

Capparaceae in the flora of Egypt

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A systematic revision of the native species of the family Capparaceae (*Cleome* excluded) was carried out. The presence of *Boscia angustifolia* in Egypt is uncertain, while *Capparis spinosa* is represented in Egypt by 3 varieties viz. : *spinosa*, *inermis* & *deserti*.

Diagnostic characters of the taxa are given and a key for the separation of species and varieties, synonyms and notes on distribution are provided. SEM features of the leaf epidermis were proved to be of taxonomic significance.

Key words: *Boscia*, *Cadaba*, Capparaceae, *Capparis*, *Dipterygium*, Egypt; *Maerua*.

Introduction

The Capparaceae is a medium-sized family, containing 40-50 genera with about 700 species. Few of its members are of horticultural or economic importance. The family inhabits the warmer parts of the world, mainly in the tropics and subtropics of both hemispheres and in the Mediterranean. It is well represented by about 15 genera in Africa where it forms a conspicuous element of the flora of dry regions.

It is generally agreed that the Capparaceae is allied to the Cruciferae and that both are evolved from a common ancestor. Heywood (1978), referred to some relationships that this family has with the Papaveraceae and Resedaceae.

The present work deals with the native taxa belonging to the genera : *Capparis*, *Cadaba*, *Boscia*, *Maerua* and *Dipterygium*. Special attention is paid to the earlier applied characters as well as other macro- and micromorphological characters which were not the subject of earlier investigations and which may prove their of systematic value.

SEM features of the leaf epidermis, viz. of the cell patterns, anticlinal cell boundaries and the periclinal cell walls, show a wide range of variation and provide useful diagnostic characters. Various works have shown that these microcharacters can be used at generic, specific and even at infrspecific level (Ball & Heywood, 1962; El-Karemy & Hosni, 1993; Mc Clure, 1957 and Syed *et al.* 1990).

The present account is based on the collections of Cairo University Herbarium (CAI) and Assiut University Herbarium as well as field observations.

With the exception of *Capparis spinosa* var. *inermis*, which is confined to the Mediterranean coastal land of Egypt and *C. spinosa* var. *deserti* which is confined to the northwestern corner of the country (Sollum, Matruh and Siwa area), the remaining investigated taxa are distributed mainly within the Sahelian scrub in Gebel Elba district.

Characters of systematic value

1.Habit

Among the investigated species, only *Dipterygium glaucum* is a perennial herb, not exceeding 80 cm high. *Boscia senegalensis* and *Maerua crassifolia* are trees, attaining 6m tall, while the remaining species are shrubs, or climbing on other trees.

2. Leaf characters

Leaf characters proved to be of great importance for the distinction of the investigated taxa. The leaves are generally present, except in *Capparis decidua* and *Dipterygium glaucum* which are almost leafless. Leaves are simple, being occasionally digitally compound in *Dipterygium glaucum*. Furthermore, the leaves are more or less ovate in outline, or linear-oblong to linear in *Capparis decidua* and *Dipterygium glaucum*. The leaves of the majority of the investigated taxa are almost glabrous or possess simple hairs. In *Cadaba glandulosa* the leaves are densely covered with long-stalked glandular hairs. They are densely covered with short-stalked, white, peltate hairs (farina) in *Cadaba farinosa* hence the specific name of the species. In *Cadaba rotundifolia* the leaves are densely to sparsely covered with swollen- based hairs (Fig. 2b).

Stipular characters are very useful in the differentiation between the infraspecific taxa of *Capparis*. In *Capparis spinosa* var. *spinosa* (including var. *canescens*), the stipules are often spinose; in var. *inermis* the stipules are setaceous and inconspicuous, whereas var. *deserti* is characterised by patent yellow stipular spines.

On the other hand, leaf venation is of special interest in *Boscia senegalensis*, where the leaves are distinctly reticulate, with 5-6 lateral nerves raised on both surfaces and prominently looped.

3. Floral Characters

The calyx in most of the revised taxa is characterised by subequal sepals. In *Capparis decidua* and *C. cartilaginea*, the posterior sepal is the largest and helmet-shaped.

Petals are absent in *Cadaba rotundifolia*, *C. glandulosa*, *Boscia senegalensis* and *Maerua crassifolia* (Fig. 1). In *Capparis decidua* the petals are red, and range in colour between white and yellow in the rest of the studied taxa. Species of *Capparis* and *Maerua* are characterised by flowers with numerous stamens, whereas the stamens number is limited in *Cadaba* (4-5), in *Dipterygium* (6) and in *Boscia* (4-9); (Fig. 1).

The species of *Cadaba* are characterised by a long ligulate appendage (nectary) attached to the gynophore. *Cadaba farinosa* is characterised by tubular nectary which is shortly toothed at the tip and not exceeding 5 mm long, it is tubular and petaloid above, reaching 2 cm long in *Cadaba rotundifolia* and *Cadaba glandulosa* (Fig.1).

4. Fruit characters

The present investigation proved that the characters of the fully developed fruit, applied by earlier investigators, are still among the most reliable diagnostic characters.

Capparaceae in the flora of Egypt

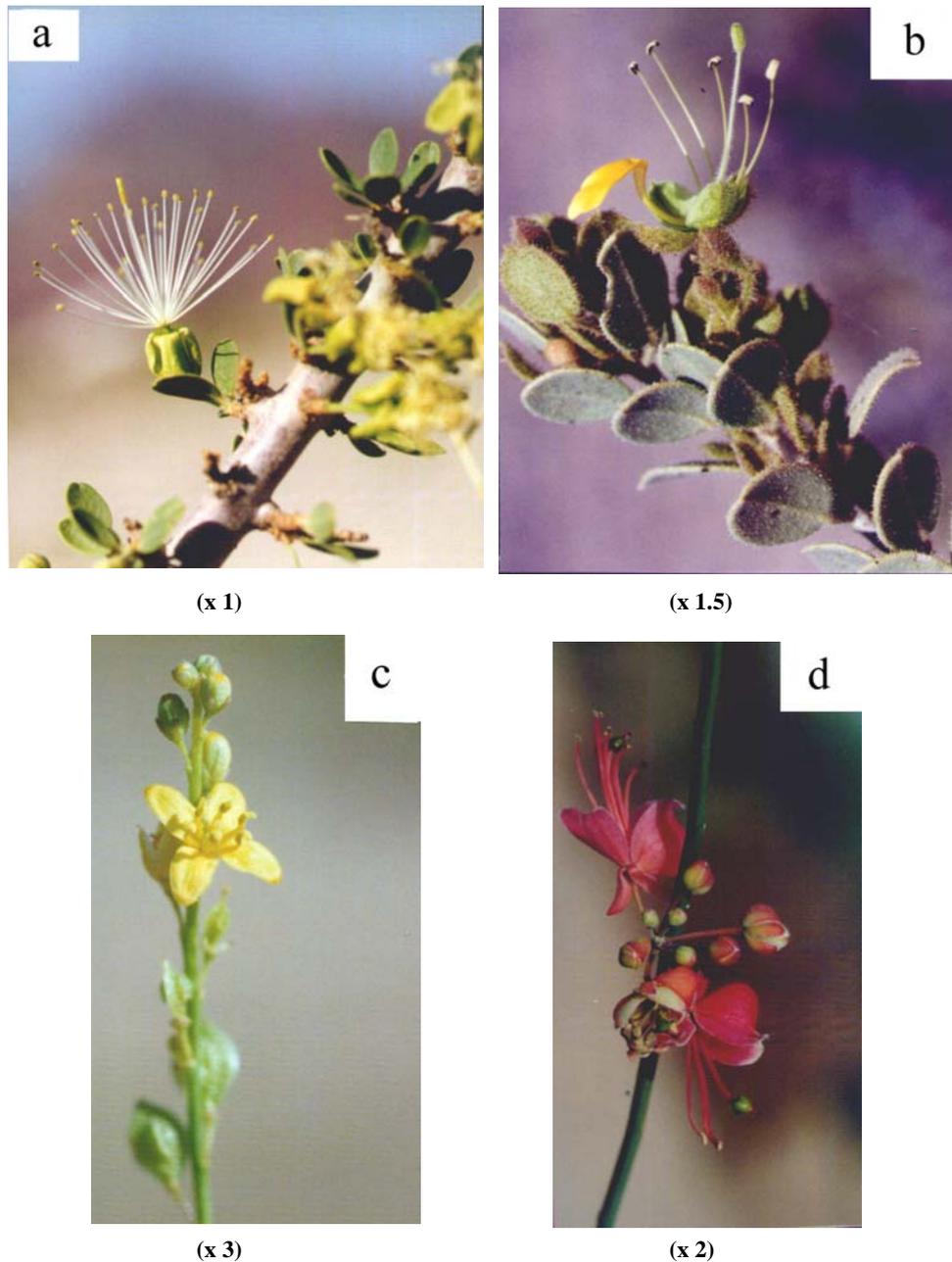


Figure 1. Flowers and fruits of representative species

- a.** *Maerua crassifolia* (petals 0, stamens ∞); **b.** *Cadaba glaindulosa* (petals 0, nectarial appendage petaloid, stamens 5); **c.** *Dipterygium glaucum* (petals 0, stamens 5); **d.** *Capparis decidua* (sepals unequal with the posterior larger and helmet-shaped).



(x 4.0)



(x 10)

Figure 1, continued. Flowers and fruits of representative species:

e, *Maerua oblongifolia* (unilaterally torulose); **f**, *Dipterygium glaucum* (narrowly winged, muricate).

4.a . Shape and size

Five shape categories are recognized: pyriform (*Capparis spinosa* and *C. cartilaginea*), globose (*Capparis decidua* and *Boscia senegalensis*), cylindrical (*Cadaba* species), torulose (*Maerua* species) and elliptic in *Dipterygium glaucum* (Fig.1f).

The smallest fruits are those of *Dipterygium glaucum* and *Capparis decidua*, where the fruit measures between 3.5 and 15 mm long. In *Boscia senegalensis* the fruit is larger, ranging between 1-2.5 cm long. In *Cadaba* species the fruit measures 1.5x0.2-0.8 cm, while those of *Maerua* species it measure 1-2.5x2-4 cm. The largest fruits are those of *Capparis spinosa* and *Capparis cartilaginea* being 2.5-5.5x4-9 cm.

4.b . Indumentum

Most species are characterized by more or less minutely tomentose or even glabrous fruits. In *Cadaba glandulosa* the fruit is covered with long-stalked glands, while those of *C. farinosa* are farinose.

5 . SEM features of leaf epidermis (Figure 2)

Most of the investigated species are characterized by almost glabrous leaves, only in studied species *Cadaba*, the leaves are glandular-hairy. The hair structure was found very useful in the distinction of the *Cadaba* species. In *Cadaba glandulosa*, the leaves are densely covered with long stalked glandular hairs. In *Cadaba farinosa*, the leaves are densely covered with white peltate hairs which constitute the white indumentum leaf covering (farina) characteristic to this species. In *Cadaba rotundifolia*, the leaves are densely to sparsely covered with swollen- based glandular hairs.

Generally the investigated epidermal cells were found to be more or less isodiametric or elongated in one direction, while the anticlinal boundaries are slightly raised, sinuate and smooth. On the other hand, the periclinal cell walls were found to be variable within the examined species. In *Dipterygium glaucum* they are flat, and in *Boscia senegalensis* the periclinal cell walls are distinctly reticulate. In *Capparis* species they are reticulate with the exception of *Capparis decidua* where the periclinal cell walls are microstriate. Moreover, *Capparis decidua*, *C. cartilaginea* and *Boscia senegalensis* are characterized by sunken stomata namely.

Systematic treatment

1. *Capparis* L.

The genus *Capparis* comprises about 250 species, mainly in tropical regions of both hemispheres, nearly half of which are American. Zohary (1960), recognised six species of *Capparis* occurring in the Mediterranean and Near Eastern countries.

According to Täckholm (1974), six species, including one variety were reported from Egypt viz: *Capparis decidua* (Forssk.) Edgew., *C. cartilaginea* DC., *C. aegyptia* Lam., *C. leucophylla* DC. (including var. *microphylla* (Ledeb.) Täckh.), *C. deserti* (Zoh.) Täckh. and *C. orientalis* Duh.

The present revision revealed the presence of three species of which *Capparis spinosa* L. is polymorphic and includes three varieties:

1.1. *Capparis decidua* (Forssk.) Edgew., Proc. Linn. Soc. Bot. 6 : 184 (1862).

Syn.: *Sodada decidua* Forssk., Fl. Aegypt.- Arab. 81 (1775).

Type : Arabia, Yemen, *Forsskal* (C).

Distribution : Uncommon shrub in the desert plains and wadi beds. Known from N. and Tropical Africa, Arabia, eastwards to India.

Representative specimens : Red Sea hills, wadi Atalla, 24.3.1965, *Osborn & Helmy* s.n. (CAI); Mersa Alam, Feb. 1977, *El-Gazzar* (CAI); Gebel Elba, 23.1.1929, *G. Täckholm* s.n. (CAI).

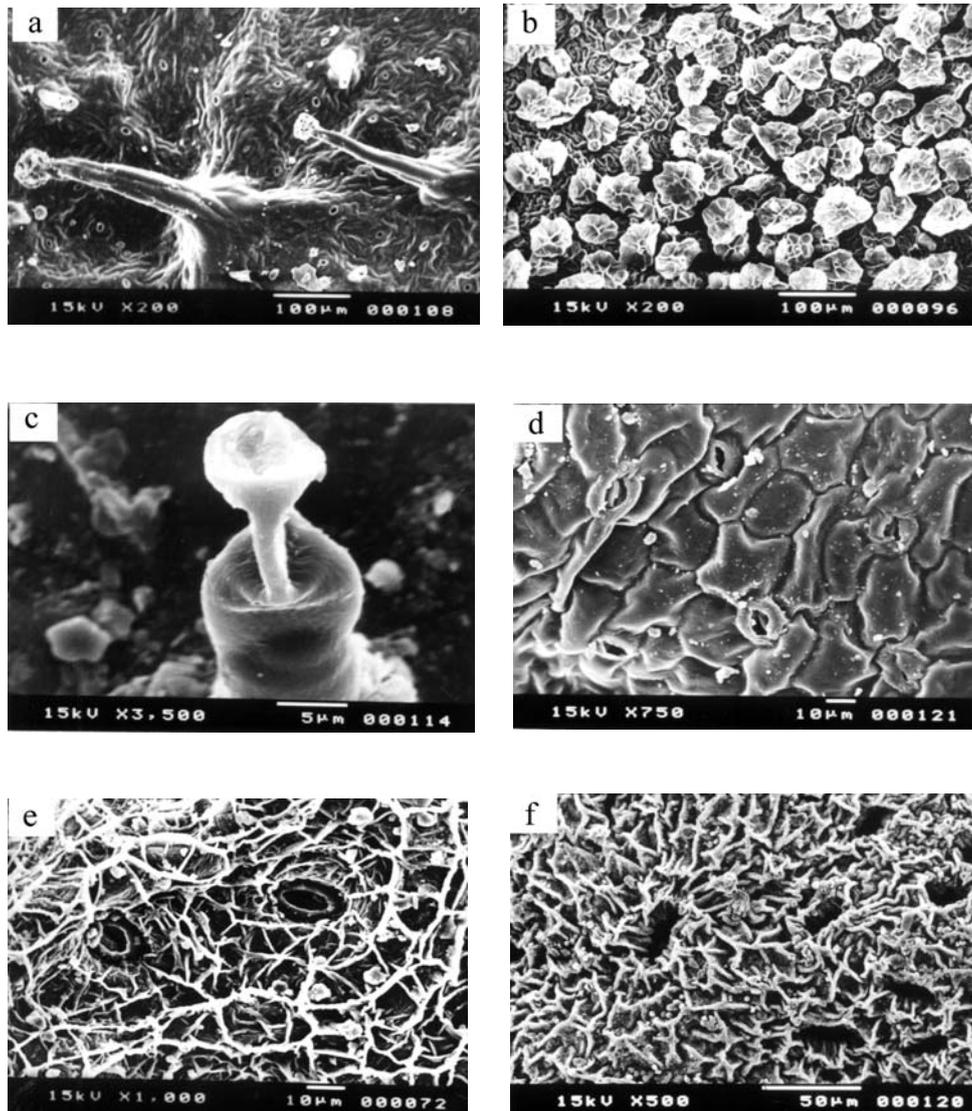


Figure 2. SEM features of leaf epidermis among the investigated species of Capparaeae. **a.** *Cadaba glaindulosa*, indumentum of long stalked glandular hairs; **b.** *Cadaba farinosa*, white indumentum of peltate hairs; **c.** *Cadaba rotundifolia*, indumentum of swollen based glandular hairs; **d.** *Dipterygium glaucum*, epidermal cell flat with slightly raised stomata; **e.** *Capparis spinosa* var. *spinosa*, epidermal cell walls reticulate with sunken stomata; **f.** *Boscia senegalensis*, epidermal cell walls reticulate with sunken stomata.

1.2. *Capparis cartilaginea* Decne., Ann. Sci. Nat. Bot., ser. 2, 3: 273 (1835).

Syn.: *Capparis sinaica* Veill. In Duh., Traite. Arbr. Arbust., ed. 2,1:144 (180);
Capparis galeata Fresen., Mus. Senkenb. 2 : 111 (1837).

Type : Egypt, Sinai, *Bové* 148 (P).

Distribution: Common on rocks of Wadi beds. Known from S.W. and E. Africa, Palestine, Iraq, Arabia, S. Iran and Pakistan.

Representative specimens : S. Galala, Wadi Askhar, 14.5.1945, *Shabetai* 5824 (CAI); Gebel Al-Shayeb, 11.2.1960, *Täckholm et al* s.n (CAI) ; Sinai, mountain region, April 1956, *El Hadidi* s.n (CAI); Gebel Elba, Wadi Mawaw, 28.1.1962, *Täckholm et al.* s.n. (CAI).

1.3. *Capparis spinosa* L., Sp. Pl., ed. 1.503 (1753) .

Represented in Egypt by three varieties:

1.3.1. var. *spinosa*

syn.: *Capparis aegyptia* Lam., Encycl. 1:605 (1785); *Capparis spinosa* L. var. *aegyptia* (Lam.) Boiss., Fl. Orient. 1:420 (1867); *Capparis spinosa* var. *canescens* Coss., Notes pl. crit. 1:28 (1848) ; *Capparis leucophylla* DC., Prodr. 1:246 (1824).

Type : Specimen labelled as *Capparis aculeata* in herb. Hort. Cliff. (BM).

Representative specimens : Sinai, St. Catherine Monastery, 10.5.1956, *El Hadidi* s.n. (CAI); Wadi Hof, 14.4.1930, *Oliver* s.n. (CAI) ; Red Sea coast, 10.5.1956, *Täckholm* 24 (CAI); 130 km S Mersa Matruh, on the way to Siwa, 27.10.1963, *Boulos* s.n. (CAI).

1.3.2. var. *inermis* Turra, Fl. Ital. Prodr. 65 (1780).

syn.: *Capparis orientalis* Duh., Traite Arbr., ed. 2,1:142 (1801); *Capparis spinosa* L. subsp. *orientalis* (Duh.) Jafri in Ali & Jafri, Fl. Libya 12:3 (1977).

Type: "Les rochers de l'isle de Crete et des iles de l'Archipel, particulierement celle d'Antiparos; en Syrie et dans la Palestine".

Representative specimens : Sollum, 24.5.1963, *Täckholm et al.* s.n. (CAI); Wadi Agiba, 5.3.1976, *Täckholm et al.* s.n. (CAI); Mariut, 2.5.1955, *El Hadidi* s.n. (CAI).

1.3.3. var. *deserti* Zohary, Bull. Res. Council Israel D, 8:54 (1960).

syn.: *Capparis deserti* (Zohary) Tackh. Boulos, Publ. Cairo Univ.Herb. 5:14 (1974).

Type: not designated.

Representative specimens : Road between Mersa Matruh and Siwa Oasis, near Bir El Basm, 90 km from Mersa Matruh, 10.8.1953, *Boulos* s.n. (CAI); 145 km from Mersa Matruh, 10.8.1953, *Abdel-Fadeel* 47 (CAI).

Distribution of the species: Wadis and cliffs in the Eastern and Western deserts. Known from the Mediterranean region, W. and Central Asia to India.

2. *Cadaba* Forssk.

The genus *Cadaba* includes 30 species, chiefly in the tropics of the Old World, especially Africa. It is characterised by the long ligulate appendage of the gynophore, the nectary.

Cadaba is called after the Yemen plant name as “Qadab” which is the local name for *Cadaba rotundifolia* (Wood, 1997). Three species occur in Egypt.

2.1. *Cadaba rotundifolia* Forssk., Fl. Aegypt. – Arab. 68 (1775).

Type : Yemen, *Forsskal* (C,BM).

Distribution: Confined to the *Acacia* bushland of the coastal plains and escarpment foothills of the southeastern parts of Egypt. Known from Sudan, Kenya, Ethiopia, Djibuti, Somalia, Saudi Arabia and Yemen.

Representative specimens : Gebel Elba; Wadi Kansisrob, 4.2.1933, *Drar* s.n; 24.10.1956, *Boulos* (CAI); Wadi Serimtai, 23.1.1962, *Täckholm et al.* 354 (CAI) – Khor Wadi Siamtit, *Täckholm et al.* 354 (CAI).

2.2. *Cadaba glandulosa* Forssk., Fl. Aegypt. – Arab. 68 (1775).

Type : Yemen, *Forsskal* (C).

Distribution: Confined to the *Acacia* bushland on rocky slopes of Gebel Elba distinct. Known from Sudan, Uganda, Kenya, Tanzania, Mali, Saudi Arabia and Yemen.

Representative specimens : Gebel Elba; Gebel Alafoot, 7.2.1962. *Täckholm et al.* 1680 (CAI).

2.3. *Cadaba farinosa* Forssk., Fl. Aegypt. – Arab. 68 (1775).

Type : Yemen, *Forsskal* (C).

Distribution : In Egypt, confined to the *Acacia* bushland, on rocky and sandy slopes of the southeastern desert. Widespread in tropical Africa, Arabia, Pakistan and India.

Representative specimens: Mersa Halaib, 21.1.1929, *G. Täckholm* s.n. (CAI); Gebel Elba: Wadi Aideib, 20.1.1962, *Täckholm et al.* 129 (CAI); Khor Wadi Siamtit, 23.1.1962, *Täckholm et al.* 358 (CAI); Wadi Oalak, 27.1.1962, *Täckholm et al.* 668 (CAI) ; Wadi Mera Kwan, 10.2.1962, *Täckholm et al.* 2047 (CAI).

3. *Boscia* Lam.

Comprises 37 species, mainly in tropical and southern Africa. Represented in Egypt by *Boscia senegalensis*.

3.1. *Boscia senegalensis* Poir. In Lam., Tab. Encycl. 2:517 (1819).

Type : not designated.

Distribution: Rare on the stony ground of the southwestern parts of Egypt. Known also from Sudan, Chad, Nigeria and Senegal. It is doubtfully recorded in Arabia.

Representative specimens: Mersa Alam, Red Sea coast, Feb. 1977, *El-Gazzar* 52 (CAI).

Note: No specimens of *Boscia angustifolia* A. Rich. reported by El Hadidi & Fayed (1994/95) and Boulos (1999) was seen by the author. It is known from Tropical Africa, southwestern Saudi Arabia and northwestern Yemen (Nyberg, 1996; Wood, 1997). The occurrence of this species in Egypt is uncertain.

4. *Maerua* Forssk.

It comprises 50 species, mainly tropical and southern Africa to India.

This genus was named by Forsskal based on Arabic name, 'Miru', which is used for *Maerua crassifolia* in Yemen (Wood, 1997).

Two species occur in Egypt.

4.1. *Maerua crassifolia* Forssk., Fl. Aegypt. – Arab.: CXIII, 104 (1775).

Type : Yemen, *Forsskal* (C).

Distribution: Uncommon on sandy or gravelly plains and stony hills of the Eastern Desert and Sinai. Also known from north and tropical Africa, Palestine, Arabia, Iran and Pakistan.

Representative specimens: Wadi Monbatah, Cairo – Suez road, 13.1.1961, *Täckholm et al.* s.n. (CAI); Wadi El Qattar, near Hurghada, 5.6.1960, *Täckholm et al.* s.n. (CAI); Sinai, on the cliffs, near Abu Zeneima, 10.5.56, *Täckholm et al.* s.n. (CAI); Gebel Um Gurdí, 11.2.1961, *Täckholm et al.* s.n. (CAI).

4.2. *Maerua oblongifolia* (Forssk.) A. Rich., Tent. Fl. Abyss. 1:32 (1847).

Syn.: *Capparis oblongifolia* Forssk. Fl. Aegypt.- Arab. 99 (1775); *Capparis mithridatica* Forssk. Fl. Aegypt.- Arab. 99 (1775).

Type : Yemen, *Forsskal* (C,BM).

Distribution: Frequent in the protection of *Acacia* and other bushes in the southeaster parts of Egypt. Also known from Tropical Africa, southwestern Saudi Arabia, Yemen and Oman.

Representative specimens : Gebel Elba: Wadi Aideib, 20.1.1961, *Täckholm et al.* s.n. (CAI); North – West and West slopes of Gebel Asotriba, 28.1.1962, *Täckholm et al.* s.n. (CAI).

5. *Dipterygium* Decne.

A monotypic genus placed by some authors in the Cruciferae (Täckholm, 1974). Hedge *et al.* (1980), discussed the history of its family assignment and pointed out that phytochemical data strongly reinforce its inclusion in the Capparaceae.

5.1. *Dipterygium glaucum* Decne., Ann. Sci. Nat. Bot., ser. 2,4:67 (1835).

Type : Saudi Arabia, Jeddah, *Bové* (P).

Distribution: Common in the sandy plains, gravelly and stony areas of the Egyptian deserts. Widely distributed in Tropical East Africa, Saudi Arabia, Yemen, Oman, Iran and Pakistan.

Representative specimens: Wadi Abu Nad, Hurghada district, 6.9.1960, *Täckholm et al.* s.n. (CAI). Wadi Yoider, 20.2.1967, *Osborn & Helmy* s.n. (CAI); Gorge across Gebel Shallal, 24.1.1962, *Täckholm* s.n. (CAI).

Key to the revised taxa

- 1.a. Herbs; leaf epidermal periclinal cell walls flat *Dipterygium glaucum*
- b. Shrubs or trees; leaf epidermal periclinal cell walls more or less reticulate or microstriate 2
- 2.a. Stipular thorns present 3
- b. Stipular thorns absent 7
- 3.a. Plant soon leafless; leaves when present linear-oblong to linear; Petals red *Capparis decidua*
- b. Plant leafy; leaves mostly broadly ovate; petals white or cream 4
- 4.a. Sepals distinctly very unequal, with the posterior the largest and helmet- shaped *Capparis cartilaginea*
- b. Sepals subequal 5
- 5.a. Stipular thorns setaceous , inconspicuous *Capparis spinosa* var. *inermis*
- b. Stipular thorns spinose 6
- 6.a. Fruit 25-50 mm long; petiole up to 10 mm long *Capparis spinosa* var. *spinosa*
- b. Fruit 10-20 mm long ; petiole not exceeding 5 mm long *Capparis spinosa* var. *deserti*
- 7.a. Nectary appendage present ; leaves glandular – hairy 8
- b. Nectary appendage absent; leaves not glandular-hairy 10
- 8.a. Leaves densely covered with short-stalked peltate hairs (farina); Stamens attached near the middle of the gynophore..... *Cadaba farinosa*
- b. Leaves densely to sparsely covered with long – stalked, non-peltate hairs; stamens attached towards the base of the gynophore 9
- 9.a. Fruit glandular *Cadaba glandulosa*
- b. Fruit non-glandular *Cadaba rotundifolia*
- 10.a. Fruit globose or ovoid; leaf nerves raised 11
- b. Fruits cylindrical or torulose; leaf nerves not raised 12

Capparaceae in the flora of Egypt

- 11.a. Leaves mostly more than 2.5 cm long, with 5-6 pairs of lateral nerves *Boscia senegalensis*
b. Leaves not exceeding 1.2 cm long with reticulate venation *Boscia angustifolia*
12.a. Climbing, puberulent shrubs *Maerua oblongifolia*
b. Non-climbing, glabrous shrubs or trees *Maerua crassifolia*

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