

STUDIES IN THE FLORA OF ARABIA XXII:

Dhofaria, a new genus of Capparaceae from Oman

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ABSTRACT. *Dhofaria* A. G. Miller a new genus of Capparaceae (subfamily Capparoideae), sole species *D. macleishii* A. G. Miller from Dhofar, Oman, is described. An illustration is provided and its affinities within the family discussed.

INTRODUCTION

During a collecting trip to southern Oman in 1979 I collected a spiny aphyllous shrub bearing glandular fruits the size of peas. At the time I was unable to place it in a family and could not match it at either Edinburgh or Kew. However at the British Museum Miss Hillcoat recognized the plant and produced a similar fruiting specimen collected by Vessey-Fitzgerald in Dhofar in 1947. On several occasions during 1984 and 1985 I was able to return to Oman, and although I found more fruiting specimens none were flowering. It was not until 1986 that Ian McLeish, after visiting a population of plants on several occasions, at last managed to collect male and female flowers, and it was then realized that the plants represented a distinct new genus in the Capparaceae.

Dhofaria A. G. Miller, **gen. nov.** (Capparaceae—Capparoideae).

Ab *Apophylla* F. Muell. fructu capsulari, ovario biloculari, staminibus quattuor differt. Ab omnibus generibus aliis Capparacearum statu dioecio recedit.

Dioecious shrub, \pm aphyllous, branches becoming spine-tipped. Leaves alternate, simple, linear-obovate to linear-elliptic, glabrous, soon deciduous. Stipules absent. Flowers shortly pedicellate, bracteate, arranged in spinose racemes. Sepals 4, free, unequal, upper and lower valvate enclosing lateral. Receptacle asymmetrically produced into a small wedge-shaped process. Petals 4, shortly clawed, unequal. Male flowers: stamens 4, anthers apiculate, gynoecium absent. Female flowers: ovary supported on a gynophore c.5mm long, 2-locular, with 2 ovules per loculus, placentation parietal, stigma sessile, capitate. Fruit a tardily dehiscent capsule splitting into (3-)4 valves, 1-3(-4)-seeded, densely covered with stalked glands; seeds reniform, immersed in pulpy tissue.

Dhofaria macleishii A. G. Miller, **sp. nov.** Fig. 1.

Ab omnibus aliis speciebus Capparacearum characteribus in descriptione generis supra indicatis differt; a totis speciebus arabicis familiae fructibus globosis glandulis stipitatis obtectis recedit.

Spiny shrub, much branched throughout, \pm aphyllous, the branches becoming spine-tipped, branching intricate, often with two \pm parallel branches coming from each node, bark on old wood fissured. Leaves alternate, simple, linear-obovate to linear-elliptic, 4-15 \times 1-2mm, tip acute to obtuse, margin entire, base attenuate, glabrous, soon deciduous.

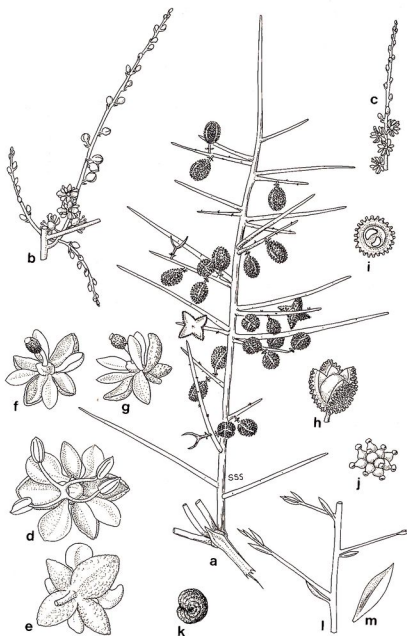


FIG. 1. *Dhofaria macleishii*. a, fruiting branch $\times \frac{2}{3}$; b, racemes of male flowers $\times \frac{2}{3}$; c, raceme of female flowers $\times \frac{2}{3}$; d, male flower viewed from above $\times 3$; e, male flower viewed from beneath $\times 3$; f, female flower viewed from above $\times 3$; g, female flower viewed from side $\times 3$; h, capsule $\times 1\frac{1}{2}$; i, section through capsule $\times 1\frac{1}{2}$; j, glands from surface of capsule $\times 3$; k, seed $\times 3$; l, young leafy shoot $\times 1\frac{1}{2}$; m, leaf $\times 2$.

Inflorescence a raceme, 5–10cm long; flowers c.6mm across, pedicel 1.5–2.5mm long, each subtended by a small linear-ovate bract c.1.6mm long. Sepals 4, free, unequal, densely stellate hairy outside, the upper and lower valvate, larger, overlapping the 2 lateral in bud: posterior sepal broadly ovate, strongly hooded, 3.8–4.5 × 2.7–4mm; anterior sepal ovate, 3.4 × 1.7–3mm; lateral sepals elliptic 3.0–3.5 × 1.5–2.5mm. Receptacle on one side produced into a small, wedge-shaped process. Petals 4, cream, shortly clawed, unequal, the two upper slightly larger than the two lower, obovate, glabrous, upper 3.5–4 × 2–2.5mm, lower 3–3.5 × 1.3–2.0mm. Male flowers: stamens 4, filaments c.3mm, anthers apiculate 2 × 1.3mm, gynoecium absent. Female flowers: ovary supported on a gynophore c.5mm long, ovary ovoid, 2.0 × 1.3mm, 2-locular, with 2 ovules per loculus, placentation parietal, glandular; stigma sessile, capitate. Fruit a tardily dehiscent capsule, splitting into (3–)4 valves, globose, 6–8 × 6–8mm, 1–3(–4)-seeded, densely covered with stiff stalked glands c.1mm long; seeds reniform, 3.0–3.5 × 2.5–3.0mm, reddish-brown to black, immersed in orange pulpy tissue in the fruit.

Type: Sultanate of Oman, Dhofar, E of Aqarhanawt, dissected limestone plateau. *Euphorbia balsamifera* scrub, shrub to 1m, intricately branched, blue-green, fruits viscid, green becoming pinkish, 1600m, 23 ix 1984, A. G. Miller 6330 (holo. E; iso. K, MUSCAT, UPS, KWT.)

SULTANATE OF OMAN: Dhofar, 1km N of Jibjat, 17°20'N 54°25'E, 16 v 1985, *McLeish* 533 (E, K); J. Qara, north draining wadi, 8km from Ashinhaib on Zeak road, 800m, 27 v 1985, *Miller* 7019 (E, K, MUSCAT, UPS); 6km on Ashinhaib to Zeak road, 17°20'N 54°10'E, 26 iv 1985, *McLeish* 518 (E); 7km along Ashinhaib to Zeak road, 17°20'N 54°10'E, 15 v 1985, *McLeish* 529 (E), 530 (E); 72km from Ashinhaib to Zeak road, 17°20'N 54°10'E, 27 iv 1985, *McLeish* 523 (E); 2km N of Police Post, Thumrit road, 24 ii 1986, *McLeish* 646A [female] (E, K, MUSCAT, UPS), 646B [male] (E); c.2km N of Police Post, Salalah to Thumrit road, 13 ii 1986, *McLeish* 627 (E); dry wadi 2.5km from Ayun turnoff, 17°20'N 54°02'E, 14 xi 1984, *McLeish* 364 (E, MUSCAT); J. Qamr, Shaib Azibi, c.65km W of Salalah, 1000m, 9 x 1979, *Miller* 2647 (E, K).

Dhofaria macleishii is a dioecious spiny shrub forming straggling clumps to about 1.5m tall. It bears small linear leaves which soon drop so that older plants are usually leafless. It flowers in the middle of the dry season in February, with the small cream-coloured flowers being borne on short spine-tipped racemes, but perhaps its most distinctive feature is the glandular fruits which persist on the plants throughout the year. To date it has been found only in the Dhofar region of southern Oman but almost certainly occurs over the border in S Yemen—a botanically unexplored area. In Dhofar it is locally common in rocky areas on the northern dip-slopes of the escarpment mountains where it is occasionally the dominant shrub, often occurring with *Euphorbia balsamifera* Ait., *Commiphora* spp. and a variety of succulents including *Eulophia petersii* (Rchb.f.) Rchb.f., *Aloe dhufarensis* Lavranos and *Sarcostemma viminale* (L.) R.Br. These areas receive only partial 'spill-over' benefit from the mists brought to the mountains during the monsoon season from May until September. It also occurs, although with much less frequency, in most of the large south-draining wadis of the escarpment mountains. These wadis are shrouded in

thick mists for most of the summer and in consequence are densely vegetated with woodlands dominated by the endemic combretaceous tree *Anogeissus dhofarica* A. J. Scott, *Euphorbia smithii* S. Carter, *Acacia senegal* (L.) Willd. and various *Commiphora* and *Ficus* species.

Dhofaria exhibits a number of interesting or unusual features in the family:

1. Habit. The method of branching is rather interesting: two parallel branches, one directly above the other, arising at the nodes are very common.
2. *Dhofaria* is dioecious; this is a very unusual character in the Capparaceae occurring in only one other genus—*Apophyllum*. *Forchammeria* is monoecious.
3. The receptacular appendage is small, asymmetrically placed and apparently wedge-shaped.
4. The sepals are densely stellate hairy externally. Hutchinson (1967: 304) notes that only six other genera in the Capparoideae have a stellate indumentum.
5. The fruit is capsular consisting of four valves bearing a dense covering of stiff, stalked glands with the 1-4 seeds immersed in bright orange, pulpy tissue. At maturity the fruits are either dispersed whole or the valves splay out exposing the seeds. After the seeds are dispersed the valves fall and leave characteristic stalked, horn-like structures formed from the nerves leading to the placentas.

POSITION OF DHOFARIA WITHIN THE CAPPARACEAE

The 4-merous flowers, gynophore, receptacular appendage and clawed petals all immediately suggest that *Dhofaria* is a good Capparadaceous genus—although its affinities within the family are not at all obvious. 27

The first significant treatment of the Capparaceae was by Pax & Hoffman in the *Planzenfamilien* (1936). They divided the family into eight subfamilies, two of which, the Capparoideae and Cleomoideae contained the bulk of the species; the remaining six subfamilies (Emblingioideae, Pentadiplandroideae, Calyptrothecoideae, Podandrogynioideae, Dipterygioideae, Buhsioideae) each contained only one or two species. Using the keys in the *Pflanzenfamilien*, the shrubby habit, fruits without a replum, 4-~~poly~~merous flowers and simple leaves suggest a position for *Dhofaria* somewhere in the subfamily Capparoideae. The 4-merous flowers and lack of hypanthium then place it in the tribe *Cappareae* (Capparideae), where the simple leaves, presence of petals, free sepals and ovary containing few ovules put it near the monotypic Australian genus *Apophyllum*. 28

This treatment has been more or less followed by later authors including Cronquist (1981), Takhtajan (1980) and Thorne (1983), who recognize the two large subfamilies, but with the subordinate taxa being variously segregated into distinct families, included in the two main subfamilies, or moved to other families. Schmid *et al.* (1984:145) summarize the differences between the Capparoideae and the Cleomoideae, but apart from this the only other useful treatment, i.e.

containing keys, is that of Hutchinson (1967:303) who treats both the Capparoideae and Cleomoideae at the rank of family. Thus, the Capparaceae are woody and have indehiscent fruits without a replum, whilst the Cleomaceae are all herbs and have capsular fruits with a replum. *Dhofaria* clearly belongs in the former family. Hutchinson splits the Capparaceae (as Capparidaceae) into three tribes thus:

Flowers bisexual; ovules more than 2:	
Petals present	1. Capparideae
Petals absent	2. Cadabeae
Flowers unisexual; ovules 1 or 2;	3. Apophylleae

Dhofaria with its 4 ovules and unisexual flowers presents a problem. However, this split does not work even for genera included by Hutchinson: *Emblingia* (placed in the Polygalaceae by Cronquist, 1981: 446) has only one ovule but is included in the *Capparideae* (= *Cappareae*); and *Forchammeria* in the *Apophylleae* has four ovules! The *Apophylleae* contains only two genera, *Apophyllum* and *Forchammeria*, which differ as follows: *Forchammeria* is monoecious, has a minute 4-8-toothed calyx, no petals and a sessile ovary; *Apophyllum* is dioecious, has 3-4 imbricate sepals, 2-4 petals and a shortly stipitate ovary. From the descriptions these two genera do not seem to be at all closely allied, particularly considering that Hutchinson considers that the presence versus absence of petals is a tribal difference between the *Cadabeae* and the *Capparideae*. If *Dhofaria* is keyed out using numbers of ovules then it falls into the tribe *Cappareae* where it comes out next to *Cadaba* (in part), the other 'part'

TABLE I
Comparison between *Dhofaria* and *Apophyllum*

	Dhofaria	Apophyllum
Habit	spiny \pm leafless shrub	\pm leafless shrub
Indumentum	stellate hairy	simple hairs
Stipules	absent	spiny
Leaves	linear	linear
Sex of plants	dioecious	dioecious or sometimes polygamous
Sepals	4, imbricate	3-4, imbricate
Petals	4, clawed	2-4, sessile
Receptacular appendage	short, wedge-shaped	absent
Stamens	4	8-16
Ovary	shortly stipitate 2-locular 2 ovules per loculus ovules laterally attached?	shortly stipitate 1-locular 1-2 ovules ovules pendant from above middle of ovary wall
Fruit	tardily dehiscent capsule 4-valved 1-4-seeded	berry 1-2-seeded

being in the *Cadabaeae*! It is clearly not closely related to *Cadaba* which has an androgynopore and a tubular receptacular appendage.

In conclusion, *Dhofaria* does not fit happily into either of the above systems; it is probably best placed next to *Apophyllum* in the *Capparaceae* (*Capparideae*) sensu Pax & Hoffman.

Apophyllum, a monotypic genus from northern Australia, is the only other genus recorded in the *Capparaceae* as being dioecious, although it is sometimes polygamous with some 'female' flowers having up to three stamens. The differences between the two genera are set out in Table 1.

The most significant differences between the two genera lie in the number of stamens, the absence of a receptacular appendage in *Apophyllum*, the type of fruit and in the ovary. These are all important characters within the family and suggest that the two genera are not closely allied.

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Note: The Herbarium at The Natural History Museum, P.O. Box 668, Muscat, Sultanate of Oman, cited as MUSCAT above, has been designated the herbarium code ON for the forthcoming, 8th edition, of *Index Herbariorum*.