

A REVISION OF OCHRADENUS

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ABSTRACT. A synopsis, including keys and illustrations, is given of the genus *Ochradenus* Delile (Resedaceae). Six species are recognised including two new ones: *O. arabicus* S. Chaudhary, D. Hillcoat & A. G. Miller (Central and SE Arabia to Socotra) and *O. harsuticus* A. G. Miller (Oman). Three subspecies of *O. aucheri* Boiss. are recognised: subsp. *rechingeri* A. G. Miller, subsp. nov., subsp. *ochradenii* (Boiss.) A. G. Miller comb. et stat. nov. and the type subspecies. The genus stretches from Pakistan to N Africa. Its relationships with the N African genus *Randonia* Cosson are considered.

INTRODUCTION

Ochradenus is a small genus of six species found in desert and semi-desert steppe and mountains from Pakistan west to Libya and Jordan south to Somalia. The genus is apparently centred in southern Arabia and in addition there is one widespread, Saharo-sindian species, *O. baccatus*: this pattern of distribution is very similar to that of the genus *Schweinfurthia* A. Braun (Miller et al., 1982). All the species are similar in habit: they are switch shrubs often becoming spiny, normally c. 1 m in height but growing to 3 m in *O. baccatus*; the leaves are usually linear and caducous and the inflorescences are spicate.

The name *Ochradenus* refers to the pale yellow area around the insertion of the leaves and branches in the type species, *O. baccatus*.

This paper is primarily concerned with the Arabian species but also covers the extra-Arabian species and considers the relationship of the N African genus *Randonia* Cosson with *Ochradenus*. Complete descriptions and excellent illustrations of all species can be found in Abdallah's revision of the Resedaceae (1967).

A selection of specimens has been cited and all these have been seen unless otherwise indicated.

ACKNOWLEDGEMENTS

I would like to thank my co-authors of *O. arabicus*, Miss D. Hillcoat (British Museum, Natural History) and Dr S. A. Chaudhary (Riyadh), for much helpful discussion and particularly for comments on *O. arabicus* and *O. baccatus* in the field, and Dr Robert Mill for writing the latin diagnoses. I am grateful to the authorities of BM, CAI, G, K for the loan of material.

NOTES ON CHARACTERS OF TAXONOMIC IMPORTANCE

Seeds. The surface texture and ornamentation of mature seeds provide useful diagnostic characters. In *O. arabicus*, *O. aucheri* and *O. randonioides* the seeds are smooth with a varnished appearance and very shiny. In *O. baccatus*, *O. spartioides* and *Randonia africana* the seeds are minutely tuberculate and do not appear varnished, though they are

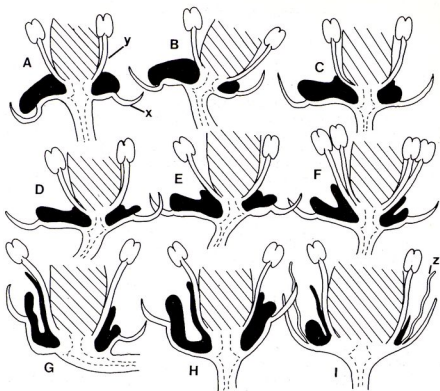


FIG. 1. Diagrammatic representations of half flowers: A, *Ochradenus baccatus*; B, *O. arabicus*; C, *O. harsusiticus*; D, *O. aucheri* subsp. *ochradenii*; E, *O. aucheri* subsp. *rechingeri*; F, *O. aucheri* subsp. *aucheri*; G, *O. spartioides*; H, *O. randonioides*; I, *Randonia africana*. X, sepal; Y, stamen; Z, petal; solid areas—discs; cross-hatched areas—ovaries; dotted lines—vascular traces.

sometimes shiny in *O. baccatus*. In *O. harsusiticus* the seeds are smooth but do not appear varnished.

Disc. This is a fleshy excentric ring around the base of the stamens (Figs 1A–I, 3A–B) which also acts as a swollen receptacle upon which the petals and sepals are inserted—these becoming separated as the disc swells laterally. The disc may be: flat, e.g. *O. aucheri* subsp. *rechingeri* (Fig. 1E); cup-shaped, e.g. *O. spartioides* (Fig. 1G); more or less reflexed, e.g. *O. baccatus* (Fig. 1A); or semi-lunar (only swollen in the anterior part), e.g. *Randonia africana* (Fig. 1I). A second, inner, disc is sometimes present; this can be a frill-like, membranous ring in *O. spartioides* (Fig. 1G), *O. randonioides* (Fig. 1H) and *Randonia africana* (Fig. 1I), or a complete inner, fleshy ring, e.g. *O. aucheri* subsp. *aucheri* (Fig. 1F). A somewhat intermediate position is found in *O. aucheri* subsp. *rechingeri* (Fig. 1E) which has a flat disc with a raised inner rim around the stamens. Abdallah (1967, p. 65) notes that in *O. randonioides* the disc may be double or single.

KEY TO THE SPECIES

(Applicable to both male and female plants)

1. Petals well-developed, readily seen, persistent (N Africa) . *Randonia*
 + Petals inconspicuous, ephemeral (*Ochradenus*) 2
2. Branches white or pale brown (when dried), surface flaking on older branches; leaves mostly fascicled; fruit with pedicel 2–3 mm long (Somalia, Ethiopia) 6. *O. randonioides*
 + Branches green or yellowish green, surface wrinkled (rarely white and flaking); leaves solitary or fascicled; fruit sessile or pedicellate. If leaves fascicled and branches white and flaking, then fruit sessile or pedicel <0.5 mm long 3
3. Fruit oblong-ovoid to ellipsoid, at least 1.5 × as long as broad, ascending on pedicel at least 2 mm long; stamens 17–80 4
 + Fruit globose, ± as long as broad, subsessile or pedicel to 1.5 mm long; stamens 10–18 5
4. Inflorescence glandular-pubescent, dense, flowers ± touching; seeds tuberculate-undulate (PDRY) 5. *O. spartioides*
 + Inflorescence glabrous, lax, flowers distant; seeds smooth, glossy (Pakistan, Iran, SE Arabia) 4. *O. aucheri*
5. Fruit papery, inflated, ± 3(–6)-lobed in transverse section; leaves spatulate, 1.5–3 mm broad, or reduced and ± round; sepals 1.5–2 mm long (Oman) 3. *O. harsusiticus*
 + Fruit baccate or papery and inflated, round in transverse section; leaves linear, up to 1.75 mm broad; sepals 1–1.5 mm long 6
6. Fruit baccate, white (often drying red); seeds minutely tuberculate; male flowers usually on short c. 1 mm pedicel (Pakistan to Libya) 1. *O. baccatus*
 + Fruit papery ± inflated, yellow or straw-coloured; seeds smooth, glossy as if varnished; male flowers subsessile (Saudi Arabia, Oman, PDRY incl. Socotra) 2. *O. arabicus*

Ochradenus Delile, Flore aegyptiacae illustratio [in Descr. Égypte, Hist. nat.]: 63 (1813).

Dioecious or hermaphrodite shrubs, 0.5–3 m tall. *Stems* much branched, often spinescent, sometimes scandent, soon aphyllous. *Leaves* linear to narrowly obovate, entire, sessile, single or fascicled. *Inflorescence* a spike or spike-like raceme. *Sepals* 5–8. *Petals* absent or linear with an ovate or round, sometimes lobed, auriculate base. *Disc* excentrically surrounding ovary, fleshy, sometimes with an inner, fleshy or membranous, disc. *Stamens* 10–60+. *Ovary* unilocular of 3 fused carpels, placentas parietal. *Fruit* a capsule or berry, gaping at apex or not. *Seeds* reniform. Type species: *O. baccatus* Delile.

1. ***O. baccatus*** Delile, Flore aegyptiacae illustratio [in Descr. Égypte, Hist. nat.]: 63 (1813). Figs 1A, 2.

Ic.: Delile Flore d'Égypte, pl. 31, f. 1 (1826); Abdallah in *Meded. Landbouwhogeschool* 67-68: t. 6-7 (1967).

Dioecious shrub, sometimes straggling, 1-2(-3) m tall. Shoots slender, glabrous. Leaves linear, 1-4 cm. Inflorescence lax or ± dense, 8-20 cm; pedicels 1-2 mm. Sepals oblong-ovate, 1-1.5 mm. Petals absent or rarely present. Disc ± reflexed, fleshy. Stamens 10-18. Fruit baccate, globose, 3-6 mm broad, subsessile to sessile, white when mature (often red when dried). Seeds 1.2-1.8 × 1-1.5 mm, minutely tuberculate, brown to black.

Rocky and sandy open habitats in desert and semi-desert steppe and mountains, 25-2700 m.

Type: [Egypt] In valle fontis el Touareq, prope Soueys; et in Aeg. Sup. *Delile* s.n. (n.v.).

PAKISTAN. 15 miles from Gharo on road to Karachi, 4 i 1970, *Ghafoor & Qaiser* 364 (E). Baluchistan: Quetta, Torkhan, 1000 m, *Lamond* 1311 (E).

IRAN. Between Bam and Jiroft, 28°40' N 57°47' E, 1150 m, 19 iv 1972, *Léonard* 5659 (E); 45 km E of Bandar Lengeh, 25 m, 30 iii 1974, *Davis & Bokhari* D.56168 (E); between Kāzerūn and Būshehr, 12/13 xii 1892, *Bornmüller* 2047 (E).

SAUDI ARABIA. Sumām Yabrin, 23°27' N 48°34' E, 28 ii 1969, *Mandaville* 2154 (BM); Wadi Al A'qila, 30 km N of Riyadh, 19 iii 1981, *Hillcoat* 245 (BM); Asir Province, Hijla, 14 km E of Abha, 16 ii 1980, *Nasher* H.40 (E); Wadi Manfah, 50 km NNW of Najran, 1900 m, 23 i 1980, *Collenette* 1611 (E); Ad-Dammam, 140 km W of Dhahran, 250 m, 23 iii 1981, *Frey & Kürschner* 6469 (E).

SULTANATE OF OMAN. 5 km E of Ayun Pools, 17°16' N 53°55' E, 660 m, 11 x 1977, *A. Radcliffe-Smith* 5451 (K); Ayun crossroads, 23 ix 1978, *Berkeley* 110 (E).

PDRY (S Yemen). Wadi Dhabab, 4 i 1890, *Deflers* 231 (E); Wadi Irma, Shabwa area, 790 m, 6 ii 1952, *Popov et al.* 4172 (BM).

YAR. Sana'a to Marib road 10 km E of Sana'a, 2200 m, 3 iv 1981, *Miller* 3395 (E); Ysla Pass c. 45 km S of Sana'a, 2700 m, 13 iii 1981, *Miller* 3010 (E).

JORDAN. Ghor Safi, southern tip of Dead Sea, 2 xii 1973, *Boulos* 5816 (E); between Petra and Mt Hot, 17 iv 1945, *Davis* 9055 (E).

EGYPT. Wadi Um Diheiz, NW of Hurghada, 15 iii 1964, *Boulos* s.n. (CAI); Wadi El-Deir, Red Sea Coast, 10 iii 1954, *Boulos* s.n. (CAI).

SUDAN. Khor Arhaat? 17 ii 1954, *Kassas* 826 (CAI); Red Sea Hills, Simkat, 4 iii 1938, *Drar* 306 (CAI).

Ochradenus baccatus is the most widely distributed species, being found over the entire range of the genus with the exception of SE Arabia, where it is replaced by *O. arabicus*, and N Iran (Fig. 2). It can be distinguished from all other species by its baccate fruits which are white at maturity, and by its minutely tuberculate seeds.

All the material of *O. baccatus* that I examined was dioecious, female flowers usually having vestigial stamens, sometimes, however, apparently well-developed stamens were present but these on examination were found to produce no pollen.

2. *O. arabicus* Chaudhary, Hillcoat & Miller, sp. nov. Figs 1B, 3Babc, 4.

Ab *O. baccatus* Delile seminibus nitidolaevis et capsulis chartaceis

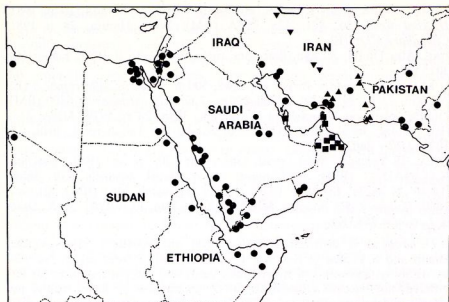


FIG. 2. Distribution of *O. baccatus* ●; *O. aucheri* subsp. *aucheri* ■; *O. aucheri* subsp. *rechingeri* ▲; *O. aucheri* subsp. *ochradenii* ▼.

stramineis differt. Ab *O. harsusiticus* A. G. Miller facie dissimili, sepalis minoribus fructuque rotundato non trilobato recedit. Ab omnibus speciebus alteris generis fructu sessili staminibusque paucioribus distinguitur.

Dioecious, spiny shrub forming low, spreading bushes 20–50(–100) cm tall and up to 2 m across. *Shoots* numerous, intricately branched, spinescent at tips, terete, wrinkled when dry, glabrous, aphyllous with age. *Leaves* linear-oblong, tips acute, sessile, (2–)15–25 × 0.5–1.75 mm, sometimes fascicled. *Inflorescence* subspicate, conferted at the ends of spiny branches; male 2–6 × 0.45–0.6 cm; female 4–5 cm extending to 4–11 cm in fruit; fruits normally crowded. *Bract* one, narrowly ovate to narrowly oblong, 1–3.5 × 0.3–0.7 mm, caducous; bracteoles 2, minute. *Flowers* yellow, unisexual, 1.5–2.5 mm across, subsessile. *Sepals* (5–)6–7, oblong-ovate, obtuse, 0.5–1 × 0.3–0.4 mm. *Petals* absent or rarely 1 or 2 present, shorter than sepals, linear, base sometimes lobed. *Disc* entire to undulate, somewhat reflexed, excentrically surrounding ovary, fleshy, glabrous. *Stamens* 12–16; filaments 1–2 mm; anthers 0.7–0.8 × 0.6 mm, oblong; also present in female flowers, but very short with smaller, sterile anthers. *Ovary* glabrous, present but sterile in male flowers. *Fruit* a capsule, globose or ovoid when mature, 4.5–5.5 × 4.5–6 mm, leathery or papery in texture, green becoming yellow, apex closed, subsessile, 10–18-seeded. *Seeds* reniform, 1.2–1.8 × 1–1.5 mm, smooth, glossy, appearing varnished, black to reddish black when mature.

Open rocky and sandy habitats, 0–1220 m.

Type: UAE: Fujayrah, Wadi Kub al Fay, near watershed, 24 ii 1980, J. R. Edmondson 3129 (holo. E).

SAUDI ARABIA. Wadi Kurmah, 60–70 km WNW of Riyadh, 10 iv 1981, Hillcoat 418, 420, 421, 425, 425A (BM); Wadi Hanifa, 28 ii 1981, Chaudhary E726 (E).

UAE. Abu Dhabi: Al ayn, limestone ridge, 300 m, 16 ii 1980, Edmondson 3015 (E).

SULTANATE OF OMAN. Birkat al Mawz, 500 m. 4 i 1978, Whitcombe 5 (E); An Nid, 23°13' N 57°19' E, 760–820 m, 7 iv 1975, Mandaville 6300 (BM); Dhofar, plain on N outskirts of Salalah, 30 m, 24 ix 1979, Miller 2179 (E); Dhofar, Jebal Qara, 23 km E of Salalah on Taqah road, 30 m, 2 x 1979, Miller 2462 (E).

PDRY (S Yemen). West road, Jol, mile 70, 6 ix 1949, Guichard K.G./HAD/47 (BM); Hadramaut, above Battik towards Kôr Sêbân [14°40' N 48°31' E], 15 v 1939, H. von Wissmann 3042 (BM); Socotra, 1880, Balfour 2 (E); Socotra, Jebal Rughid, 670 m, 13 iv 1967, A. R. Smith & Lavranos 368 (K).

O. arabicus is distributed from central and southern Saudi Arabia, Oman and S Yemen to Socotra. It is distinguished from (a) *O. baccatus* by its shiny, smooth, not tuberculate, seeds and the papery, more or less inflated, not baccate, fruit, from (b) *O. harsusiticus* by facies, round not lobed (in transverse section) fruits, sepals 1–1.5 mm, not 1.2–2 mm, and leaves linear, not spatulate, and (c) from all other species by its fewer stamens (12–16 not 18–40+) and globose, sessile, not oblong-ovoid, pedicellate, fruit.

Within *O. arabicus* there is a little morphological variation. In Oman the seeds are 1.2–1.6 mm long and the plants tend to be low (to 0.5 m) and spiny. Further north and west in the Emirates and Saudi Arabia the plants are taller (to 1 m) and less spiny and the seeds are 1.6–1.8 mm long. In Socotra the plants appear rather twiggy and the seeds are 1–1.2 mm long. We have not recognised any subspecific taxa because there is no close correlation between seed size and other characters.

Reseda spinescens O. Schwartz is possibly conspecific with *O. arabicus*. Schwartz (1939, p. 75–77) described three species, all based on single gatherings, from Wadi Himen, 14°33' N 49°10' E, above Mukalla in S Yemen: *Reseda micrantha*, *Randonia spartioides* and *Reseda spinescens*. Unfortunately none of the specimens upon which they are based can be traced. I agree with Abdallah (1967, p. 67) who transferred *Randonia spartioides* to *Ochradenus* and suggested that *R. micrantha* was conspecific with it. I, however, disagree with his suggestion, that *Reseda spinescens* should be included in *O. ochradenii* (now *O. aucheri* subsp. *ochradenii*), presumably on account of the shiny seeds. *O. aucheri* is restricted to northern Oman, Iran and Pakistan at least 1000 km away from the type locality of *R. spinescens*; furthermore the inflorescence of *R. spinescens* according to Schwartz is 2–5 cm not 10–30 cm long as in *O. aucheri*. I have not used the name *R. spinescens* because from the inadequate description and in the absence of the type it could also be referable to *O. harsusiticus*.

Vernacular names (taken from herbarium sheets): S Yemen—Gurdiyah (Ingrams), Qurdhiya (Popov, Tillin & Gilliland); Oman—Qurliya (Thesiger), Hibâb (Thesiger), Asmat (Mandaville). The vernacular name of *O. baccatus* in Arabia is Qurliya and its variations.

3. *O. harsusiticus* A. G. Miller, sp. nov. Figs. 1C, 3Aa-e, 4.

Ab *O. baccato* Delile et *O. arabico* Chaudhary, Hillcoat & Miller facie dissimilis, praesentia petalorum, sepalis maioribus et capsula trilobata differt. Ab *O. baccato* Delile seminibus laevibus, fructu chartaceo recedit. Ab omnibus speciebus alteris generis fructu sessili staminibusque paucioribus distinguitur.

Low spiny, $\pm$ aphyllous, hermaphrodite shrub to 0.5 m tall. Shoots intricately branched; gnarled, with $\pm$ flaking, whitish grey bark below; above with short, divaricate, spine-tipped branches, 2-4 cm long, longitudinally striately grooved (when dried). Leaves (present on younger branches only) often fascicled on short c. 1-2 mm side branches, narrowly elliptic to spatulate, 3-10 $\times$ 1-1.5(-3.5) mm, sometimes very reduced, $\pm$ round, c. 0.75 mm; wrinkled when dry, possibly fleshy in vivo. Inflorescence a lax, spine-tipped spike c. 4 cm long, c. 5-8-flowered, fruits distant. Bracts ovate, c. 1 mm. Flowers hermaphrodite, c. 4 mm across. Sepals 6, ovate to narrowly elliptic, 1.5-2 $\times$ (0.5-)-0.8-1.4 mm, $\pm$ incurved. Petals 4, c. 2 mm, white, linear with 1 or 2 basal teeth. Disc entire, pentagonal, $\pm$ excentrically surrounding the ovary, flat, fleshy. Stamens c. 12, orange; filaments c. 1.5 mm; anthers oblong, 0.75 mm. Ovary glabrous. Fruit a capsule, ovoid, $\pm$ 3-lobed in transverse section, (4-)-5-6 mm broad, papery, $\pm$ brittle-textured, yellowish brown when mature, apex closed, sessile, c. 12-seeded. Seeds reniform, 1.4 $\times$ 1 mm, smooth not glossy, blackish brown when mature.

Type: Oman, Bwai, 19°38' N 57°25' E, 29 iv 1982, J. R. Maconochie 3430 (holo. E).

OMAN. 30 km N Yalooni, 30 iv 1982, Maconochie 3498 (E); nr Wadi Ya Luni [Yalooni], Jiddat al Harāsis, 7 iii 1978, Lawton 1968 (BM).

O. harsusiticus is known from three gatherings in the Jiddat al Harāsis area of central Oman. It probably owes its restricted distribution to the extreme climate of the area. I am grateful to Dr Mark Stanley-Price for the following remarks about the Jiddat al Harāsis:

'Rainfall is highly sporadic and although the Harāsis say rain can occur in any month, winter rain from the south or south-east seems the most common occurrence. The influence of the SW monsoon or "Khareef" is not marked on the Jidda'. I have never known any moisture here that could be attributable to this monsoon. The most dramatic and consistent source of water are the fogs and dews which are common in the autumn and spring months, although they have been recorded in every month of the year. The mists come in on a south breeze from the Indian Ocean, 140 km due south of Yalooni.....

The Jidda's surface rock is limestone.....with the exception of a few places, the run off is high and surface retention is poor. Because of this, it seems that the mists are an essential source of water in the maintenance of the area's good tree cover of *Acacia tortilis*, *A. ehrenbergiana* and *Prosopis cinerea*.'

O. harsusiticus is easily distinguished from all other species by its distinctive habit with gnarled, woody, base, rosulate clusters of spatulate leaves and its fruit which is three-lobed in section, each lobe being itself 2-lobed, i.e. it is 'clover leaf-shaped'. *O. harsusiticus* is most likely to be confused with *O. arabicus* from which it also differs in having hermaphrodite (not unisexual) flowers, larger sepals (1.5-2 mm not 1-1.5 mm long) and seeds which are smooth but apparently not shiny.

Reseda spinescens O. Schwartz from S Yemen, nr Mukalla, (already

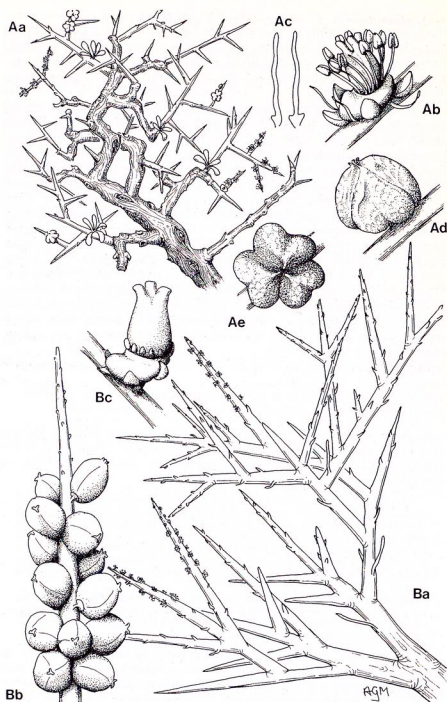


FIG. 3. *Ochradenus harsusiticus*: Aa, habit $\times \frac{2}{3}$; Ab, flower $\times 7$; Ac, petals $\times 12$; Ad, fruit $\times 4$; Ae, fruit—top view. *Ochradenus arabicus*: Ba, habit $\times \frac{2}{3}$; Bb, fruiting branch $\times 2$; Bc, female flower $\times 10$.

discussed under *O. arabicus*) is possibly conspecific with *O. harsusiticus*. However, the inadequate description, lack of type, and different distribution suggest it could as easily be placed under *O. arabicus*. The disjunct distribution from the Jiddat al Harāsis to S Yemen is, however, not unparalleled—*Euphorbia riebeckii* Pax. described from the coast at Balhaf, about 100 km W of Mukalla, has recently been found in the Jidda'.

The name *O. harsusiticus* commemorates the Hārsusi tribe who inhabit the Jiddat al Harāsis, which means approximately 'Land of the Harāsis'.

4. *O. aucheri* Boiss., Diagn. pl. orient. Ser. 2:50 (1854).

Syn.: *Homalodiscus aucheri* (Boiss.) Boiss. Fl. orient. 1:422 (1867).

Glabrous, hermaphrodite shrub, 0.5–1(–2) m tall. Shoots slender, yellowish green. Leaves linear, 1–6 cm. Inflorescence lax, 10–30 cm, pedicel 1–2 mm, lengthening in fruit. Sepals 6, obovate, 1.5–2 mm. Petals present. Disc single or double, flat to cup-shaped. Stamens 17–40+. Fruit oblong to ovoid, c. 10 × 7–8 mm, leathery, gaping or not, yellowish brown, held erect on c. 4 mm pedicel. Seeds 1.5–1.8 × 1–1.4 mm, shiny, smooth, pale brown to black.

Type: [Oman] 'in regno Mascatensi', *Aucher-Eloy* 4178 (K, G).

O. aucheri is distributed from Pakistan to SE Arabia. It is readily distinguished by its long, lax inflorescence, pedicellate fruit and smooth, shiny seeds. My treatment of *O. aucheri* is much broader than that of Abdallah. I have included *O. dewittii* and *O. ochradenii* and recognized three subspecies, based on the characters used in the key below, no other differences correlate.

1. Disc clearly double, the inner cup-shaped (Fig. 1F); stamens 25–80 (Oman) subsp. *aucheri*
- + Disc single, although sometimes with raised collar around stamens, ± flat (Fig. 1D, E); stamens 17–30 2
2. Disc with raised collar around stamens (Fig. 1E); stamens 17–30 (Iran, Pakistan) subsp. *rechingeri*
- + Disc flat (Fig. 1D); stamens 17–25 (Iran) subsp. *ochradenii*

subsp. *aucheri* Fig. 1F, 2.

Syn.: *O. dewittii* Abdallah in Meded. Landbouwhogeschool 67–68:61–2 (1967).

Loc.: Abdallah, op. cit. 67–68: t. 9 (1967)—under *O. dewittii*.

QATAR. 7 km W of Al Wukair, along road to Kharanah, 2 iv 1977, *Boulos* 11072 (E).

UAE. Hatta, 110 km ESE of Dubai nr Oman border, 250 m, 23 iv 1982, *Brown* 64 (E); Fujairah, between Khatt and Dibba, 25°55' N 56°04' E, 450–1050 m, *Western* 186 (E).

SULTANATE OF OMAN. Musandam peninsula, Khaşab, 26°12' N 56°15' E, 10 m, *Mandaville* 7285 (BM); Wadi Sahtan, 23°23' N 57°19' E, 420 m, 6 iv 1975, *Mandaville* 6269 (BM); Nizwa, N of town, 30 i 1982, *Maconochie* 3127 (E); Wadi Sumail, 330 m, 27 i 1978, *Whitcombe* 108 (E).

Open rocky slopes, 10–1000 m.

Subsp. *aucheri* is found in SE Arabia and is not yet known from Iran. *O. dewittii* was described by Abdallah as differing from *O. aucheri* in its double disc and 40 or more stamens. However, the type of *O. aucheri* (*Aucher-Eloy* 4178) clearly has a double disc, as Müller (1857, p. 96) suggested when comparing it with *O. baccatus* 'hic apice magis urceolatus et minor', and stamen number in plants with double discs from SE Arabia varies from 25 to 80—I have therefore not recognized it as a separate taxon.

subsp. ochradenii (Boiss.) A. G. Miller, **comb. et stat. nov.** Figs 1D, 2.

Basionym: *Reseda ochradenii* Boiss., *Diagn. pl. orient. Ser.* 2(1):49 (1854).

Syn.: *Homalodiscus ochradenii* (Boiss.) Boiss., *Fl. orient.* 1:422 (1867).

H. minor Boiss., *op. cit.* 1:423 (1867).

Ochradenus boissieri (Boiss.) DC., *Prodr.* 16(2):588 (1868).

O. ochradenii var. *minor* (Boiss.) Abdallah in *Meded. Landbouwhogeschool* 67-68:63 (1967).

Ic.: Abdallah, *op. cit.* 67-68: t. 10 (1967).

Type: [Iran] 'In regno Mascate vel in Persia australis', *Aucher-Eloy* 4179. (holo. G, iso. K).

IRAN. Prov. Tehran, 130 km from Hamadan on road to Ghazvin, 1850 m, 26 vi 1974, *M. Assadi & Shirdelpur* 13224 (E); Prov. Kerman, at Kuschkuh between Kerman and Yazd, 1600 m, 18 v 1892, *J. Bornmüller* 2045 (E).

On sandy and gravel desert, 1600-1850 m.

Subsp. *ochradenii* differs from subsp. *aucheri* in the flat, single, not double, disc and by the fewer stamens. It is found in the deserts of central and northern Iran. Within subsp. *ochradenii* I have included *O. ochradenii* var. *minor* (Boiss.) Abdallah which seems to differ only on very unsatisfactory characters, i.e. angle of branching, length of bracts and stamen number (17-18 v. c. 20).

subsp. rechingeri A. G. Miller, **subsp. nov.** Figs 1E, 2.

Misident.: *O. aucheri* sensu Abdallah in *Meded. Landbouwhogeschool* 67-68:53-54 (1967), non Boiss. (1854).

Ic.: Abdallah, *op. cit.* 67-68: t. 6 (1967)—under *O. aucheri* Boiss.

A subsp. *aucheri* disco singulo (non duplici) cum collo elevato et staminibus paucioribus recedit.

Type: Iran, Prov. Kerman, Khabr va Ruchoun protected region, 50 km SSW of Baft, hot stoney desert c. 10 km SW of Ruchoun, 28°36' N 56°15' E, 1400 m, 9 vi 1977, *Assadi, Edmondson & Miller* 1711 (holo. E, iso. TARI).

PAKISTAN. Baluchistan, Makran, 30-50 km from Turbat nr Kikki, 150 m, 12 iv 1965, *Lamond* 427 (E); Makran, 10-20 km from Turbat on road to Gwadar, 150 m, 12 vi 1965, *Lamond* 408 (E).

IRAN. Mt Karvandan, 1500 m, 16-17 v 1948, *Rechinger* 3968 (E); Prov. Kerman, Ashin Bala, 30 km SSW of Esfandaqah, 1950 m, 11 vi 1977, *Assadi et al.* 1950 (E).

Open rocky slopes, sand and gravel desert, 150-1950 m.

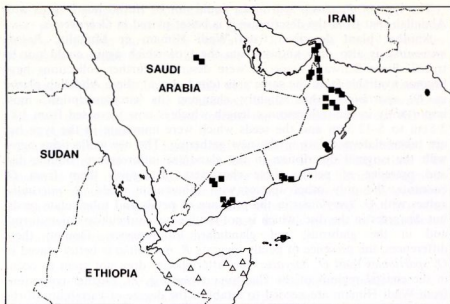


FIG. 4. Distribution of *O. arabicus* ■; *O. harsusiticus* ●; *O. spartioides* ▲; *O. randonioides* △.

Subsp. *rechingeri* differs from subsp. *aucheri* by the single, not double, disc with raised collar, and by the few stamens. It is distributed from S Pakistan to central and southern Iran. This taxon includes all non-Arabian plants placed under *O. aucheri* by Abdallah (1967).

5. *O. spartioides* (*O. Schwartz*) Abdallah in Meded. Landbouwhogeschool 67-68:67-69 (1967). Figs 1G, 4.

Type: [PDRY] in Arabien im Küstengebiet von Hadramaut: am Gebirgsabfall hinter Mukalla, Wadi Himam, *Wissman* 1474 (n.v.).

Syn.: *Randonia spartioides* *O. Schwartz* in *Mitt. Inst. Allg. Bot. Hamb.* 10:76 (1939).

?*Reseda micrantha* *O. Schwartz*, *ibid.* 10:75 (1939). Type: not traced.

See below.

Ic.: Abdallah, *op. cit.* 67-68: t. 12 (1967).

Straggling, hermaphrodite shrub, 1-1.5 m tall, glandular pubescent above in region of inflorescence. *Leaves* linear, 1.5-5 cm. *Inflorescence* densely flowered, (2-)7.5-12 cm long, pedicels 4-5 mm. *Sepals* 6, oblong, 2-2.5 mm. *Petals* present. *Disc* double, cup-shaped, inner membranous, outer fleshy. *Stamens* c.25. *Fruit* leathery, closed, erect on pedicel 4-6 mm. *Seeds* c. 1.5 × 1 mm, undulate-tuberculate, pale yellow-green (immature).

PDRY (S Yemen). Hadramaut: Wadi Himam above Mukalla, iv 1961, *Kerfoot* 3033 (K); Rocks nr Mukalla, 1 viii 1950, *Guichard* KG/HAD/376(BM).

A very distinctive species with densely flowered inflorescence, erect pedicellate fruit and undulate-tuberculate seeds.

The type of *Randonia spartioides* could not be traced but I agree with Abdallah that from the description it is better placed in *Ochradenus*.

Another plant described from Wadi Himam nr Mukalla, *Reseda micrantha*, is also only known from the type which again could not be traced. Since Schwartz's species were described further collections have become available from the same area (cited above); these Abdallah placed in *O. spartioides*, thus slightly changing its circumscription, most importantly in the inflorescence length which is now increased from 1.8–2.5 cm to 5–12.5 cm and the seeds which were immature in the type but are tuberculate-undulate in the new gathering. The new collections agree with the original description in the glandular inflorescence, double disc and presence of petals; these characters distinguish them from *O. baccatus*, the only other species with tuberculate seeds. *R. micrantha* agrees with *O. spartioides* in the presence of petals and tuberculate seeds, but disagrees in the disc, which is not double but 'auriculate-squamiform', and in the glabrous, not glandular, inflorescence. Despite these differences, the presence of petals suggests *R. micrantha* is better placed in *O. spartioides* than *O. baccatus*; the latter species does not seem to occur in the coastal regions of the Hadramaut (see Fig. 2). Further collections from Wadi Himam are needed to establish the degree of variability of the double disc.

6. *O. randonioides* Abdallah in Meded. Langbouwhogeschool 67–68:64–67 (1967). Figs 1H, 4.

Syn.: *Randonia somalensis* Schinz in Bull. Herb. Boiss. 3:398 (1895).

Ochradenus somalensis E. G. Baker in J. Bot. 34:52 (1896).

Ic.: Abdallah, op. cit. 67–68: t. 11 (1967).

Intricately branched bushy, hermaphrodite shrub, 0.5–3 m tall. *Shoots* pale brown to white, flaking, glabrous or hispid. *Leaves* linear to linear-obovate, 0.5–1.5 cm, mostly fascicled. *Inflorescence* densely flowered, c. 5 cm, pedicels 1–3 mm. *Sepals* 6, oblong, 1–2 mm. *Disc* single or double, cup-shaped to reflexed. *Stamens* 12–14. *Fruit* ovoid, 6–10 × 3–6 mm, semi-succulent or leathery, closed, patent on 2–5 mm pedicels. *Seeds* 1.5 mm × 1.5 mm, smooth, glossy, dark brown to black.

On sand and rock in open habitats and lowland *Acacia* woodland, 500–1500 m.

Type: [Somalia] *Ruspoli-Keller* Exp. à 1891 (n.v.).

SOMALIA. Jaleeb, 100 km E of Burao on road to Las Anod, 11 x 1978, *Allen & Elmi* 529 (E); Burao district, 14 x 1944, *Glover & Gilliland* 100 (K).

ETHIOPIA. Harar prov., Aware, IECAMA, 2 i 1960, *BH* 6 (K).

O. randonioides is found in northern Somalia and eastern Ethiopia. It is a very distinctive species with white or pale brown flaking stems and clusters of small leaves. According to Abdallah (1967, p. 65) the flowers may have single or double discs and may be glabrous (var. *glaber* Abdallah) or hispidulous (var. *randonioides*).

RANDONIA Cosson

Randonia, sole species *R. africana* Cosson, is distributed across

N Africa from Egypt to Morocco and south just into Mauritania (Quezel, 1964, p. 91). It is found mainly on gypsaceous soils where it sometimes forms a dominant part of the vegetation. *R. africana* closely resembles *Ochradenus baccatus* in habit and more or less replaces it in the western Sahara.

O. spartioides and *O. randonioides* were originally described in *Randonia* and now, because of the broadened circumscription of *Ochradenus* following the inclusion of these species, the differences between the two genera need clarification.

J. Müller (1868, p. 550) placed the two genera in different subtribes, the *Randoniae* and the *Resedineae*, on the basis of floral structure. The *Randoniae* (sole member *Randonia*) were described as having perigynous petals and stamens and the *Resedineae* (*Reseda*, *Oligomeris* and *Ochradenus*) as having these organs hypogynous. Abdallah (1967, p. 35) also emphasized floral characters in his key to the genera of Resedaceae separating the two genera as follows:—

- Petals luxuriously developed, persistent. Disc double (inner disc a lacerate 'parastaminal corona'). Carpels 2 or 3 *Randonia*
- + Petals minute, if present at all ephemeral, on the outer wall of the fleshy torus, often disc more or less doubled, carpels 3, rarely 4 *Ochradenus*

However, Fig. 1 shows the floral structure of *Randonia africana* and all species of *Ochradenus* and it can be seen that there are no significant differences between the two genera. The outer disc of *Randonia africana* is only swollen on one side of the ovary and is consequently semi-lunar, the inner disc is membranous, resembling that of *O. randonioides* and *O. spartioides*. In Abdallah's key the only absolute difference is on petal development. However, too much weight should not be placed on petal size as a generic character, considering the degree of variation in petal size and structure shown by most species of Resedaceae (see figures in Abdallah, 1967).

In conclusion floral structure does not provide good characters to separate *Ochradenus* and *Randonia*. The only consistent differences are in the showy, well-developed, persistent petals and the more or less cup-shaped fruiting calyx. These differences serve to make *Randonia* immediately identifiable but are probably of insufficient importance for the recognition of separate genera: further study will probably show that the two genera should be combined.

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