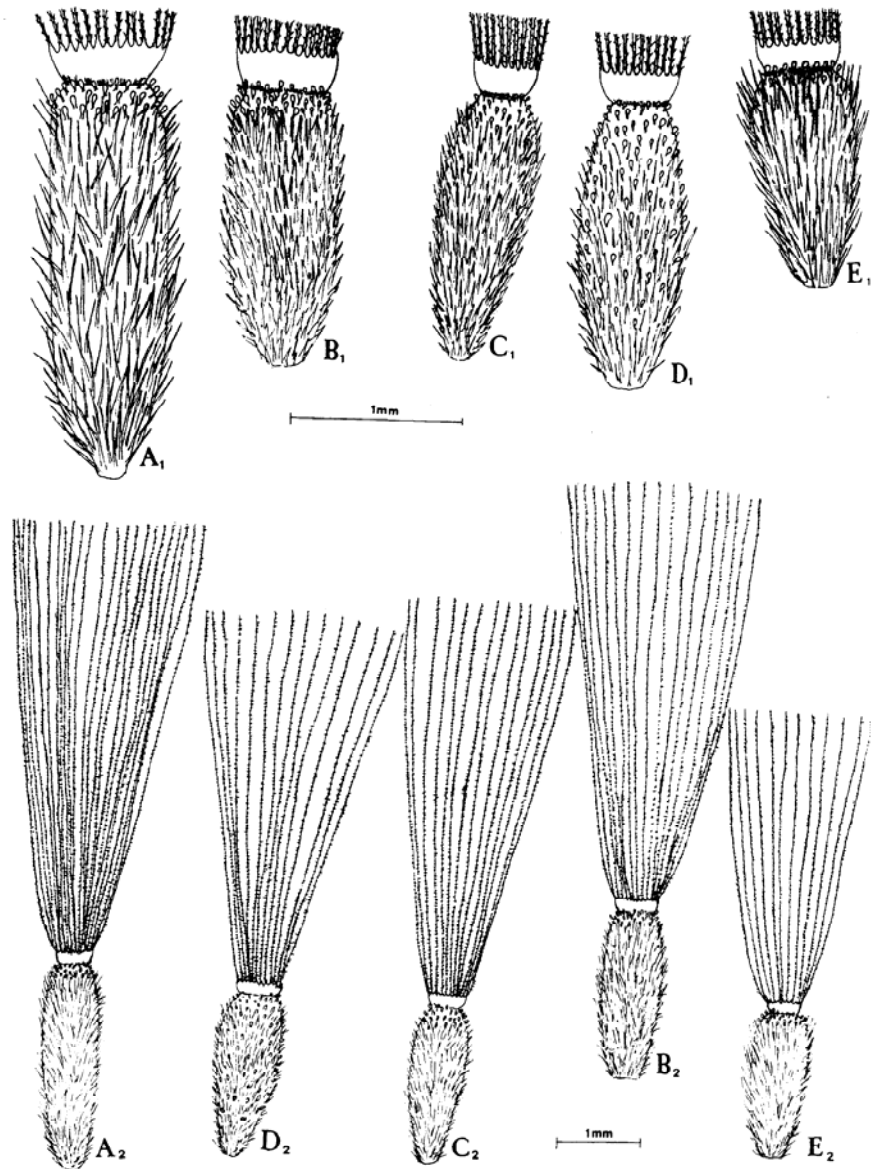


Fig. 4 - Detail of the achene (1) and cypsela (2) of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E).

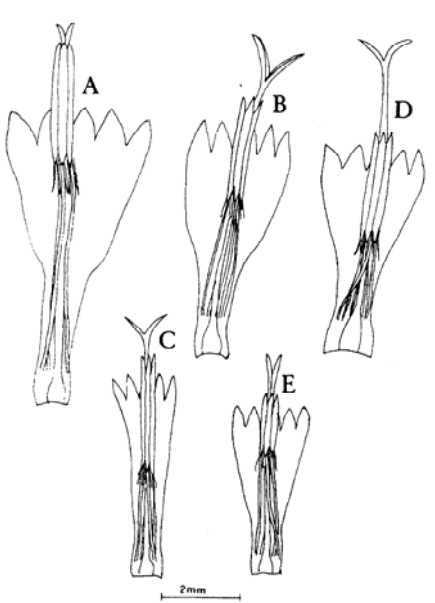


Fig. 5 - Open hermaphrodite flower of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E)

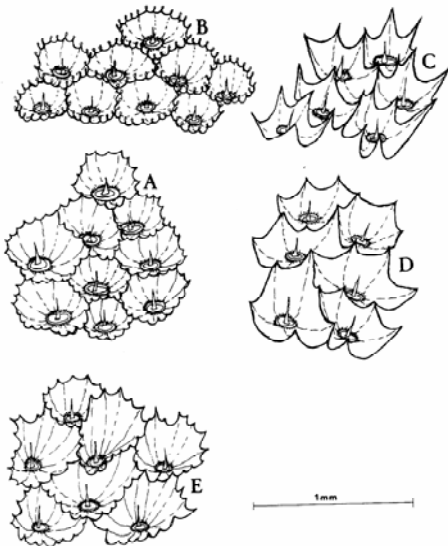


Fig. 6 - Receptacle piths of *D. viscosa* (A), *D. orientalis* (B), *D. revoluta* (C), *D. maritima* (D), *D. graveolens* (E)

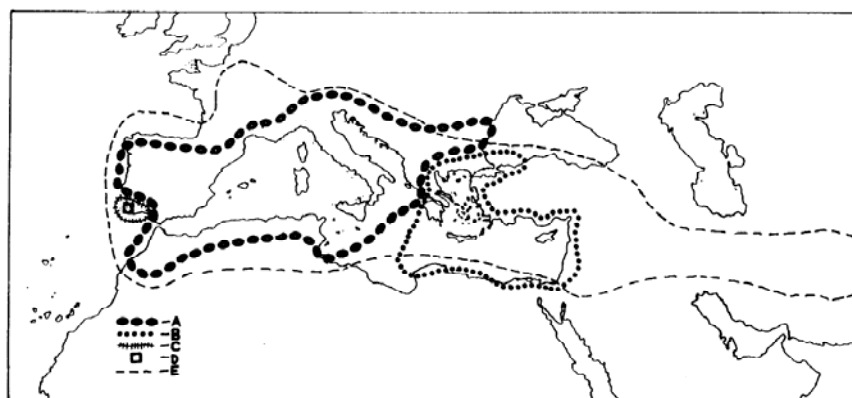


Fig. 7 – Geographic distribution of *D. viscosa* (A), *D. orientalis* (B), *D. revolute* (C), *D. maritime* (D), *D. graveolens* (E).

REFERENCES

- AITON, W. (1789). *Hortus kewensis, or a Catalogue of the Plants cultivated in the Royal Botanic Garden at Kew*. London.
- BALL, P.W. (1976). *Dittrichia* W. Greuter. In Tutin et al. (eds.), *Flora Europaea*, 4: 136-137. Cambridge.
- BÉGUINOT, A. (1912). Contribuzione alla flora estivo-autunnale dell'isola di Prinkipo (Mare di Marmara). *Bull. Soc. Bot. Ital.* 1912: 214-223.
- DESFONTAINES R. L. (1799). *Flora atlantica, sive Historia Plantarum, quae in Atlante, Agro tunetano et algeriensi crescunt*. 2. Parisiis.
- FRANCO, J. do AMARAL (1984). *Nova flora de Portugal (Continente e Açores)*. 2. Lisboa.
- GRENIER, J. C. M. & GODRON, D. A. (1851). *Flore de France, ou Description des plantes qui croissent naturellement en France et en Corse*. 2. Paris.
- GREUTER, W. (1973). *Exsiccatorum genavensium a conservatorio botanico distributorum*. 4. Genavae.
- HOFFMANNSEGG, J. C. von & LINK, J. H. F. (1825). *Flore Portugaise*. 2. Berlin.
- LINNE, C. von (1753). *Species Plantarum*. Holmiae.
- LINNÉ, C. von (1755). *Centuria Plantarum*. 1. Upsaliae.
- LINK, J. H. F. (1833). *Hortus regius botanicus berolinensis, descriptus*. 2. Berolini.
- MONNET DE LA MARCK, J. B. A. P. (1779). *Flore Française*. Paris.
- NYMAN C. F. (1855). *Sylloge Florae Europaeae*. Oerebroae.
- RAFINESQUE-SCHMALTZ, C. S. (1837). *Flora telluriana*. 2. Philadelphia.