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A REVISION OF ADENIUM ROEM. & SCHULT. AND OF DIPLORHYNCHUS WELW. EX FIC.& HIERN (APOCYNACEAE)

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INTRODUCTION

The present publication is a revision of the genera *Adenium* and *Diplorhynchus*. Both genera are indigenous in Africa, but *Adenium obesum* reaches the extreme southern part of Arabia and the island of Socotra.

This research is based mainly on herbarium specimens, fortunately well prepared and richly provided with flowers and/or fruits. Of *A. swazicum* hardly any fruits were available.

It was possible to trace almost all type specimens of the species of these genera. A new key to the species of *Adenium* is added; *Diplorhynchus* is considered to be monotypic.

Most of the species of *Adenium* are quite variable and two of them are easily confused viz. *A. obesum* and *A. multiflorum*.

Diplorhynchus seems to be one complex with several clines as to indumentum, leafsize and there are no reasons to uphold more than one species.

The two phytochemical chapters were written by N. G. BISSET, while the others were written by A. C. PLAIZIER.

ADENIUM

HISTORY OF THE GENUS

In 1775 FORSKÅL described *A. obesum* as *Nerium obesum* in the Flora Aegyptiaco-Arabica, which became with ROEMER and SCHULTES (1819) the type species of their new genus *Adenium*.

Many authors added new species to this genus, but the majority of them were later reduced into synonymy, mainly of *A. obesum*.

The vernacular name of the latter species is Öddajn or Aden, latinized as *Adenium*.

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

The genus *Adenium* comprises 6 species in tropical and southern Africa. Only *A. obesum* reaches Socotra and the extreme southern part of Arabia; it is also the only species occurring in West Africa. H. HUBER (1963) suggests, that the West African material is possibly an introduced form of the widespread and variable East African and Arabian material.

As far as known to the present author, *A. obesum* is cultivated as ornamental in West-, Central-, East Africa and in Southeast Asia, while *A. multiflorum* is cultivated in southern Africa. In greenhouses of the botanical gardens of Amsterdam, *A. obesum*, *A. multiflorum* and *A. swazicum* are cultivated; in Brussels and in Wageningen, *A. obesum* only.

In Amsterdam and in Wageningen, *A.* spp. have been succesfully grafted on a *Nerium oleander* stock and resulting in much richer flowering material.

All species occur in savannes or open forests with a sandy or rocky soil, which is sometimes brackish, at low to medium altitudes.

Except *A. obesum*, all species are restricted to rather small areas. F.i. *A. swazicum* is endemic in Swaziland and in the adjacent areas of Moçambique and of South Africa.

RELATIONSHIP TO OTHER GENERA

Adenium belongs to the tribe *Nerieae* of the subfamily *Apocynoidae (Echitoidae)* and is closely related to *Pachypodium* and particularly to *Nerium*. The latter genus has been cultivated for many centuries in the subtropical countries.

The inflorescence, corolla, carpels, and fruits and the usually slightly exserted appendices of the stamens of *Adenium* and *Nerium* resemble each other strikingly. However, both genera differ as follows:

	Nerium	*Adenium*
Flowers	actinomorphic	slightly zygomorphic
Scales between the corolla lobes	laciniate	obcordate
Corolla lobes	longer than the corolla tube	shorter than the corolla tube
Colleters	on the petiole	on the branchlets
Leaves	3-whorled	alternate and confined to the apices of the branchlets
Secondary veins	~	inconspicuous or if conspicuous up to 19 (–24)
Follicles	erect	reflexed
Seeds	an apical tuft of hairs at one side; sericeous	apical tufts of hairs at each side; glabrous

Pachypodium differs from *Adenium* especially by its spines, which are in fact its stipules; the stipules of *Adenium* are early caducous.

GENUS DIAGNOSIS

Adenium Roem. & Schult., 1819: 35; Don, 1837: 80 (As *Adenum*); De Candolle, 1844: 412; Lindley, 1846: t.54; Hooker, 1863: t.5418; Bentham & Hooker, 1876: 689, 722; Schumann, 1895: 319; Stapf, 1902: 226; Stapf, 1907: 513; Phillips, 1951: 587; Codd, 1963: 278; Hutchinson & Dalziel, 1963: 76.

Type species: Arabia, Melhan, *Adenium obesum* (Forsk.) Roem. & Schult.

Homotypic synonym: *Idaneum* Post, T. v. & O. Kuntze, 1904: 296.

Succulent shrubs or trees, 0.2–5 m tall; trunk mostly up to 1 m, rarely up to 2 m in diameter; bark pale green to greyish green or brown, smooth; rhizomatous or carrot-like tubers; clear or white latex.

Branchlets more or less pubescent at the apex, soon glabrous.

Leaves alternate, confined to the apices of the branchlets, with colleters in the axils; stipules minute or absent; blade variable in shape, linear to obovate, cuneate at the base, entire, pubescent or glabrous; secondary veins more or less conspicuous, tertiary veins inconspicuous.

Inflorescence thyrsoid, lax; bracts narrowly obovate to linear, acuminate at the apex, entire, pubescent; peduncle very short or absent; pedicels pubescent.

Flowers 5-merous, slightly zygomorphic.

Sepals connate at the base, subequal, narrowly oblong to narrowly obovate, acuminate, entire.

Corolla tube infundibuliform to salver-shaped; much widened at the throat, outside more or less pubescent, inside glabrous or pubescent to strigose; lobes obovate or narrowly obovate, acuminate, entire, undulate or crispate, outside more or less appresssed-pubescent, inside glabrous or more or less appressed-pubescent; contorted and overlapping to the right in bud, spreading; between all the lobes an obcordate, glabrous or pubescent to velutinous scale at the base, which is united by its edges with the lobes.

Stamens included to exserted, inserted at the apex of the narrow basal portion of the corolla tube; anther narrowly triangular, sagittate at the base, and with a long appendix at the apex; cells two, linear; appendices filiform, usually coherent and twisted at the apex.

Pistil: two carpels, globose, gradually to abruptly narrowed into the styles, coherent at the base; style only at the base split, cylindrical; clavuncula subcylindrical, which is more or less coherent with the apices of the filaments; stigmas bifid, about 0.5 mm long.

Fruit consisting of two spreading or recurved follicles, which are coherent at the base, oblong and tapering towards each end; outer-side pubescent, inner-side glabrous, many-seeded.

Seed many, oblong, truncate, and with tufts of dirty white to light brown hairs at both ends.

Distribution: 5 species in the tropics of South Arabia, Western, Central, Northeastern and Southern Africa and on Socotra.

KEY TO THE SPECIES

1. Leaves linear, very narrowly obovate or narrowly oblong; secondary veins inconspicuous; flowers appear usually with the leaves 2

   Leaves obovate, ovate, oblong or less often narrowly obovate; secondary veins conspicuous; flowers appear with or often before the leaves . . 5

2. Leaves glabrous on both sides, rarely somewhat pubescent near the petiol; corolla lobes inside glabrous; Arabia, Socotra, Northeastern, Central and rarely in Western Africa . . . . . 3. **A. obesum**

   Leaves pubescent or only slightly so beneath; corolla lobes inside glabrous or pubescent 3

3. Leaves at the apex obtuse to rounded, subsessile; petiol 1–4 mm long; stamens included; corolla tube inside glabrous, narrow basal portion of the corolla tube 0.6–1 × as long as the calyx; S. Africa (N. Transvaal), Southern Moçambique, Swaziland . . . . . 5. **A. swazicum**

Leaves, at the apex acute, sessile; stamens barely included or exserted; corolla tube inside pubescent, narrow basal portion of the corolla tube (1.1–) 1.5–2 × as long as the calyx 4

4. Shrublet up to 40 cm with densily crowded leaves at the apex of each branchlet and with a carrot-like tuber; leaves always flat, never crispate; sepals ovate; South Africa . . . . . 4. **A. oleifolium**

Shrubby, slightly to much-branched tree, 0.4–5 m high; trunk swollen at the base; leaves crispate to undulate; sepals very narrowly oblong to very narrowly ovate; Arabia, Socotra, Northeastern, Central and rarely in Western Africa . . . . . 3. **A. obesum**

5. Narrow basal portion of the corolla tube shorter than the calyx; stamens included; corolla tube inside glabrous; lobes undulate; leaves pubescent at least at one side 6

Narrow basal portion of the corolla tube as long as or longer than the calyx; stamens barely included to exserted; corolla tube inside pubescent; lobes crispate or slightly so; leaves glabrous or pubescent 7

6. Secondary veins conspicuous, 16–19 (–24) on each side; leaves 4.5–8 cm wide, pubescent on both sides, exceptionally glabrous, obovate or rarely narrowly obovate; S.W. Africa, Southern Angola . . . 1. **A. boehmianum**

Secondary veins more or less inconspicuous; leaves 0.5–3.0 cm wide, pubescent or slightly so beneath, glabrous above except for the margins and midrib, oblong to narrowly oblong; Swaziland, South Africa (N. Transvaal), Southern Zimbabwe . . . . . 5. **A. swazicum**

7. Leaves glabrous on both sides, obovate or oblong; stamens distinctly exserted; calyx as long as the narrow basal portion of the corolla tube or nearly so; lobes crispate (flowers appear usually before the leaves); Zambia, Malawi, Zimbabwe, Moçambique, South Africa, Swaziland . . . . . 2. **A. multiflorum**

Leaves pubescent or glabrous, obovate to narrowly obovate or oblong; stamens barely included to exserted; calyx usually much shorter than the narrow basal portion of the corolla tube; lobes usually slightly crispate; Arabia, Socotra, Northeastern, Central and rarely in Western Africa . . . . . 3. **A. obesum**

DESCRIPTIONS

1. Adenium boehmianum Schinz, 1888: 259–261; Stapf, 1902: 227; Codd, 1963: 282; Rowley, 1974: 160, 164. **Fig. 1, Map 1**

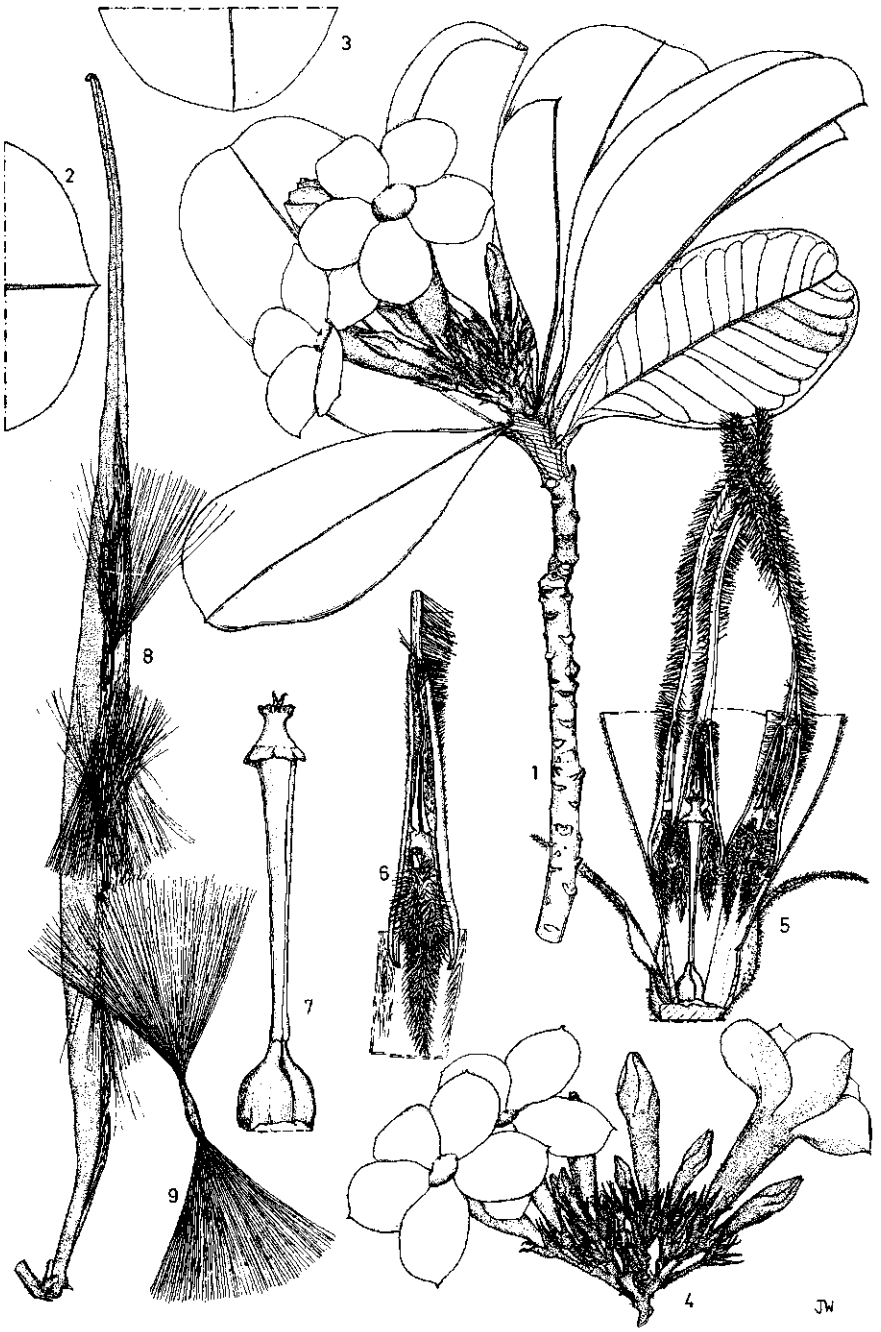


FIG. 1. *Adenium boehmianum* Schinz – 1. habit × 2/3; 2, 3. apex of the leaves × 2/3; 4. inflorescence × 2/3; 5. anthers and pistil × 3; 6. anther × 6; 7. pistil × 6; 8. fruit × 2/3; 9. seed × 2/3. - (1, 3. *Werdemann & Oberdieck 2425;* 2. *Santos 854;* 4. *Mendes 3945;* 5, 6, 7. *Menezes 3670;* 8, 9. *Teixeira et al. 12751).*

Types: S.W. Africa, Ovamboland: Olukonda, *Schinz 216* (K, lectotype); *Schinz I. 1886* (Z, paratype); *221* (Z, paratype).

A *succulent* rhizomatous shrub, 0.8–2.5 m high, and at the extreme base up to 40 cm in diameter.

Leaves subsessile; blade obovate to narrowly obovate, 1.5–2 (–3.5) × as long as wide, 8–15 × (2.5–) 4.5–8 cm, rounded to emarginate and apiculate to mucronate at the apex, above slightly shiny, glaucous or pale green, and pubescent, rarely glabrous, beneath dull, slightly paler green, and often more densily pubescent, rarely glabrous; secondary veins conspicuous, 16–19 (–24); petiole 1–3 mm long.

Inflorescence 7–8 × 3–5 cm; bracts narrowly oblong, 6–11 × 1–3 mm, acuminate at the apex, pubescent on both sides.

Pedicels 7–14 mm long.

Sepals glaucous to green, narrowly oblong to narrowly ovate, 7–11.5 × 2–2.5 (–3.5) mm, outside pubescent, inside appressed pubescent, especially towards the apex.

Corolla (pale) pink to red; tube deeper pink or deeper red than the corolla lobes, 2.6–3.6 (–4.5) × as long as the calyx, 2.3–3.7 × 1–1.5 cm, outside pubescent, only at the extreme base nearly glabrous, inside glabrous; narrow basal portion 0.5–0.9 × as long as the calyx, 0.7–1 × (0.25–) 0.5–0.7 cm; lobes (pale) pink, obovate, 2–3.2 × 1.5–2.7 cm, apiculate, slightly undulate, outside sparsely and minutely pubescent, inside glabrous; a glabrous, 2 × 1.5 mm scale, at the base.

Stamens included, free portion of the filament 0.3 – 0.4 × as long as the anther, outside glabrous, inside woolly; anther 5–6.5 × 1–1.5 mm, outside hispid; cells 2–3 × 1 mm; appendices 1.7–2.5 × as long as the anthers, hispid.

Pistil 8.5–11 mm long; ovary glabrous or sometimes with some appressed stiff hairs at the apex; carpels 1–2 × 0.7–1 × 1–1.5 mm; style 6–7 × 0.5 mm; clavuncula 1.5–2 × 1–1.5 mm.

Fruit grey to grey-brown, (7–) 16–28 × 0.7–1.3 cm.

Seed pale brown, glabrous, 1–1.2 × 0.2–0.4 cm; hairtufts dirty white, 3–4.8 cm.

Distribution: Southern Angola and Southwest Africa.

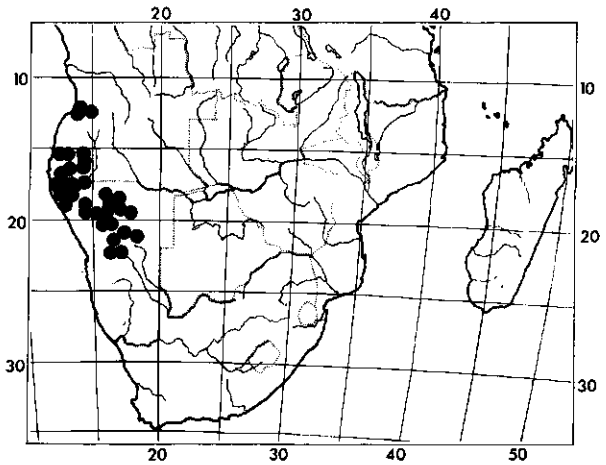
Ecology: Widespread in rocky places and occasionally on wet banks of marshes. Alt.: 50–850 (–1300) m.

Uses: Rootsap and latex are used as arrow poison by the Heikom Bushmen.

Vernacular names: Ouzuwo or Ouzuoo (S.W. Africa – Herero name).

Specimens examined:

ANGOLA: Benguella: country of the Ganguellas and Ambuellas (fl. June) *Gossweiler 1680* (BM, K, LISJC); Lengue (fr. Aug.) *Gossweiler 4951* (BM); ibid. (fl. Dec.) *Gossweiler 9684* (BM, K, LISJC, US); Catengue (fl., fr. July) *Gossweiler 12136* (BM, LISC, LISJC); ibid., 96 kms S.E. of Benguella (fl. July) *Reynolds 9304* (PRE); Caimbambo (fl. Aug.) *Leach & Cannell 13917* (LISC); Moçamedes



MAP. 1. *Adenium boehmianum*

distr.: Iona Campendo (fr. Sept.) *Mendes 146* (LISC); ibid. (fr. Oct.) *Teixeira et al. 12757* (LISC); Serra da Providencia (fl. May) *Mendes 3945* (LISC); Tchieque (fr. Oct.) *Teixeira et al. 12751* (LISC); Oncoéna (fl. Jan.) *Torre 8470* (LISC); Huila distr.: Curoca, Chitado (fl. Jan.) *Menezes & Henriques 30* (LISC); 42 kms from Gambos to Chimboledo (fl. Nov.) *Menezes 3557* (K, LISC, PRE); Gambos (fl. Dec.) *Menezes 3670* (BM, K, LISC, P); *3713* (BM, K, LISC, P); sin.loc. (fl. Jan.) *Santos 854* (LISC, PRE); 18 kms from Gambos to Chibenda (fl. Nov.) *Santos & Barrosa 2880* (LISC); Kaokoveld distr.: sin.loc. (fl.) *Otzen III. 1940* (BOL).

S.W. AFRICA: Kaokoveld distr.: Otjikonda: Utjitambi (fl.) *Barnard I. 1926* (NBG); Otjihipaberg, *Davies, Thompson & Miller 92* (PRE); Sanitatas (fl.) *Gibson 215* (MO, US); between Sanitatas and Otjikonga (fr. Jan.) *Merxmüller 1460* (PRE); Swartbooisdrift (fl. July) *Goyns 47* (PRE); Kunene R. (fl. June) *Hall 472* (NBG); ibid., S.E. of Omberera (fl. July) *Leistner, Oliver, Steenkamp & Vorster 289* (K, MO, PRE); Otjomborombonga (fl., fr. July) *Leistner et al. 164* (K, MO, PRE); 6 kms E. of Epupa Falls (fl. July) *Leistner et al. 266* (K, PRE); Otjikuare (fl. Jan.) *Merxmüller 1343* (PRE); Kupupa Valley (fr. Aug.) *Story 5648* (PRE); Kamanjab Mt. (fr. Aug.) *Story 5838* (PRE); ibid. (fl.) *Thorne I. 1925* (NBG); sin.loc. (fl. Apr.) *Winter & Leistner 5406* (PRE), *5618* (B, K, PRE); Ovamboland, Klein Namutoni (fl. Jan.) *Breyer 20576* (PRE); between Olukonga and Uukwanyama (fl. Jan.) *Rautanen 425* (G, K), *684* (Z); 25 kms W. of Ruacuna Falls (fl. Mar.) *Rodin 9186* (K, MO, PRE, UC); Kaross, Etosha Nat. Park (fl. Mar.) *Le Roux 340* (PRE); Olukonda (fl.) *Schinz 216* (K, paratype), *221* (Z, lectotype), *I. 1886* (Z, paratype); Grootfontein: Otjikote (fl.) *Jensen 18.XII. 1955* (PRE); Tsumeb, 25 kms from Oshivelo Pol. Contr. Post (fl. Jan.) *Jaarsveld 2791* (NBG); Grootfontein (fl. Jan.) *H. & E. Walter 785* (B); Otjikoto (fl.) *Barnard 862* (NBG); Okakuba (fl.) *Breda IV. 1927* (PRE, Z); Outjo: (fl. Mar.) *Hardy 2096* (PRE); F. Franken, Hauskamp (fl. Jan.) *Schwerdtfeger 1/123* (B); Sarataga (fl. Apr.) *Steyn 22548* (PRE); 52 kms E.S.E. of Kamanjab Mt. (fl. Apr.) *Winter 3063* (K, PRE); Hereroland: Quaqiprits (fl. Jan.) *Dinter 180* (Z); Matchlessmine (fl.) *Flerk 802* (Z); Okahandya (fl.) *Zschokke (1928)* (Z); Farm Westfalen, Okauhuejo (fl. Apr.) *Giess 8181* (PRE); Namibrand: Karibib, Okomitundu (fl. Mar.) *Hälbich 959* (B, PRE); ibid. (fl. Apr.) *Seydel 1510* (BR, WAG), (fl. June) *2944* (A, B, G, L, US); Windhoek: Khomas Highlands (fl. Jan.) *Kinges 2479* (PRE); 164 kms N. of Windhoek, *Hardy & de Winter 1385* (PRE); ibid. (fl. Mar.) *Werdemann & Oberdieck 2425* (A, B, BR, K, PRE, WAG); Windhoek (fl. Feb.) *van Vuuren 968* (K, PRE); ibid. (fl. Mar.) *de Winter 2446* (K, PRE).

2. Adenium multiflorum Klotzsch, 1861: 279, 280, t. 44; Stapf, 1902: 229, 230; Stapf, 1907: 514; Dyer et al., 1921: t. 16; Codd, 1963: 279, 280; Rowley, 1974: 160, 164. **Fig. 2, Map 2, Phot. 1**

Types: Moçambique, neighbourhood of Tette, *Peters s.n.* (holotype not seen, destroyed in B); neotype, between Uopeio and Campo, *Mendonça 2040* (LISC).

Homotypic synonyms: *A. obesum* (Forks.) R. & S. var. *multiflorum* (Klotzsch) L. E. Codd, 1961: 452; *A. obesum* (Forsk.) R. & S. ssp. *multiflorum* (Klotzsch) Rowl., 1974: 164 **(syn. nov.)**.

A *succulent* shrubby tree, 1 – many branched, 0.5–3.5 m high; large carrot-like root, up to 1 m in diameter; poisonous white latex; bark shiny grey.

Leaves usually appearing after the flowers, subsessile; blade obovate to oblong, 1.5–3 (–5.5) × as long as wide, (3.5–) 7.6–12.5 × (1.4–) 2–7.6 cm, acute or rounded to emerginate and apiculate to mucronate at the apex, above shiny green to pale green, and glabrous, beneath dull, slightly paler green and glabrous; secondary veins conspicuous (5–) 6–11 (–13); petiole 3–7 mm long.

Inflorescence 0.75–2 × 0.5–1.5 cm; bracts narrowly obovate 4–6 × 1–3 mm, acuminate at the apex, entire, outside pubescent, inside somewhat appressed pubescent.

Pedicels densely pubescent to tomentose, 2–4 mm long.

Sepals narrowly ovate, 6–10 × 2.5–3 mm, outside pubescent, inside appressed pubescent, especially towards the apex.

PHOT. 1. *Adenium multiflorum* (*Plaizier 1442*, phot. J. W. MUGGE, cult. Wageningen, the Netherlands).

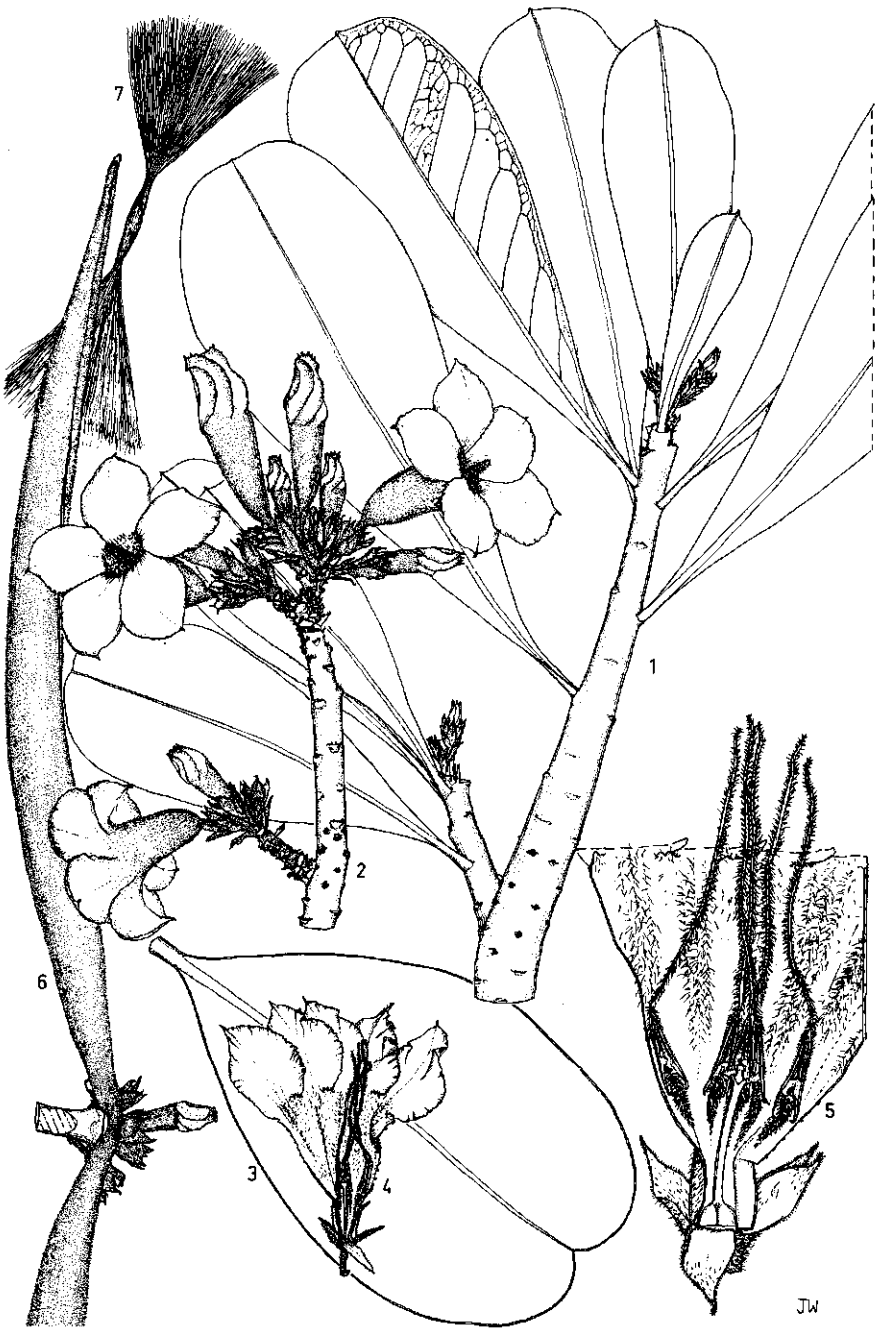


FIG. 2. *Adenium multiflorum* Klotzsch – 1. habit, leaves × 2/3; 2. habit, flowers × 2/3; 3. leaf × 2/3; 4. flower × 2/3; 5. anthers and pistil × 2; 6. fruit × 2/3; 7. seed × 2/3. – (1. *Leach 9923;* 2, 6. *Mendonça 2040;* 3. *Rogers 20717;* 4. *Rodin 4721;* 5. *Taylor 638;* 7. *Angus 3335*).

Corolla red to white; tube pink to white, red striped within the throat, (2–) 2.5–4 × as long as the calyx, 2.2–3.9 × 1–1.3 cm, outside pubescent, sometimes towards the extreme base somewhat less pubescent, inside a pubescence of obscure glandular hairs, usually on the main veins strigose glandular hairs; narrow basal portion 0.9–1.1 (–1.4) × as long as the calyx, 0.7–1 × 0.3–0.7 cm; lobes pink to white with deep pink to scarlet margins, 1.3–2.9 × 1–1.9 cm, narrowly ovate to narrowly obovate, mucronate to apiculate, crispate, outside sparsely and minutely pubescent, inside glabrous, with a velutinous scale, 2 × 2–2.5 mm, at the base.

Stamens distinctly exserted; free portion of filament 0.3–0.4 × as long as the anther, outside densily pubescent, inside woolly; anther 5.5–7 × 0.5–1 mm; cells 2–3 × 0.5 mm; appendices pink to white, 2–4.9 × as long as the anther, especially on the outside hispid.

Pistil 10.5–12.5 (–15) mm long; ovary glabrous; carpels 1–2 × 0.5–1 × 0.5–1.5 mm; styles 8–11 × 0.5 mm; clavuncula 1–1.5 × 0.5–1 mm.

Fruit pale grey to pale grey-brown, (7–) 10–18 × 0.8–1.5 cm.

Seed very pale brown, glabrous or very minutely appressed pubescent, 1–1.5 × 0.2–0.3 cm; hair tufts dirty white to light brown, 2–3 cm long.

Distribution: In the extreme southeastern part of Zambia, widespread in Malawi, Moçambique, Zimbabwe, South Africa (Transvaal, Natal) and Swaziland.

Ecology: Savannas and occasionally in open forests; on sandy soil of marsh- and riverbanks and in much drier sandy or rocky habitats. Alt.: 0–700 (–1.200) m.

Uses: Fish-, arrow-, and magic poison. Poisonous for stock, but probably not touched by it.

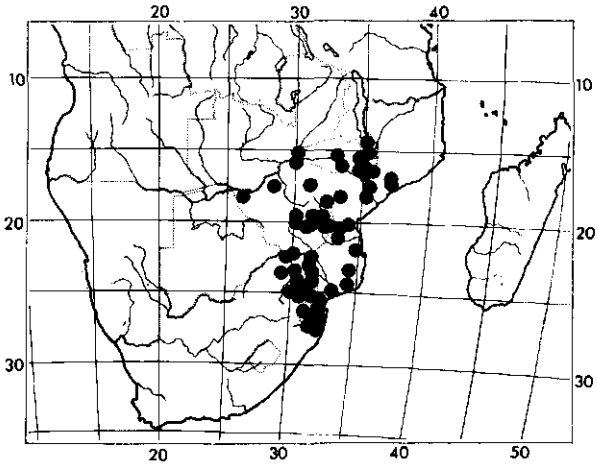
Vernacular names: Sabi Star (Zambia, Zimbabwe); Star of Rhodesia, Nyakalambe (Malawi); Megoza, Ximoane, Chimungumudzua (Moçambique); Impala Lily or Lelie, Mutio (South Africa).

Specimens examined:

ZAMBIA: Feira distr.: Katondwe Mission (fr. Sept) *Angus 3335* (FHO); Katondwe, *Fanshawe 8247* (K).

MALAWI: Fort Johnston (fl., fr. Sept.) *Burtt Davy 21762* (K); Kusupa distr.: Liwonde Nat. Park (fl. Oct.) *Carey* 4 (BM); ibid. (fl., fr. July) *Patel 105* (SRGH); M'Patamanga Gorge (fl. July) *Goyns 1* (PRE); ibid. (fl. May) *Leach 9923* (K, PRE, SRGH); Chikwawa distr.: Lengwe Game Res. (fl. June) *Hall-Martin 864* (K, SRGH); Lower Shire distr.: Chiromo area (fl. July) *Hornby 2891* (PRE); ibid. (fl., fr.) *Purves 220* (K); Elephant Mash area (fl.) *Robertson 28* (K); Junction of Shire R. and Ruo R. (fl. July) *Seagrief 3093* (SRGH); Nsanje distr.: Matope-Mwabvi Game Res. (fl. Aug.) *Salubeni 1967* (SRGH); Silangu Plain (fl.) *Topham 498* (FHO).

ZIMBABWE: Southern Prov.: Gwembo (fl. Sept.) *Bainbridge 101/55* (FHO, SRGH); Ewanrigg distr.: Arctusus, *Hopkins B 1603* (UC); Wankie, between Sebuagwe R. and Zambesi R. (fl. May) *Plowes 1848* (K, PRE); Umtali distr.: Chipinga (fl.) *Brain 18. VIII. 1932* (PRE); Ndanga distr.: Lundi area (fl. June) *Hall 63* (NBG); ibid., Sabi R. (fl. June) *Hall 82* (NBG); *101* (NBG); Sabi Valley distr.: Birchenough Bridge, near Sabi R. (ff. Aug.) *Hall 1114* (NBG); ibid. (fl. Aug.) *Methuen 97* (K);



MAP 2. *Adenium multiflorum*

ibid. (fl. July) *Stock 43613* (SRGH); *43614* (SRGH); Sabi Valley Dev. Farm (fl. Aug.) *Taylor 3407* (NBG); Lower Sabi distr.: W. bank of Devuli R. *Wild 2471* (BR, K, SRGH); Melsetter distr.: Nyanyadzi (fl. Aug.) *Plowes 3433* (K, PRE); Victoria distr.: (fl. Oct.) *Eyles 2760* (K, SRGH); ibid. (fl. Oct.) *Mundy 3250* (SRGH); Bikita distr.: sin. loc. *Phipps 2233* (K, SRGH).

MOÇAMBIQUE: Tete distr.: 46.5 kms from Tete to Robuo (fl. July) *Barbosa & Carvalho 3744* (LISC); N.E. of Tete ferry (fl., fr. Aug.) *Leach 10460* (K, SRGH); Porto de Tete (fl. July) *Menyhart 8* (Z); between Lóbùe and Tete (fl., fr. Sept.) *Torre 3379* (LISC); Zambezi distr.: Posto Chive (fl. May) *Bawbrick 5208* (LISC, SRGH); sin. loc., *Carvalho annis 1884–1885* (COI); between Uopeio and Campo (fl., fr. Sept.) *Mendonça 2040* (LISC, neotype); Inhambane distr.: Covaro, kms 37 Matoba–Macheila (fl. Sept.) *Correia & Marques 3303* (WAG); Vilanculos, between Fuhalouro and Sauté (fl. Fr. May) *Torre 2699* (LISC); Arredores de Mopeia (fl. Oct.) *Torre 3656* (LISC); Gorongosa Game Res.: N.W. end of Urema flats (fl. July) *Chase 6626* (FI, P, SRGH); Manica Sofala distr.: 21 kms S. of Muda (fl. June) *Leach 9181* (SRGH); 22.5 kms S. of Tica (fl. June) *Leach & Wild 11114* (K, LISC, PRE, SRGH); 16 kms S. of Mambone (fl., fr. Oct.) *Leach & Bayliss 11886* (K, LISC, SRGH); Maringa, Save R. (fl.) *Pedrogad 7847* (PRE); 120 kms from Mambone to Buzi (fl. Oct.) *Torre & Pareira 12346* (LISC); Cara distr.: 8 kms from Masangasa to Madisdêre (fl. Aug.) *Correia & Marques 3258* (WAG); Meringua distr.: 8 kms N. of Meringua village (fl. June) *Chase 2235* (BM, NY, SRGH); Danga distr.: sin. loc. (fl. June) *Chase 2363* (BM, K, SRGH); Mupieto (fl.) *Sito 930* (LISC); Maputo distr.: Umbeluzi (fl. Aug.) *Borle 543* (K, PRE, SRGH); Umbeluzi Valley (fl. July) *Gestner 6680* (BOL); Maputo (fl.) *Junod VIII. 1919* (PRE); ibid. (fl. Oct.) *Torre 1903* (LISC); 20 kms from Matola to Umbeluzi (fl. June) *Macuácua 72* (K, LISC); 1.2 kms from Mazeminhama (fl. Aug.) *Mafumo & Boane 66* (WAG); Matola Rio (fl. May) *Monra 61* (COI); Boane (fl. June) *Pedro 47* (PRE); along Sabi R. (fl. Nov.) *Swynnerton 557* (BM); Chikwala Kwala, Limpopo flats (fl.) *Smits VII. 1928* (PRE); Santo Antonio (fl. May) *Menyharth 616* (WU, Z).

SOUTH AFRICA: Transvaal: Zoutpansberg distr.: Nuanetsi (fl.) *Breyer 16033* (PRE); Chipise (fl., fr. Sept.) *Codd 3007* (PRE); Kruger Nat. Park (fl. May) *Codd & de Winter 5540* (PRE); Tzaneen Est. (fl. Sept.) *Gray 2999* (PRE); Chipise-Mopanird (fl. Aug.) *Hardy 972* (K, PRE); Punda Maria (fr.) *Lang XI. 1932* (PRE); Klein Letaba (fl. Oct.) *Matthewman PRE 4067* (PRE); Njejele R. (fr., fr.) *Munro IX. 1939* (PRE); Messina (fl. June) *Galpin 9183* (PRE); ibid. (fl.) *Rogers 20016* (Z); (fl. July) *20717* (NH, PRE); (fl. Sept.) *21862* (Z); Ingelela R. (fl.) *Schinz 12.VI.1926* (BOL, Z); *29.VII.1926* (Z); ibid. (fl. Nov.) *Steyn 13531* (PRE); Gudzane-dam (fl. July) *van der Schijff 631* (PRE); Shingwidzi Rest Camp (fl., fr. Sept.) *van der Schijff 856* (PRE); Pietersburg distr.: Great Letaba (fl. July) *Breyer 17583* (PRE); sin. loc. (fl.) *Galpin 13528* (BOL, U, PRE); Letaba, 1 km S. of

Selate R. bridge (fl. July) *Taylor 638* (NY, PRE); Selati Res., near Selati R. (fl., fr. Sept.) *Pole-Evans H 18862* (K, PRE); Selati Railway (fl., fr. June) *Rogers 2671* (PRE); Nelspruit distr.: Kruger Nat. Park (fl. May) *Codd 5495* (PRE); ibid. Malelane Rest Camp (fl. Aug) *Codd 6147* (PRE); Sabie Game Res. near Res. Tiding (fl. June) *Potts 3662* (PRE); Barbeton distr.: Ten Bosch near Komatipoort (fl. Aug.) *Keet 1489* (PRE); Kruger Nat. Park near Res. Station (fl.) *Lang 18.VIII.1932* (PRE); sin. loc. (fl. June) *Rogers 2691* (BOL, NBG, Z); sin. loc. (fl. Sept.) *Pearson 13666* (BOL, K); Natal: Ingwavuma distr.: near Pangola R. (fl. July) *Boocock 44* (PRE); Tozinidam in Pangola R. (fl. Aug.) *Hardy 1767* (PRE); Ngotshe, Candover Estate on Pangola R. (fl.) *Liebenberg VIII.1929* (A, PRE); Ndumu Game Res. (fl. July) *Pooley 637* (E); Shemula's Pont (fl. July) *Ward 2357* (NH, PRE); N. Zululand distr.: Mkuzi R. (fl. Aug.) *Galpin 13313* (BOL, K, PRE); Mukuzi loc. (fl., fr. July) *Johnson 69* (NBG); 8 kms E. of Ubombo/Mbazwana (fl. Sept.) *Ross & Moll 5050* (K, LISC); 26 kms E. of Ubombo Range (fl.) *Uys 26.VIII.1952* (NBG); Makathini area (fl. Aug.) *Wearne 66* (PRE); *92* (NH, PRE); *93* (PRE).

SWAZILAND: Hatikulu distr.: Big Bend loc. (fr.) *Dlamini 18.XI.1960* (NBG); Siphofaneni (fl. Sept.) *Kemp 925* (PRE); 6.5 kms S.W. of Big Bend (fl. June) *Murdock 80* (NBG); Gollel distr.: Gollel (fl. May), *Rodin 4721*(K, MO, PRE, UC); sin. loc. (fl. June) *Stewart 8839* (PRE).

Notes: In this publication *A. multiflorum* is treated as a species and not as a variety or as a subspecies of *A. obesum* as CODD (1961) and ROWLEY (1974) had done. *A. multiflorum* is almost as easily distinguished from *A. obesum* as from the other species. Moreover, no intermediate specimens between *A. multiflorum* and another *A.* species exist and therefore the present author prefers to reinstate *A. multiflorum* as a species.

The type specimen, *Peters s.n.*, collected in the neighbourhood of 'Tette' (= Tete), Moçambique, has been destroyed in B and no isotypes have been found. Therefore a neotype is designated. Two specimens of this species had been collected on a rather short distance from the type, *Leach 10460*, represented in two herbaria and consisting of leafless flowering branches and *Mendonça 2040*, represented unfortunely in a single herbarium and consisting of leafbearing, flowering branches, and two immature fruits. Although MENDONÇA's collection is represented in a single herbarium only, it is chosen, as it is much richer than that of LEACH. It should be repeated here, that *A. multiflorum* usually bears leaves only after the flowering season.

3. Adenium obesum (Forsk.) Roem. & Schult., 1819: 411; Don, 1837: 80 (as *Adenum obesum*); De Candolle, 1844: 412; Anders, 1860: 23, 24; Hooker, 1863: t.5418; Balfour f., 1888: 159–161; Schumann, 1895: 319; Huber, 1963: 76; Rowley, 1974: 160, 164. **Fig. 3, Map 3**

Basionym: *Nerium obesum* Forsk., 1775: 205; Vahl, 1791: 45, 46. Type: Arabia, Melhan, *Forskål Herb. 235* (C, holotype).

Homotypic synonym: *Cameraria obesa* (Forsk.) Spreng., 1825: 641.

Heterotypic synonyms: *A. honghel* A. DC., 1844: 412: Lindl., 1846: t.54; Stapf, 1902: 229, 230. Type: Sénégal, *Leprïeur s.n.* (G, paratype); *Perrottet 462* (G-DC, lectotype, not seen, micro WAG; isotypes: G, P).

A. speciosum Fenzl, 1865: 140, 141; Grant, 1874: 108; Stapf, 1902: 228. Type:

Ethiopia, Neighbourhood of Mt Nubanorum, also seen near Fassoglu and Akkaro, *Kotschy 399* (K, holotype).

A. arabicum Balf. f., 1888: 162. Types: *A. honghel* A. DC. in Lindl. 1846: t.54, plate only (lectotype); *A. obesum* (Forsk.) Roem. & Schult. in Hooker, 1863 t.5418 (paratype): *A. obesum* (Forsk.) Roem. & Schult. in Anders, 1860: Suppl. 23 (paratype).

A. somalense Balf. f., 1888: 162; Stapf, 1902: 228, 229; Chiovenda, 1932: 287; Rowley, 1974: 160. Type: Somalia Coast, *Playfair 3* (K, holotype), **(syn. nov.)**.

A. micranthum Stapf, 1894: 334. Type: S. Arabia, Dobaibah, *Lunt 215* (K, holotype).

A. arboreum Ehrenberg, 1900: t.4, partly (excl. syn. *A. multiflorum* and *A. boehmianum*), **(syn. nov.)**, (lectotype: *Ehrenberg, 1900: t.4)*.

A. coetaneum Stapf, 1902: 227, 228: Engler & Drude, 1910: 161, 258; Chiovenda, 1932: 287; Dyer, 1939: t.753. Type: Uganda, Bari Country, *Speke & Grant 766* (K, lectotype; designated by Turrill, 1956: t.277).

A. socotranum Vierh., 1904: 286. Types: Socotra, Hagher Mts, *Paulay* (paratype, not seen); *Simony 12.I.1889* (WU, lectotype). Homotypic synonym: *A. obesum* ssp. *socotranum* (Vierh.) Lavranos, 1974: 160, **(syn. nov.)**.

A. tricholepis Chiovenda, 1932: 288, 289, **(syn. nov.)**. Types: Somalia, Oltregiuba, *Senni 70* (FI, lectotype); ibid., Cisguba, *Senni 77* (FI, paratype); ibid., Oltregiuba, *Senni 579* (FI, paratype).

A. somalense var. *caudatipetalum* Chiovenda, 1932: 288, **(syn. nov.)**. Type: Somalia, *Puccioni & Stefanini 242* (FI, holotype);

A. somalense var. *crispum* Chiovenda, 1932: 288, **(syn. nov.)**. Types: Somalia, *Puccioni & Stefanini 444* (FI, lectotype); ibid. *Puccioni & Stefanini 469* (FI, paratype), *512* (FI, paratype).

A *succulent* shrubby tree, 2 – many-branched, 0.4–4 m, rarely 5 m high, and at the extreme base up to 1 m, rarely up to 2 m in diameter; sometimes with a fleshy taproot. Bark pale greyish-green, smooth grey or smooth brown; latex fresh clear or white, dried white and sticky.

Leaves sessile or subsessile, flat or crispate; blade variable in shape, obovate, narrowly obovate to linear, 1.4–19 (–55) × as long as wide, 3–12 (–17) × (0.2–) 0.5–5 cm, acute to emarginate and apiculate to mucronate at the apex, above slightly glaucous, pale green or green, and pubescent to glabrous, beneath dull, slightly paler green, and pubescent to glabrous; midrib pale green, secondary veins if conspicuous up to 13, tertiary veins inconspicuous; petiole up to 4 mm long.

Inflorescence 1–2.5 × 0.5–1 cm, bracts linear to narrowly oblong, 3–8 × 1–3 mm, outside pubescent, inside appressed pubescent.

Pedicels 5–9 mm long, green suffused with pink.

Sepals green to white, suffused with pink, narrowly oblong to narrowly ovate, 0.5–1.1 × 0.2–0.3 cm, outside pubescent, inside appressed pubescent, especially towards the apex.

Corolla pink to red; tube reddish-pink to white suffused with pink, sometimes

FIG. 3. *Adenium obesum* (Forsk.) Roem. & Schult. – 1. habit, leaves × 2/3; 2. habit, flowers × 2/3; 3, 4. leaf × 2/3; 5. anthers and pistil × 2/3; 6. anthers and pistil × 2; 7, 8. clavuncula × 10; 9. fruit × 2/3; 10. seed × 2/3. – (1, 2. *Greenway 15400*; 3. *Paulo 1078*; 4. *Khattat 47*; 5, 6, 7. *Leeuwenberg 10784*; 8. *de Wilde 8726*; 9, 10. *Dekker 376*).

red striped within the throat (2.3–) 3–5.5 (–8.0) × as long as the calyx, 2–4.5 × 0.9–1.7 cm, outside pubescent at the extreme base pubescent or nearly glabrous, inside pubescent and on the (main) veins velutinous glandular hairs; narrow basal portion, 1.1–3.3 (–3.8) × as long as the calyx, 0.9–1.7 × 0.4–0.7 cm, lobes very pale pink to pale red in the centre, along the margins much darker, pink to crimson, 0.9–2.8 × 0.5–2 (–2.5) cm, mucronate to apiculate, undulate to crispate, outside sparsely and minutely pubescent, inside glabrous to appressed pubescent; a pubescent to velutinous scale at the base, 3–5 × 2–3 mm.

Stamens just included or exserted; free part of the filament 0.3–0.5 × as long as the anther, outside puberulous to tomentose, inside woolly to tomentose, (3–) 5–7 × 1–1.5 mm; cells 2–3 × 1 mm; appendices 2–5 (–5.6) × as long as the anther, hispid, especially on the outside.

Pistil 11–20 mm long; ovary glabrous or sometimes with some appressed stiff hairs at the base or at the apex; carpels (1–) 1.5–2.5 × 0.8–1.3 × 1–1.5 (–2) mm; style 8.5–17 (–21) × 0.5 mm; clavuncula 1–1.5 × 0.5–1 mm.

Fruit grey to pale grey-brown, sometimes fringed with pink, 11–22 × 0.9–2 cm.

Seed very pale brown, slightly rough, 1–1.4 × 0.2–0.4 cm, with dirty white, 2.5–3.5 cm long, hairtufts.

Distribution: Arabia, Socotra, Northeastern, Central and rarely in Western Africa.

Ecology: Savannas and occasionally in open forests, on sandy or rocky soils. Alt.: 0–2100 m.

Uses: as arrow poison; to mark graves; to kill lice and thicks; poisonous for stock.

Vernacular names: 'Desert Rose' (Kenya, Tanzania); 'Gol', 'Midiga' (Kenya); 'Kilengandumba' (Tanzania).

A selection of the more than 450 examined specimens:

SENEGAL: Bakel (fl. Dec.) *Berhaut 4221* (P); ibid. (fr. June) *Chevalier 26034* (P); Namari, *Fotius 350*[a] (P); Region du Ferlo (fl. Oct.) *Koechlin 7031* (P); Matam and Benkal (fl. Febr.) *Roberty 10090* (G); Babil (fl., fr. June) *Trochain 3590* (P).

MALI: 13.45N, 8.35W (fr.) *Dekker 376* (WAG); Sebekoro (fl. Oct.) *Geerling & Coulebaly 5888* (WAG).

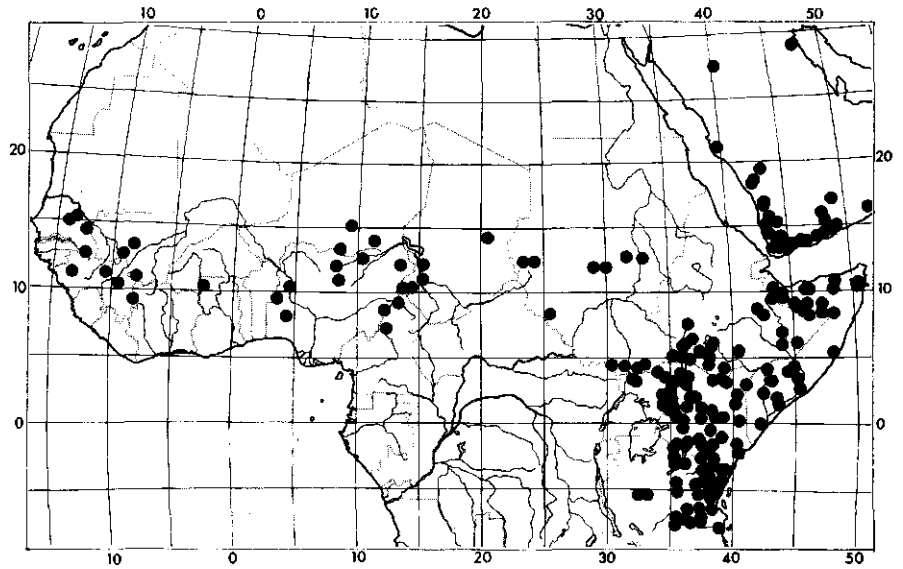
GUINEA (–Konakry): Dinguiraye (fl. Dec.) *Jacques & Felix 1498* (P); Kouroussa (fl., fr.) *Pobéguin 603* (P); Guelba de Soungout (fl., fr. Mar.) *Roberty 16898* (G); Boé entre a Jangada a Madina (fl., fr. Jan.) *Santo 2364* (K, LISJC).

GHANA: Lawra (fr. May) *Vigné 3811* (FHO).

NIGER: Zinder, *Blum 2503* (NY); Boulouli (fl. Oct.) *Chevalier 93* (P); Nioro, *Chuderau 13. VII. 1918* (B); Baukolé (fl., fr. Oct.) *Dubois 133* (P).

NIGERIA: Banfarie (fl. Mar.) *Chevalier 530* (BR, G, K, P); Dikwa (fl. Jan.) *Clintock 141* (K); Adamawa (fl. Dec.) *Ekwuno 347* (K); Kano (fl. Dec.) *Hagerup 669* (C, K); Alantika Mts (fl. Dec.) *Hepper 1609* (K, P); Jos Plateau (fl.) *Lely III.1929* (FHO, K).

CAMEROUN: Ngaoundere (fl., fr. May) *Dang 555* (P); Trinquelin (fl.) *Geerling & Mayouo 5687* (WAG); Garbabi (fl.) *Latilo & Daromolo 22.I.1955* (FHO, K); Soulédé (fl. Oct.) *Saxer 553* (K, PRE, WAG, Z); Darboki (fr.) *Vaillant 131* (P); (fl. Sept.) *131*[b] (P).



MAP 3. *Adenium obesum*

CHAD: Dalama El Amer, *Chevalier 9900* (BR, G, K, P); Mogroum (fl.) *Fotius 1803* (P); Maigoma (fl. Nov.) *Gaston 1300* (P); Biltine (fl. Dec.) Zolotarevsky, *Murat & Dupont 659* (P).

SUDAN: Abu Zabad (fl. Jan.) *Dandy 253* (BM); Mongalla (fl. Sept.) *Jackson 340* (FHO); Khartum (fl.) *Lucas 75* (K); Torit (fr. Dec.) *Macdonald 4* (BM); Jorit (fl. Apr.) *Snowden 1674* (BM, K); Bake (fl.) *Vuillet 264* (P); between Zalingei and Nyala (fl. Jan.) *Wilde 5618* (WAG).

SAUDI ARABIA: Wadi Bin Hishbal (fl. June) *Hewitt 8* (BM); Wadi Dele (fl.) *Khattat & Shabetai 25.V.1944* (G); Hadil (fl. Nov.) *Mosnier 2996* (P); Shaïb Hanjur (fl. June) *Philby 2.VI.1936* (BM); Qaideh (fl. Aug.) *Radcliffe, Smith & Henchie 4414* (K); Schemsâm, *Schweinfurth 69* (BR, G, K, LE, P); Wadi Turban (fl. Mar.) *Smith & Lavranos 44* (K); Mts above Shihr (fl.) *Thesiger 24.IV.1947* (BM); Dhufar (fl. Oct.) *Vesey-Fitzgerald 12550/2* (BM).

OMAN: North of Zick (fl. Nov.) *Lawton 897* (K); 43 kms N. of Salalah (fl. Sept.) *Radcliffe & Smith 5157* (K); Jebel Qamar, *5247* (K).

YEMEN: Bilad Amir Wadi el Negil (fl. Jan.) *Deflers 233* (G, K, P); Melhân (fl. Febr.) *Forskål Herb. 235* (C, holotype of *A. obesum*); Mudia Area (fl. May) *Grierson 184*[a] (BM, E); (fl. Apr.) *265* (BM, E); Jebel Shamsan (fl. Mar.) *Smith & Lavranos 46* (FI, K); Jebel Bura, *Schweinfurth 291* (G, K); Melhân (fl. Jan.) *694* (BM, BR, C, G, LE, P).

HADRAMAUT: Mukalla, *Lunt 48* (BM, K); Wadi Himim (fl.) *Wissmann 1200* (HBG); (fl.) *1205* (HBG); Mukalla (fl.) *1206* (HBG).

ETHIOPIA: S. of Arba Minch (fl. Nov.) *Ash 2261* (K, MO); W. of Yaballo (fl. Sept.) *Bally 9253* (G, K); E. of Yaballo (fl. Sept.) *9267* (G, K, UC); Fich (fl. Nov.) *Burger 2288* (FI, K, US); Daletti (fl. Nov.) *3366* (FI, K, US); 5N, 36E (fl. June) *Carr 204* (K, MO); Lower Omo R. Basin (fl. July) *776* (EA, GENT, K); Murlé (fl. July) *Corradi 8019* (FI); (fl. July) *8020* (FI); (fl. July) *8021* (FI); (fl. July) *8022* (FI); El Rago (fl.) *Ellis 244* (FI, K); L. Margherita (fl.) *Mangana anno 1909* (FI); Hamare (fl. May) *Riva 810* (FI); Cavernay (fl. Jan.) *853* (Z); L. Margharita (fl., fr. Dec.) *Vàtova 1341* (FI); Ijjojetremo (fl., fr. Dec.) *1365* (FI); 81 kms from Sodda (fl. Febr.) *Westphal & Westphal-Stevens 3197* (BR, MO, WAG).

SOMALILAND: Gura Taktak (fl. Oct.) *Bally 10197* (K); Arorih Plains (fl. Oct.) *10210* (K); Eik (fl. Oct.) *10215* (K); Boudary Piller 93 (fl. Oct.) *Gillet 4149* (FI, K, P); 9.57N 44.18E (fl. Oct.) *4343* (FI, K); Budiawing (fl. Oct.) *Glover & Gilliland 57* (BM, K); (fl. Oct.) *227* (BM, FHO, K); Elayu (fl. Mar.)

905 (BM, FHO, K); 32 kms W. of Berbara (fl. April) *1118* (BM, FHO, K); 8 kms E. of Durah (fl. Sept.) *Hemming 1923* (FI, K); Berbara (fl.) *Playfair 3* (K, holotype of *A. somalense*).

SOMALIA: Chismaio (fl. Oct.) *Bally 9349* (G, K, UC); Einad, *Collenette 321* (K); Gondarabe (fl. June) *Kasmi, Elmi & Rodol 570* (WAG); Garbo (fl. Sept.) *Peck 343* (EA, K); Adahi Kararteain (fl. Oct.) *Popov 1004* (EA, K); Tra Tigieglo e Bur Cal (fl., fr. Mar.) *Puccioni & Stefanini 242(270)* (FI, holotype of *A. somalense* var. *caudatipetalum*); Tra Uarandi e Scillin – Bilhelli (fl. Apr.) *512(565)* (FI, paratype of *A. somalense* var. *crispum)*.

SOCOTRA: sin. loc. (fl. Aug.) *Balfour 139* (BM, E, GH, K, LE, OXF); sin. loc. (fl. Mar.) *174* (K, OXF); sin. loc. (fl. Febr./Mar.) *695* (BM, K, LE, OXF); Segal (fl. Aug.) *Popov 50/280* (BM, EA); Galousir (fl. Apr.) *Schweinfurth 245* (BP, K, P, WU); Hammaderoh (fl. Apr.) *Smith & Lavranos 316* (FI, PRE, WAG).

UGANDA: Agora Hill (fl. May) *Jackson in B 9840* (G); Nimule Nile (fl. Nov.) *Kassner 3164* (BM, E, K, P, Z): 1.54N 34.51E (fl. Jan.) *Maiton 15.1.1966* (EA); Moroto (fl.) *Phillips in B 11461*(K); Kidepo Nat. Park (fl. July) *Symott 1354* (EA).

KENYA: K_1: Northern Frontier: Tana (fl. Jan.) *Bally 2066* (G, K); Mt. Kulal (fl. Oct.) *5653* (C, G); 59 kms N.E. Mudo Gashi (fl. Dec.) *Bally & Melville 15249* (G, K, MO); Dandu (fl. Mar.) *Gillet 12531* (B,BR,FI, K); Lokori (fl. May) *Mathew 6320* (FI, K); Egeles (fl., fr. Aug.) *Mwangangi & Gwyne 1162* (MO, P); N. of Lokori (fl., fr. Aug.) *Mwangangi 1424* (EA, K); K_2: Turkana: L. Hannington (fl. Aug.) *Bally 9040* (K); Turkana (fl. June) *Martin 26* (FHO); K_3: Rift Valley: Chepkum (fl. Mar.) *Bally 12333*[a] (G, K); ibid. (fl. Mar.) *12333*[b](G, K); Kamasia Res. (fl. July) *Polhill 1* (K); Marigat (fl.) *Reinington 2545* (K); K_4: Central Prov.: Meru Nat. Park, Golo Circuit (fl. Dec.) *Ament 443* (EA, K); Yatta Gab (fl. Febr.) *Bally 8665* (K); Mutha Plains (fl., fr. Aug.) *Boy Joana 7385* (K, NY); N. of Isiola (fl. July); *Evans & Errens 1235* (E, PRE); 18 kms E. of Mtito Andei (fl. Oct.) *Greenway 10810* (K, PRE); K_6: Masai: Lorgasaille Plains (fl. Aug.) *Bally 2639* (K); 39 kms N. of Magadi (fl.) *Rolyns 3974* (BR); K_7: Coast Prov.: Sokoke (fl., fr.) *Battiscombe 778* (K); Tangawanda (fl., fr. Febr.) *Greenway & Rawkins 8924* (K, NY); Kipini (fl. Nov.) *9467* (FI, K, PRE); Worssera Hill (fl., fr. Dec.) *Greenway & Kanuri 12769* (FI, K, PRE); Wanny (fl. Sept.) *Hildebrandt 1005* (BM, K, L, LE); 1 km W. of Taru (fl. Nov.) *Leeuwenberg 10784* (WAG); Mombasa (fr. June) Magins 267 (K); 1 km S. of Jilore (fl. Nov.) *Perdue & Kibuwa 10026* (BR, K, LISC).

TANZANIA: T_2: Northern Prov.: Olduwai Gorge (fl. July) *Bally 10660* (EA, K); Mkomazi (fl. Sept.) *Greenway 4071* (K, PRE); S. of Olduwai Gorge (fl. July) *Greenway & Kanuri 12591* (BR, K, PRE); Engaruku (fl. Aug.) *Peter 42845* (B, WAG); Ngorongoro (fl. July) *Williams 711* (K, MO); T_3: Tanga Prov.: Tanga (fl., fr. Sept.) *Faulkner 1920* (B, BR, K); Dalumi (fl. Oct.) *Greenway 4114* (K, PRE); Kisiwani (fl., fr. Sept.) *Leippert 5025* (BR, FI, K); Amboni (fl., fr. Apr.) *Peter 39528* (B, WAG); Kissangare (fl., fr. June) *41585* (B, WAG); Msebugwe Forest (fl. Sept.) *Tanner 2226* (K, NY, UC); Tanga (fl. Febr.) *Volkens 145* (BM, E, G, K); T_4: Western Prov.: Ugalla (fl. July) *Böhm 184* (Z); S. of Tabora (fl. July) *Carrochan 3* (BM, GH); T_6: Eastern Prov.: Kilosa (fl. July) *Greenway & Kanuri 15400* (K, MO, PRE); Mikumi (fl. June) *Leach & Brunton 10144* (K, LISC); Chalinze (fl. Nov.) *Leeuwenberg 10835* (WAG); Uzaromo (fl., fr. Nov.) *Peter 31798* (B, WAG); Kindu (fl. June) *Schlieben 2529* (B, BM, BR, G, P, Z); T_7: Southern Highlands: Iringa (fl. May) *Furuya 103* (EA); T_8: Southern Prov.: Mbangala (fl.) *Semsei & Fraser 20.VII.1947* (K).

NOTES: *A. obesum* is a very variable species, especially as to the shape of the leaves. Also the indumentum of the leaves and the size of the flowers vary. The leaves may be obovate to almost linear. They are glabrous to pubescent on both sides. Examples of specimens with obovate glabrous leaves are: *Rolyns 3974* (Kenya); *Balfour 139* (Socotra). Specimens with obovate pubescent leaves are *Volkens 145* (Tanzania); *Carr 204* (Ethopia). Very narrow glabrous leaves have been observed in e.g. *Peter 41308* (Tanzania); *Gillet 12531* (Ethiopia); while narrow pubescent leaves are known from *Saxer 553* (Cameroun); *Bally 9267* (Ethiopia). Slightly crispate leaves or undulate leaves have been observed in *Peter 58193* (Tanzania); *Bally 9840* (Uganda). After having observed this great

variation within the material of *A. obesum* the present author has had great problems to distinguish *A. obesum* from *A. somalense*, as the variation is at least partly observed in specimens considered as belonging to the latter species. Examples of specimens with obovate glabrous leaves are: *Kasmi, Elmi & Rodol 570* (Somalia); *Bally 9349* (Somalia). Very narrow glabrous leaves have been observed in e.g. *Vatova 64* (Somalia); *Gillet 4343* (Somalia); while narrow pubescent leaves are known from *Corradi 8037* (Somalia). Slightly crispate or undulate leaves have been observed in *Puccioni & Stefanini 444* (Somalia); *Gillet 4191* (Somalia).

As it was absolutely impossible to distinguish both species at hand of the above mentioned characters and as careful studies of all material available did not contribute other characters, it was clear that *A. somalense* could not be maintained as a separate species.

The type specimens of *A. tricholepis* Chiov. and the type specimen of *A. obesum* (Forsk.) Roem. & Schult. resemble each other strikingly. Therefore the present author concluded that the great number of specimens examined, belong to a single species.

A. arboreum, *A. somalense*, *A. somalense* var. *crispum*, *A. somalense* var. *caudatipetalum*, *A. tricholepis*, and *A. obesum* ssp. *socotranum* are new synonyms.

4. Adenium oleifolium Stapf, 1907: 53; Stapf, 1907, 514; Codd, 1963: 281.
Fig. 4, Map 4

Types: S. Africa, sin. loc., *Todd 23* (K, lectotype; isotype: C); Botswana, Bakwena Territory near Sirome River, *Holub May-1883* (K, paratype).

Heterotypic synonyms: *A. lugardi* N.E.Br., 1909: 119, 120. Type: Botswana, Palapye, 3.000 ft., *Lugard 269* (K, holotype).

A. oleifolium Stapf var. *angustifolium* Phill., 1923: 105. Type: S. Africa, Cape Prov., Upington distr., Gordonia, *Borcherds PRE 2598* (PRE, holotype; isotypes: A, BOL, K). Homotypic synonym: *A. somalense* Balf.f. var. *angustifolium* (Phill.) Rowl., 1974: 160, 164 **(syn. nov.)**.

A *succulent* shrublet up to 40 cm high, forming a dense mass of rather fleshy leaves and stems, with a subterraneous carrot-like rootstock 50–80 × 15–30 cm, which is extremely bitter.

Leaves sessile; blade linear to very narrowly obovate, 8.8–16.7 (–21.2) × as long as wide, 4.5–14.6 × 0.3–1.4 cm, acute and apiculate at the apex, above shiny, glaucous or pale green, and pubescent to glabrous, beneath dull, slightly paler green and pubescent.

Inflorescence 0.5–1 × 0.5–1 cm; bracts narrowly oblong, 3–4 × 1–1.5 mm, pubescent on both sides.

Pedicels densily pubescent to pilose, 5–8 mm long.

Sepals narrowly oblong to narrowly ovate, 6.5–9 (–12) × 3.0–4.0 mm, outside

FIG. 4. *Adenium oleifolium* Stapf – 1, 2. habit × 2/3; 3. leaf, upper surface × 2/3; 4. anthers and pistil × 1; 5. anthers and pistil × 2; 6, 7. clavuncula × 8; 8, 9. carpels × 8; 10. fruit with seeds × 2/3; 11. seed × 2/3. – (1, 3, 5, 8. *Leach & Noel 237*; 2, 6. *Merxmüller 729*; 4, 7, 9. *Werger 1636*; 10, 11. *Hardy & Bayliss 1207*).

densily pubescent to pilose, inside pubescent.

Corolla bright scarlet or red to pink; tube yellowish, especially towards the base, 5–6.9 (–8.2) × as long as the calyx, 4–6.6 × 0.9–1.4 cm, outside pubescent, only at the extreme base nearly glabrous, inside puberulous, on the main veins somewhat velutinous; narrow basal portion (1–) 1.5–2 × as long as the calyx, (0.8–) 1.2–1.7 × 0.3–0.5 cm; lobes bright scarlet to red, obovate, 1.4–2.8 × 0.8–1.8 cm, apiculate and undulate, outside sparsely and minutely pubescent, inside puberulous, a puberulous scale at the base, 3 × 1.5 cm.

Stamens barely included or slightly exserted, free portion of filament 0.3–0.5 × as long as the anther, outside hispid, inside pilose to woolly; anther 5.5–6 (–8) × 1–1.5 mm, outside hispid; cells 2–3.5 × 1 mm; appendices 2.5–3.1 × as long as the anthers, hispid.

Pistil 13.5–21.5 mm long; ovary glabrous or sometimes with appressed stiff hairs or puberulous; carpels 1–2 × 1–1.5 × 1–2 mm; style 11.5–19 × 0.5 mm; clavuncula 1.5–2 × 1–1.5 mm.

Fruit pale grey to pale grey-brown, 10–11.5 × 1 cm.

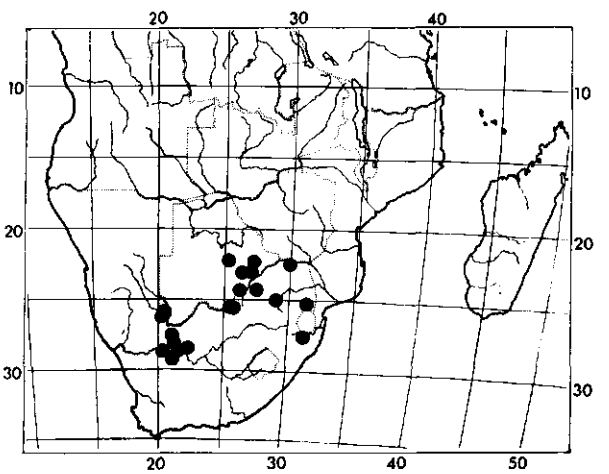
Seed very pale brown, pubescent, 1–1.5 × 0.2 cm, with tufts of dirty white hairs, 2–3.5 cm.

Distribution: Indigenous in South Africa (Cape Prov. and Transvaal), in the southeastern part of Southwest Africa and in the southern part of Botswana.

Ecology: Usually in bush grasslands with a loose white or red sandy, sometimes rocky soil. Alt.: 700–1200 m.

Uses: The roots are used for medical purposes.

Vernacular name: South Africa: Cape Prov.: 'O'Haip'.



MAP 4. *Adenium oleifolium*

Specimens examined:

SOUTHWEST AFRICA: Stingbank (fl.) *Esdaile s.n.* (Z); between Windhoek and Walvisbay (fl.) *Esdaile in Rogers 15209* (A); Narub, Central Namaland (fl.) *Dinter IV.1913* (NBG); (fl.) *XII.1919* (Z); *2995* (NBG).

BOTSWANA: Palapaye (fl. Jan.) *Lugard 269* (K, holotype of *A. lugardi*); Kalihari (fl.) *Knobel 9.V.1945* (PRE); Mochudi, *Yalala 287* (K, SRGH); 22 kms S. of Artesia B.P. (fl. Jan.) *Leach & Noel 237* (K, PRE, SRGH).

SOUTH AFRICA: Transvaal: Sirone R. (fl.) *Holub V.1883* (K, paratype); Thabazimi distr.: (fl.) *Theron & Marsh 24* (PRE); Buchanan (fl. Oct.) *Todd 23* (K, lectotype; isotype C); Hector spruit (fl. Aug.) *Shoncroft 1133* (K); Messina, *Pole-Evans 24.XI.1916* (K); Dongola Res. (fl. Mar.) *Pole-Evans 4572* (PRE); Cape Prov.: Mafeking, Sweetwater Ranches (fl.) *Trow 10.XII.1970* (NBG); S.W. Gordonia, Blaauwbosch (fl. Nov.) *Wilman 1877* (MO); Upington distr.: Gordonia (fl.) *Borcherds PRE 2598* (PRE, holotype; isotypes A, BOL, K, P, of *A. oleifolium var. angustifolium*); (fr.) *Borcherds XII.1924* (PRE); Buchuberg (fl., fr. Jan.) *Bryant 543* (PRE); Buchubergdam (fl.) *Faures XI.1935* (PRE); Kakamas, *Fuller 162* (BOL); Upington (fl.) *Glover 10434* (BOL); ibid., (fl. Jan.) *Kruger 15* (PRE); ibid., (fl. Dec.) *Merxmüller 729* (BR, K); ibid., *Pole-Evans 2143* (PRE); ibid., *Schaefer 24.II.1961* (PRE); ibid., (fl. Febr.) *Smith 2370* (PRE); *2374* (PRE); *2375* (PRE); ibid., *H. & E. de Winter 2418* (B); ibid., (fl. Mar.) *Watt & Brandwijk 2494* (PRE); ibid., (fl. Dec.) *Werger 1636* (K, PRE); ibid., (fl.) *White NBG 25277* (NBG); Sultanaoord (fl., fr. Nov.) *Hardy & Bayliss 1207* (K, PRE); Gordonia (fl.) *Kotze 840* (PRE); Gemsbok Nat. Park (fl. Apr.) *Leistner 1847* (PRE); *2243* (K, PRE).

5. Adenium swazicum Stapf, 1907: 53; Stapf, 1907: 513, 514; Wood, 1912: t. 600; Hutchinson, 1946: 376; Dyer et al., 1937: t. 664, Codd, 1963: 281, 282.

Fig. 5; Map 5; Phot. 2

Type species: Swaziland: *Rathbone BOL 6208* (BOL, lectotype; isotype: K); *Saunders s.n.* (BOL, not seen, paratype); *J. M. Wood 3511* (BOL, paratype).

Homotypic synonym: *A. boehmianum* Schinz var. *swazicum* (Stapf) Kowl., 1974: 160, 164 **(syn. nov.)**.

A *succulent* shrub, 0.2–0.7 m tall; a carrot-like tuber, diameter up to 1 m; poisonous clear latex.

Leaves oblong to narrowly oblong, 3.5–9.1 × as long as wide, 4–11.5 × 0.5–3.1 cm, rounded and apiculate to mucronate, rarely emarginate, at the apex, above slightly shiny, glaucous to pale green and pubescent, especially the midrib; secondary veins more or less inconspicuous, beneath dull, slightly paler green and pubescent; petiole 1–4 mm long.

Inflorescence 1.5–3.5 × 1–2.5 cm; bracts narrowly oblong to narrowly ovate, 3–10 × 2 mm, outside pubescent, inside appressed pubescent, especially towards the apex.

Pedicels 6–10 (–15) mm long, tinged with pink or red.

Calyx crimson or pink to green, narrowly oblong to narrowly ovate, 7–11 × 1.5–3 mm, outside pubescent, inside appressed pubescent, especially towards the apex.

Corolla crimson, deep mauve, pink to white; tube crimson to white, 2.2–3.5 (–4) × as long as the calyx, 2–3 × (0.6–) 1–1.3 (–1.9) cm, outside pubescent, only

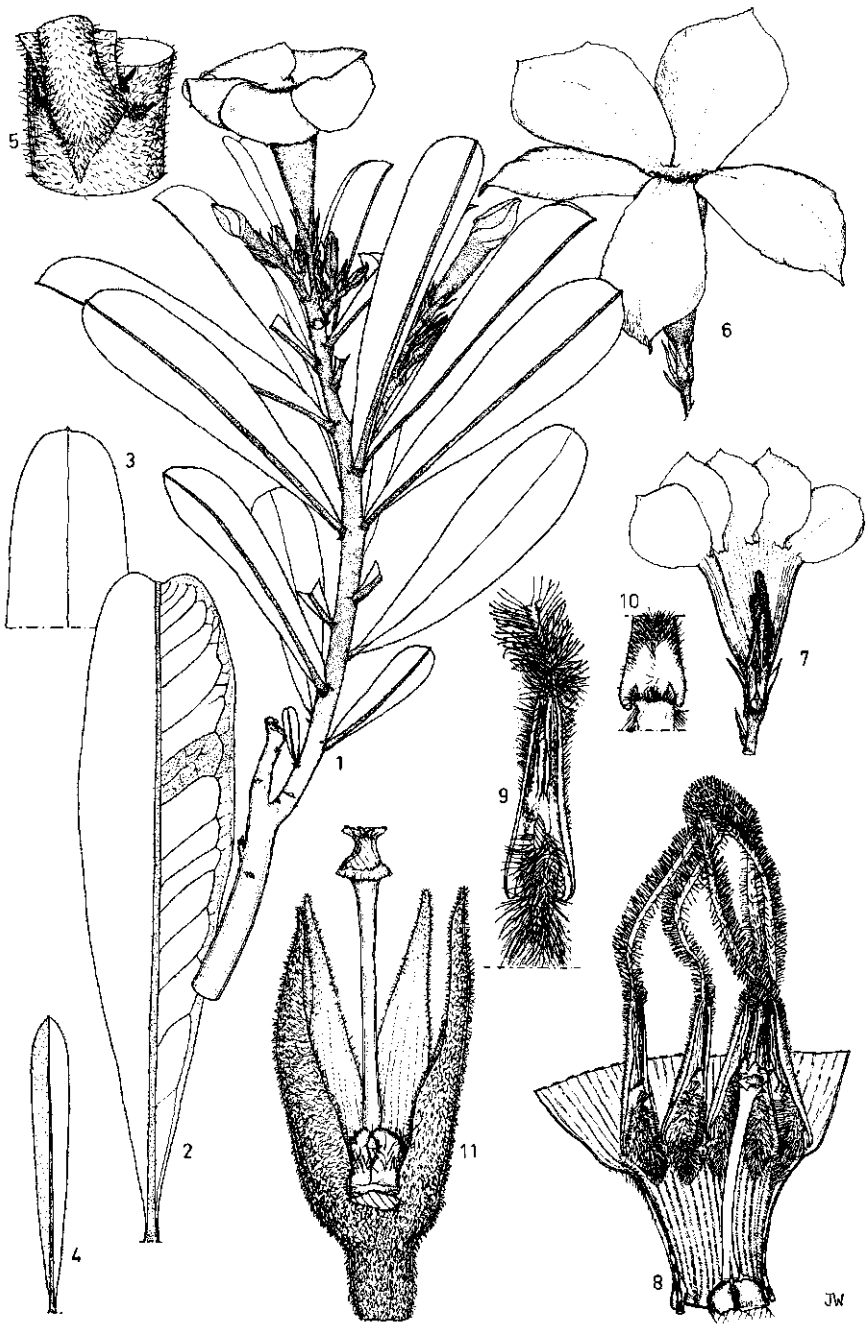


FIG. 5. *Adenium swazicum* Stapf – 1. habit × 2/3; 2. leaf, under surface × 2/3; 3. leaf, upper surface and apex × 2/3; 4. leaf, habit × 2/3; 5. glands in leafaxil × 6; 6. flower × 2/3; 7. anthers and pistil × 1; 8. anthers and pistil × 4; 9. anther × 6; 10. anther, backside × 6; 11. pistil × 6. – (1. *Kemp 614*; 2, 3, 6. *Codd 5227*; 4, 7. *Torre 6375*; 5, 11. *Hutchinson 2544*; 8. *Stephen 1443*; 9, 10. *Torre 6881*).

PHOT. 2. *Adenium swazicum* (*Plaizier 1441*, phot. J. W. MUGGE, cult. Wageningen, the Netherlands).

at the extreme base nearly glabrous, inside glabrescent; narrow basal portion 0.6–1 × as long as the calyx, 0.5–0.9 × 0.2–0.4 cm; lobes deep mauve to white, obovate, 1.3–2.5 (–3.5) × 1–2 cm, apiculate, slightly undulate, both sides puberulous; a glabrous scale at the base, (3–) 2.5 × 1.5 mm.

Stamens included; free part of filament 0.3–0.4 × as long as the anther, outside glabrous, inside woolly; anther 5–6.5 × 1–1.5 mm, outside hispid; cells 2–3 × 1 mm; appendices (1.2–) 1.5–2 × as long as the anther, hispid.

Pistil 9–11.5 mm long; ovary glabrous or puberulous to sericeous; carpels 1.5–2.5 × 1–1.5 × 1–2.5 mm; style 5.5–7 (–9.5) × 0.5 mm; clavuncula 1–1.5 × 0.5–1 mm.

Fruit only seen of *H. P. van der Schijff s.n., Aug. 1973, PRE GARD. 5040*, follicle grey-brown, 16 × 1 cm.

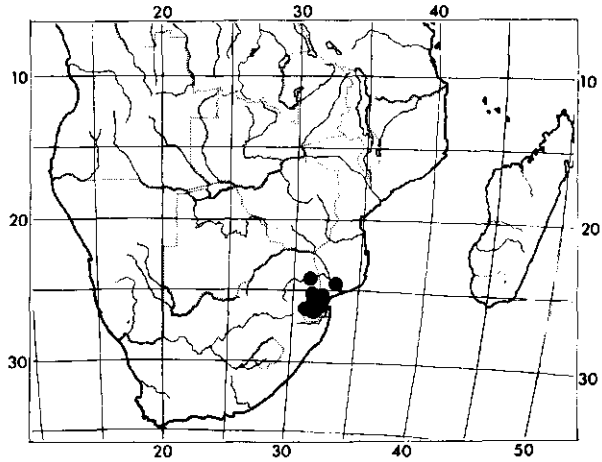
Seed pale-brown, glabrous, 1.2–1.4 × 0.3 cm, hairtufts dirty white, 2.8–3.5 cm long.

Distribution: Indigenous in South Africa (eastern Transvaal and Northern Zululand), Swaziland, and southern Moçambique.

Ecology: Widespread in savannas with a sandy and often a brackish soil. Alt.: 300–400 m.

Uses: Planted as ornamental.

Vernacular name: Rathbonia.



MAP. 5. *Adenium swazicum*

Specimens examined:

SOUTH AFRICA: Transvaal: Zoutpansberg: Kruger Nat. Park, Rabalaisdam (fl. Febr.) *Ihlenfeldt 2315* (PRE); ibid., Pelgrimsrest (fl. Febr.) *Schlieben 9355* (PRE, Z); ibid., Malelane (fl. Oct.) *Kroeger 4* (PRE); ibid., (fl.) *Stevenson & Hamilton s.n.* (PRE); Nelspruit: (fl. Febr.) *Codd 5227* (K, PRE); ibid., (fl. Mar.) *v.d. Schijff 2558* (K, PRE); Hectorspruit (fl.) *Kirk 16.IV.1926* (PRE); 16 kms from Hectorspruit to Komatipoort (fl. Jan.) *Hutchinson 2544* (BM, BOL, K, PRE); *9.I.1924* (PRE); Lomati R. (fl. Apr.) *Jenkins 10373* (PRE); Barbeton: Lebombo Flats, 26 kms S. of Komatipoort (fl. Mar.) *Strey 4018* (B, G, K, PRE, Z).

SWAZILAND: (fl.) *Rathbone BOL 6208* (BOL, K, lectotype); (fl. May) *Wood 3511* (K; paratype); Lubombo distr.: 7 kms E. of Siphofaneni (fl. Jan.) *Kemp 614* (BR, MO, WAG); Bordergate distr.: N. of Bordergate on Komati R. (fl. Dec.) *Leach & Bayliss 10606* (PRE); Stegi distr.: (fl. Mar.) *Compton 31572* (NBG); Flats below Stegi (fl. May) *Rodin 4536* (K, MO, PRE, UC); Hlane Wildlive Sanctuary (fl. Dec.) *Stephen 1443* (PRE); St. Phillip Mission Station (fl.) *Gestner 22.V.1933* (NH).

MOÇAMBIQUE: Maputo distr.: Arredores de Magude e Chobela (fl. Jan.) *Torre 6375* (LISC, PRE); between Uoamba and Ressano Garcia (fl.) *Torre 6881* (LISC); Moamba (fl. Jan.) *Carvalho 734* (PRE); Arredores da Upamba (fl. Dec.) *Mendonça 1535* (LISC); Inkomati R. (fl.) *Borle V. 1919* (PRE); Arredores do Umbeluzi (fl. Nov.) *Mendonça 3105* (LISC).

Notes: As shown above *A. swazicum* is treated as a species and not as a variety of *A. boehmianum* as was done by ROWLEY (1974).

Both species occur in completely separate areas. As no intermediate specimens exist and both species differ from each other not less than from the other *Adenium* species, *A. swazicum* is reinstated as a species here.

PHYTOCHEMISTRY OF ADENIUM

Adenium species have long been known for their use as arrow poisons and investigation has shown that the active principles occurring in the latex and other

parts of the plants are glycosides derived from cardenolide aglycones such as digitoxigenin (e.g. somalin, echujin, and honghelin) and gitoxigenin (e.g. digitalinum verum and honghelóside A); see: J. M. WATT & M. G. BREYER-BRANDWIJK, The Medicinal and Poisonous Plants of Southern and Eastern Africa, 2nd ed., E. & S. Livingstone, Edinburgh and London, 1962, pp. 62–69 and 78–80; J. KERHARO & J. G. ADAM, La Pharmacopée Sénégalaise Traditionnelle, Vigot Frères, Paris, 1974, pp. 153–155. These substances act as powerful cardiotonics. More recent research has established that, together with 3,3'-bis-(*O*-methyl)-quercetin, they are also cytotoxic and have activity in the KB strain of human carcinoma of the nasopharynx test system; see: J. J. HOFFMANN & J. R. COLE, J. Pharm. Sci. *66*: 1336–1338 (1977).

N. G. BISSET

DIPLORHYNCHUS

HISTORY OF THE GENUS

In October 1881 OLIVER published BENTHAM'S *Diplorhynchus mossambicensis* as a new species with a clear description and a nice drawing in Hooker's Icones. He referred to a manuscript of WELWITSCH of the, at that moment, not yet published genus *Diplorhynchus* with the species *D. psilopus*, which was published two months later by FICALHO & HIERN. In OLIVER'S paper the differences between the two species are indicated and therefore he could be considered as the author of both of them. However, he did not publish the genus description and therefore CODD (1951) preferred to maintain FICALHO & HIERN as the authors of the genus, in reference to Art. 41 of the Rules.

Several years previous, PICHON (1947) discovered that MÜLLER D'ARGOVIE already published a species in 1860, *Aspidosperma ? Condylocarpon*, which in fact was a *D.* sp. The error of MÜLLER D'ARGOVIE to place this species in the South American genus *Aspidosperma* is understandable, because the label of the type specimen indicates the origin as 'Brésil'. The genera *Diplorhynchus* and *Aspidosperma* are related. This type specimen was removed from the Lisboa Herbarium to the Paris Herbarium by GEOFFRY (Baillon, 1888). It has a green label as well, and a green label in LISC means, that the specimen must have been collected in Angola (PELLEGRIN in Duvigneaud, 1952).

An additional synonym for the genus, based on the same type specimen, was provided by BAILLON (1888): *Neurolobium* with one species *N. cymosum.*

A few years later BÜTTNER (1890) erroneously spelled the same as *Diplorrhynchus* and he was followed by SCHUMANN (1895).

The generic name and epithet are derived from Greek words: *Diplorhynchus* for 'Double Beak' and *condylocarpon* for 'Swollen Carpels' in reference to the two beak-like, swollen follicles.

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

The genus *Diplorhynchus* comprises in this paper only a single very variable species, *D. condylocarpon*; it occurs south of the equator in tropical and in southern Africa.

In Zaïre, north of the equator, *Diplorhynchus* is planted as an ornamental.

This species occurs in rather dry sandy loamy or rocky soils of savannas and of open forests at low to medium altitudes.

RELATIONSHIP TO ANOTHER GENUS

Diplorhynchus belongs to the subtribe *Aspidospermatinae* of the tribe *Plumeriae (Alstonieae)* of the subfamily *Plumerioideae* of the *Apocynaceae* and is closely related to the South American genus *Aspidosperma*. The main differences with *Aspidosperma* are the much larger inflorescence, the opposite instead of alternate leaves, the arrangement of the seeds in the follicle and the unilateral instead of all-sided wings of the seeds.

DESCRIPTION

Diplorhynchus Welw. ex Fic. & Hiern, 1881: 22; Engler, 1895: 316; Schumann, 1895: 142; Hiern, 1898: 666; Stapf, 1902: 105; Pichon, 1948: 195, 196; Phillips, 1951: 584, 585; Codd, 1963: 264, 265.

Type species: *D. psilopus* Welw. ex Fic. & Hiern.

Heterotypic synonym: *Neurolobium* Baill., 1888: 749; Schumann, 1895: 154. Type species: *Neurolobium cymosum* Baill.

Distribution: A single species in tropical and southern Africa.

Diplorhynchus condylocarpon (Muell. Arg.) Pichon, 1947: 368; Duvigneaud, 1952: 265; Brenan, 1954: 253; Codd, 1951: 152; Codd, 1963: 265, 267.

Fig. 6; Map 6

Basionym: *Aspidosperma ?Condylocarpon* Muell. Arg., 1860: 55; Pichon, 1947: 368; Duvigneaud, 1952: 248. Type: Africa, probably Angola, 'Quirengue', collector unknown (P, holotype).

Homotypic synonym: *Neurolobium cymosum* Baill., 1888: 749; Schumann, 1895: 154.

Heterotypic synonyms: *D. mossambicensis* Benth. ex Oliv., Oct. 1881: 40, t.135; Engler, 1895: 316; Schumann, 1895: 142; Stapf, 1902: 107; Duvigneaud, 1952: 265. Type: Malawi, Zambesia, Shire Highlands, *Buchanan s.n.*(K, lectotype). Homotypic synonym: *D. condylocarpon* ssp. *mossambicensis* (Benth. ex Oliv.) Duvign., 1952: 265 **(syn. nov.).**

D. psilopus Welw. ex Fic. & Hiern, Dec. 1881: 23; Bentham, Oct. 1881: 40; Schumann, 1895: 142; Hiern, 1898: 666; Stapf, 1902: 106. Type: Angola, sin. loc., *Welwitsch 5982* (BM, holotype; isotype: G, K, P). Homotypic synonym: *D. condylocarpon* ssp. *mossambicensis* var. *psilopus* (Welw.) Duvign., 1952: 265 **(syn. nov.)**.

D. angolensis Büttner, 1890: 85, 86; Schumann, 1895: 142; Hiern, 1898: 667; Stapf, 1902: 106; Duvigneaud, 1952: 266. Types: Angola, Quango, *Büttner 404* (K, lectotype; isotype: UC); Angola, Malange, *von Mechow 193* (BR, UPS, WU, Z, paratype). Homotypic synonym: *D. condylocarpon* spp. *angolensis* (Büttner)

Duvign., 1952: 266 **(syn. nov.)**.

D. welwitschii Rolfe, 1893: 85; Stapf, 1902: 105. Types: Angola, Cazengo distr., *Welwitsch 5968* (BM, holotype; isotype: G, K); ibid., Malange, *Marques 16* (paratype, not seen).

D. poggei Schum., 1895: 142. Type: Angola, Lomami, probably *Pogge s.n.* (holotype not seen, destroyed in B; isotypes not seen).

D. angustifolia Stapf, 1902: 107; Duvigneaud, 1952: 265. Types: Tanzania, Ugalla, Kabombue, *Böhm 29*[a](Z, lectotype); Moçambique, Lower Zambesi, opposite Sena, *Kirk s.n.* (K, paratype). Homotypic synonym: *D. condylocarpon* ssp. *mossambicensis* var. *mossambicensis* f. *angustifolius* (Stapf) Duvign., 1952: 265 **(syn. nov.)**.

D. condylocarpon ssp. *mossambicensis* var. *psilopus* f. *microphylla* Duvign., 1952: 266 **(syn. nov.)**. Types: South Africa, Bufferfontein, *Galpin 8857* (PRE, holotype; isotype: K); ibid., Rietspruit, *Smuts 364* (K, PRE, paratype); ibid., Rhenosterkop, *Obermeyer 35922* (PRE, paratype).

A *tree or shrub*, sometimes lianescent, 1 – many-stemmed, (1–) 3–12 (–20) m tall; sticky white or yellow latex; main stem reclining, 0.10–0.50 (–2.0) m in diameter; bark smooth to rough, usually longitudinally fissured or reticulate, greyish, brownish to blackish; wood whitish yellow to pale orange; branches straight to drooping, rufous brown; branchlets drooping, puberulent to glabrous, green, purplish grey or reddish, usually dotted with paler lenticels; crown well developed, spreading, sometimes irregular.

Leaves decussate, opposite or rarely subopposite, those of a pair equal, petiolate; petiole (0.5–) 1.0–2.0 (–3.7) cm, glabrescent to puberulent, upside sometimes tomentose, and there with or without a scale-like colleter and/or 1–4 rows of 1–4 smaller glands; blade variable in shape, obovate, elliptic, suborbicular, or ovate, (1.1–) 1.5–2.4 (–3.2) × as long as wide, (2.6–) 3.8–9.3 (–12.1) × (1.1–) 2.2–5.4 (–6.7) cm acute, rounded to emarginate and acuminate to mucronate at the apex, cuneate to obtuse at the base, flat to undulate or sometimes somewhat crispate, above glossy or slightly glossy dark green to yellow green, beneath dull, slightly paler green, thinly coriaceous to leathery, glabrous to pubescent, sometimes only on the margins puberulent; veins prominent, pale green, costa puberulent, sometimes the basal part only, rarely glabrous, secondary veins conspicuous (6–) 8–14 (–19) pairs, glabrous or somewhat puberulent, sometimes in the axils tufts of glandular hairs, tertiary veins inconspicuous.

Inflorescence thyrsoid, terminal and in the axils of the upper leaves, lax to congested, (1.5–) 2–9 (–14) × (2–) 2.5–9 (–13) cm; bracts obscure, rounded, glabrous to pubescent, sometimes with glandular hairs.

Peduncle 0.6–4 (–4.5) cm long; pedicels glabrous to tomentose, sometimes with glandular hairs, 0.5–2.5 (–3.0) mm long.

Flowers 5-merous, except for the sometimes slightly unequal sepals actinomorphic, very sweet scented.

Sepals green, pale green or yellow green, ovate and acute, connate at the base,

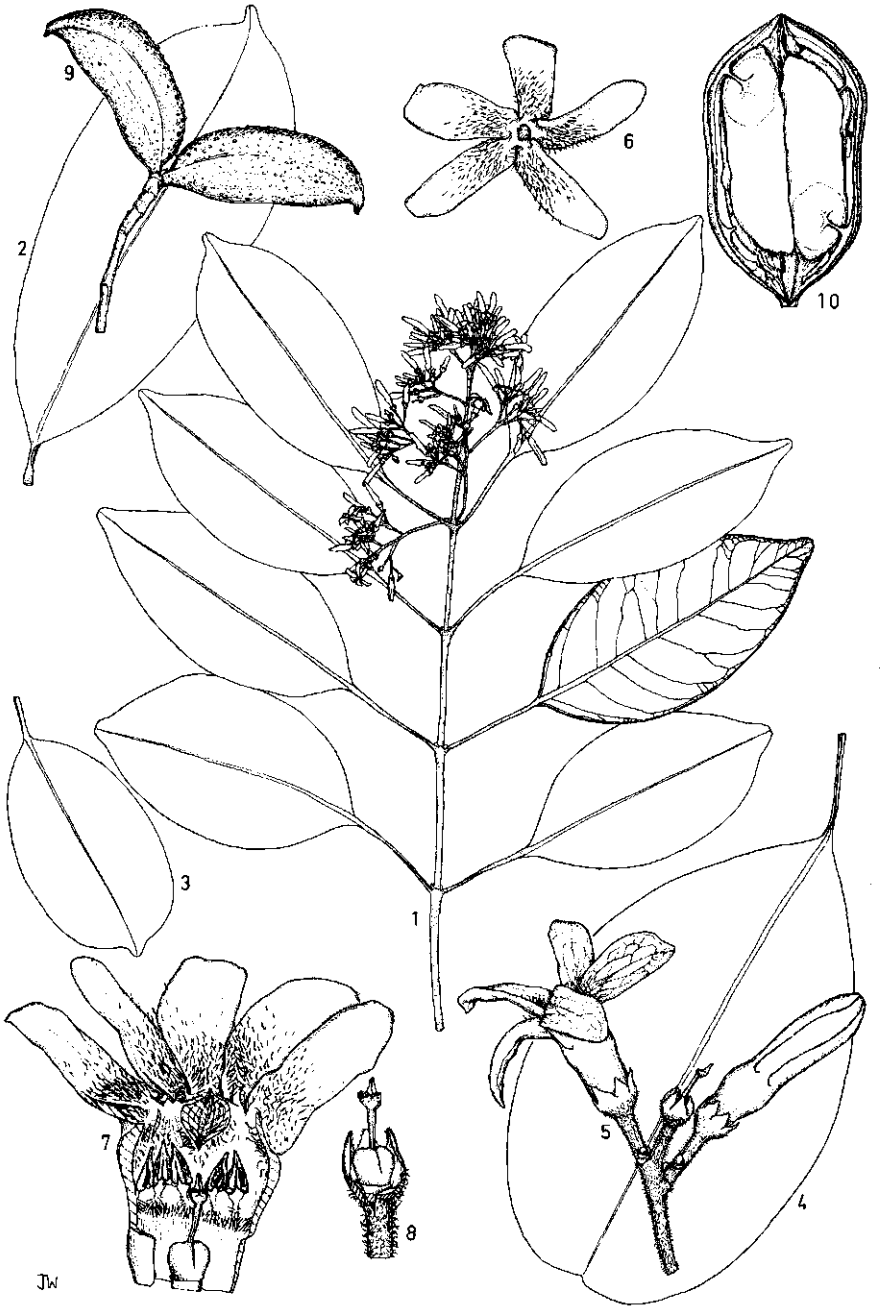


FIG. 6. *Diplorhynchus condylocarpon* (Muell. Arg.) Pichon – 1. habit × 2/3; 2, 3, 4. leaf, habit × 2/3; 5. flower, habit × 4; 6. petals, above × 4; 7. anthers and pistil × 6; 8. pistil × 6; 9. fruits × 2/3; 10. fruit, open with two seeds × 2/3.–(1, 6, 7, 8. *Norgramm 248*; 2, 9. *Brass 17414*; 3. *Swynnerton 39*; 4, 10. *Schlieben 3036*; 5. *Simon & Ngoni 1299*).

sometimes slightly unequal, (0.5–) 1–2 (–3) × as long as wide, (0.5–) 0.75–1 (–1.5) × (0.25–) 0.5 (–0.75) mm, outside at the base pubescent to tomentose, towards the apex pubescent to glabrous, exceptionally entirely glabrous, inside glabrous to appressed puberulent, especially towards the apex; margins entire, usually hyaline, scabrid to hirsute, rarely glabrous; receptacle pubescent to tomentose, rarely glabrous to puberulent, with glandular hairs or reduced glandular hairs, 0.2–0.5 (–1) × 0.5–1 (–1.8) mm.

Corolla white to creamy, very rarely reddish to orange, salver-shaped; tube a subcampanulate upper and a cylindrical narrower basal portion, (1.5–) 2–5 (–7) × as long as the calyx, (1.5–) 2–3 (–3.2) × 1–1.5 (–1.8) mm, constricted at the throat, outside glabrous to slightly puberulent, inside velutinous to sericeous, especially towards the apex of the narrower basal portion, towards the base glabrescent or glabrous; lobes (3.5–) 5 (–6) × (0.7–) 1.2 (–2) mm, narrowly oblong or narrowly obovate, at the apex rounded or slightly acute, entire, outside glabrous to puberulent, inside towards the base pilose or sericeous, towards the apex glabrescent, usually with many glandular hairs, slightly contorted and overlapping to the left in bud, spreading; buds glabrous to pubescent, red tinged; between the bases of all lobes a scale, which is glabrous, (0.5–) 0.7–1 (–1.2) mm long, and sometimes at the base provided with some long scabrid hairs, and which is connected by its edges with the lobes with each other.

Stamens included; filament inserted at the apex of the narrow basal portion of the corolla tube, apex spathulate to pandurate, base filiform, usually scabrid to hispid, rarely glabrous, 0.2–0.5 (–0.8) mm long; anthers triangular, 1–1.2 (–1.5) × 0.5 mm, sagittate at the base, mucronate, 0.1–0.2 (–0.5) mm, at the apex, completely fertile.

Pistil (1.2–) 1.7–2.1 (–2.4) mm long; ovary of two free carpels, (0.3–) 0.4 (–0.5) × (0.3–) 0.5 (–0.8) × (0.5–) 0.8 (–1.0) mm, coherent at the base, rounded at the apex, glabrous or slightly puberulous; ovules 4 in each carpel, parietal; style inserted barely below the apex of each carpel, filiform, (0.5–) 0.7–1.3 × 0.2–0.3 mm, not split at the base, glabrous to very slightly puberulous; clavuncula woolly, sometimes towards the base glabrescent, subcylindrical, (0.2–) 0.3–0.4 × 0.3–0.4 mm; apiculus bifid, (0.2–) 0.3–0.4 (–0.7) mm long, glabrous.

Fruit composed of two follicles, which are widely spreading about 180°, woody, green or pale to dark brown with much latex, 1.8–3.3 (–4.2) × as long as wide, (2.2–) 2.9–6.6 × 1.1–2.2 × 0.4–1.1 (–1.8) cm, coherent at the base, obliquely oblong, the dorsal side straight and the ventral side abruptly curved towards the apex, towards the base less abruptly curved, at the base obliquely cuneate, at the apex obliquely obtuse, acuminate, glabrous or slightly puberulent, outside dotted with many paler lenticels, inside whitish, glabrous, and a funicle of 1–2 mm wide along the ventral side; follicle 2-valved, each valve 2-seeded, dehiscent at axial side.

Seed compressed, obliquely oblong, (2.5–) 3.5–4.5 (–5.5) cm long, the dorsal side almost straight and the ventral side more or less abruptly curved towards the base, obliquely cuneate at the base, long winged at the apex; grain dark brown, elliptic, (1–) 1.3–2.0 × 0.7–1.2 (–1.8) cm, with the hilum in the middle of the inner

face; wing rounded and sometimes shallowly lobed, diaphanous, with longitudinal veins, 2.0–2.5 (–3.2) × 1–1.5 (–1.9) cm, wings of the 2 outer seeds directed towards the base and of the 2 central seeds towards the apex of the fruit.

Distribution: Angola, southern Zaïre, Tanzania except T_2, Zambia, Malawi, northern Moçambique, extreme northern parts of S.W. Africa and Botswana, Zimbabwe, and in the western and southern parts of South Africa.

Ecology: Widespread on dry, unusually wetter, sandy, loamy or rocky soils of savannas and of open forests. Alt.: 0–1700 m.

Uses: Young leaves are used against heartdiseases; wood for making bows; latex as glue, birdlime, chewing gum, and for mending drums; a decoction of the roots as medicine against gonorrhoea and testicle complications, and against stomach-ache.

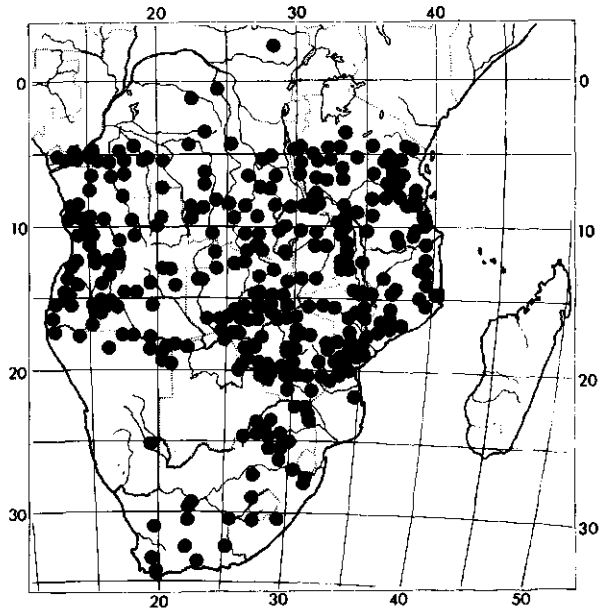
Vernacular names: A selection of the more than fifty names:

Angola:	'Wuwulia' or 'Mu Puria', (Gangueles); 'Mudêu', (Muhumbe).
Zaïre:	'Mwangé', (Kibenda, Mutumbo, Mulula); 'Ngondiasala', (Kikongo, Kiyaka); 'Mwenge', (Kitabue).
Tanzania:	'Mtogo', (Kiswahili); 'Msongati', (Kinyamwesi, Kiswahili); 'Mtalembe', (Mambwe).
Zambia:	'Mudgi' or 'Moodi', (Chilunda); 'Mwenge', (Chibemba, Lozi).
Malawi:	'Tombozi', (Chinyanya).
Moçambique:	'Mutóa', (Chindao); 'Rocooji' or 'Ròcòssi'
S.W. Africa:	'Mudia', or 'Murere', or 'Diriko'.
Botswana:	'Molya'.
Zimbabwe:	'Zezuru', (Mtowa); 'Mutongoro', (Mujanje); 'Mdebele', (Mgamasana).
S. Africa:	'Horingpeulboom'.

A selection of the more than 750 examined specimens:

ANGOLA: Cuanza Norte: banks of Luinho R. (fl., fr.) *Welwitsch 5968* (BM, C, G, K, holotype of *D. welwitschii*); Cuanza Sul: Luanda (fl., fr.) *Gossweiler 546* (BM, K, P), *1140* (BM, K, P); Palanca Res. (fl.) *Henriques 677*, (fl.) *706* (BM, LISC, PRE); Malanje (fl.) *Mechow 193* (BR, UPS, Z, paratype of *D.angolensis*); Lunda distr.: Silva Porto (fr.) *Bamps, Martius & Maia 4132* (BR, LISC, WAG); Nova Lisboa to Dundo (fr.) *Bamps, Martius & Silva 4272* (BR, LISC, UPS, WAG); Dundo (fl.) *Gossweiler 13599* (B, K, P, US); ibid. (fl.) *Young 575* (A, BM, S, Z); Vila Henrique de Carvalho (fl.) *Young 446* (A, BR, BM, MO, NY, S, Z); (fl., fr.) *612* (A, BM, S, Z); Huambo distr.: (fr.) *Dechamps-Murta & Silva 1043* (BR, K, LISC, WAG); Moxico distr.: Luio (fr.) *Monteiro, Santos & Murta 488* (BM, LISC, PRE); Huíla distr.: Chitanda (fl.) *Baum 178* (BM, BR, E, G, HBG, K, M, S, WU, Z); Gambos (fl.) *Menezes 3602* (BM, K, LISC, P); sin. loc. (fl.) *Welwitsch 5982* (BM, G, K, P, holotype of *D. psilopus*); Bié – Cuando – Cubango distr.: E. of Longa (fl.) *Dechamps-Murta & Silva 1331* (BR, K, LISC).

ZAÏRE: Bandundu Prov.: Kwango (fl.) *Germain 2465* (BR, C, K, MO, P); 20 kms S.E. of Popokabaka (fr.) *Germain 2179* (BM, BR, K, P); Elaka (fl.) *Quarré 1405* (A, BR, K, S); Katanga Prov.: Kiwakishi Gorge (fl.) *Meel 4470* (K, LISC, UC, WAG, Z); Katuba (fl.) *Quarré 695* (A, K, S);



MAP 6. *Diplorhynchus condylocarpon*

Tubeya (fl.) *Risoupoulos 1167* (A, BR, K, WAG); Mabwe (fl.) *Witte 4662* (BR, K, P); Lubumbasi (fl.) *Bulaimu 54* (BR, K, P); ibid., de Keyberg (fl.) *Quarré 5164* (BR, K, P); Karavia (fl.) *Quarré 3626* (BR, K, MO, NY, P, UC). Cult.: Oriental Prov.: Yangambi (fr.) *Germain 7278* (BR, M).

TANZANIA: T_4: Mpanda distr.: Mahali Mts (fl.) *Jefford & Newbould 2556* (B, BR, K, MO); Ufipa distr.: Rukwa (fl.) *Richards 18376* (BR, K, P); Tabora distr.: Kiliua (fl.) *Shabani 1* (B, BR, K); (fl., fr.) *22* (BR, K, S); S. of Tabora (fl.) *Carnochan 47* (BM, GH, K, MO, NY, S, UC, US); Chizungu (fl., fr.) *Silungwe 18* (BR, K, S); T_5: Dodoma distr.: Manyoni (fr.) *Burtt 1786* (BR, K); along Chunya Rd (fr.) *Greenway & Polhill 11662* (BR, K, LISC, PRE); Mpwapwa distr.: Mpwapwa (fl.) *Hornby 325* (K, NY); T_6: Morogoro distr.: Uluguru (fl., fr.) *Bruce 286* (BM, BR, K, MO, P); ibid. (fl.) *Schlieben 3036* (B, BM, BR, G, HBG, LISC, M, MO, P, PRE, Z); Masagati (fl.) *Schlieben 1478* (BR, BM, G, M, P, S, Z); Miringwa (fl. fr.) *Busse 136* (BM, G, HBG, K, L, WU); Mtibwa Forest Res. (fl.) *Semsei 1951* (BR, FHO, K); Kilosa distr.: Mikumi – Kilosa RD (fr.) *Greenway & Kanuri 15210* (K, MO, PRE, S); Kidodi (fl.) *Semsei 974* (FHO, K, PRE); (fl. fr.) *1036* (FHO, K, PRE); Kilosa (fl.) *Swynerton 972* (BH, K, NBG); *978* (BM, K, NBG); Ulanga distr.: Ifakara (fl., fr.) *Haerdi 31/26* (BR, K, Z); Rufiji – Utete distr.: Ngulakula (fl.) *Ngoundai 159* (BR, K, LISC); T_7: Iringa distr.: (fl. fr.) *Mhoro 111* (BR, K, UPS, WAG); Rungwe distr.: Kyimbila (fl. fr.) *Stolz 1505* (BM, C, G, HBG, L, MO, NBG, P, S, UPS, Z); *1673* (A, BM, BOL, BR, C, FHO, K, MO, P, PRE, UPS, Z); *1701* (BM, C, G, L, MO, NBG, NY, P, PRE, S, UPS, Z); T_8: Tunduru distr.: (fl.) *Gillett 17932* (BR, K, M, MO, PRE, WAG); Lindi distr.: Lutambasa (fl.) *Schlieben 5426* (BM, BR, G, HBG, M, P, PRE, S, Z).

ZAMBIA: Northern Prov.: Mbala distr.: Lunzua Falls (fl.) *Richards 19221* (BR, D, LISC); Northwestern Prov.: 1 km. S. of Matonchi Farm (fl.) *Milne-Redhead 2606* (B, BM, BR, K, PRE); Kasama distr.: 110 kms E. of Kasama (fl.) *Robinson 3963* (BR, M, K, SRGH); Eastern Prov.: Mukupa, Rocky slopes above Mbuga (fl., fr.) *Bullock 178* (B, BR, K, LISC, P, S); Western Prov.: Sesheke distr.: 6 kms from edge of Nanga Forest (fl.) *Angus 969* (BR, FHO, K, MO); Ngonya Falls (fr.) *Codd 7118* (BM, K, SRGH); Kalabo distr.: (fr.) *White 2058* (BR, FHO, K); Central Prov.: Lusaka distr.: 18 kms S. of Lusaka (fl.) *Angus 1415* (BR, FHO, K); 100–129 kms E. of Lusaka (fl.) *Robinson 5813* (K, M, SRGH); Mumbwa distr.: 37 kms W.S.W. of Lusaka (fl.) *Strid 2282* (C, FHO, LD, MO); Chilanga distr.: Quien Sabe Farm (fl., fr.) *Sandwith 64* (BR, K, SRGH); Southern Prov.: Mazaluka distr.: Suchenga Mica Mine (fl.) *Milne-Redhead 1234* (BR, K, PRE).

MALAWI: Nkota Kota distr.: Rocky hillside above Kaombe R. (fl.) *Benson 594* (PRE, SRGH); Kasungu Kasungu distr.: Kasungu (fr.) *Brass 17414* (Br, K, MO, NY, PRE, SRGH, UC); Chikwawa Chikwawa distr.: Chikwawa (fl., fr.) *Brass 17987* (K, MO, NY, SRGH, US); Blantyre distr.: 10 kms N.W. of Blantyre to Chileka (fr.) *Brummit 9818* (PRE); Shire Highlands (fl.) *Buchanan 12* (E, lectotype of *D. mossambicensis* Benth. ex Oliv.); sin. loc. (fl.) *Buchanan 391* (A, E, G, K, US); Zomba distr.: Palombe Plain (fl.) *Clements 162* (FHO); Mzimba distr.: Mzimba (fr.) *Jackson 1605* (BR, FHO, K); Nkhata Bay distr.: White Fathers Beach (fr.) *Pawek 8844* (MO, UC, SRGH); Rumpi distr.: 4.5 kms W. of Rumpi (fr.) *Pawek 9202* (K, SRGH, UC).

MOÇAMBIQUE: Magwe (fr.) *Chase 2720* (BM, NY, SRGH); Milanje (fr.) *Correia & Marques 2737* (K, M, SRGH); Mocuba distr.: Namagoa Plantations (fl.) *Faulkner 178* (PRE 19) (BR, G, LISJC, PRE, S, SRGH); Nyasa distr.: Mutuali (fr.) *Gomes & Sousa 4085* (COI, K, L); (fl.) *4149* (COI, K, L, LISC, PRE); Nova Fontes Vila (fl.) *Johnson 33* (P, WU, Z); Namapa (fr.) *Lemos & Macuácua 41* (BM, COI, K, LISC, PRE, SRGH); Tete distr.: Songo (fl., fr.) *Mecêdo 5101* (K, LISC, SRGH); 38 kms N. of Vila Gouweia (fr.) *Pole-Evans & Erens 494* (BR, E, K, LISC, P, PRE, S, SRGH, US); Nyamadzi Valley (fl., fr.) *Swynnerton 39* (BM, K, NBG, US, Z).

SOUTHWEST AFRICA: 16 kms S. of Katara (fr.) *Müller & Gies 473* (M, PRE); N. of Gautscha Pan (fr.) *Story 6434* (FHO, K, M, PRE); Okavango Nat. Terr.: between Runtu and Andara (fl., fr.) *Winter 4281* (K, M, PRE); Kaokoveld: Ovikange (fr.) *Winter & Leistner 5900* (B, K, M, PRE).

BOTSWANA: Chobe distr.: Kasane (fl.) *Henry 15* (SRGH); ibid. (fl.) *Mutakela 125* (SRGH); Chobe Nat. Park (fl.) *Pope, Biegel & Russell 836* (K, LISC, PRE, SRGH); Okavango Delta (fr.) *Smith 1349* (BR, K, SRGH).

ZIMBABWE: Mashonaland North: Urungwe distr.: Zwipeni Camp (fl., fr.) *Goodier 319* (BR, COI, K, PRE, SRGH); ibid. Mzukwe R. (fl.) *Wild 4192* (BR, K, LISC, MO, S, SRGH); Toroshanya Pass (fr.) *Rodin 4417* (K, MO, NY, S, SRGH, UC, US, WU); Mashonaland South: Gatooma (fr.) *Jack VI.1936* (SRGH); Marandellas (fr.) *West 3110* (K, SRGH); Matabeleland North: Bulawayo distr.: 15 kms S. of Old Essexvale (fl.) *Crass 265* (BR, K, PRE, SRGH); Wankie (fl.) *Levy 1120* (E, K, MO, PRE, SRGH); Nyamandhlovu (fl.) *Pardy 14.X.1929* (FHO, MO, PRE, SRGH); Matoba distr.: Matapos (fl.) *Plowes 1292* (NY, PRE, SRGH); Matabeleland South: Nuanetsi distr.: Shirugwe hill (fr.) *Loveridge 12.V.1958* (COI, LD, MO, SRGH); Midlands: Que Que (fl.) *Biegel 556* (MO, SRGH); Selukwe (fl., fr.) *Eyles 3713* (BOL, NBG); Manicaland: Melsetter distr.: Rusitu R. (fr.) *Barrett 95/56* (COI, LISC, MO, SRGH); Umtali distr.: Odzi Intensive Cons. Area (fl.) *Chase 303* (BM, K, SRGH); ibid., S. of Penhalonga (fl.) *Gilliland 1259* (BM, K, PRE, SRGH); Belingwe distr.: Belingwe Tribal Trustl. (fr.) *Judge 6/56* (K, LISC, MO, SRGH); Melsetter distr.: N. of Makurupini Forest (fl.) *Simon & Ngoni 1299* (K, LISC, PRE, SRGH); Victorialand: Danga distr.: (fr.) *Chase 2425* (BM, NY, SRGH); Chuhanja Plat. (fr.) *Wild 3475* (K, LISC, SRGH).

SOUTH AFRICA: Transvaal: Punda Maria (fl.) *Codd & Dyer 4535* (K, NY, PRE); Malmanies Hoek (fl.) *Hardy 988* (B, K, M, NU); 10 kms N. of Warmbad (fl.) *Marais 1264* (L, M, PRE); 35 kms N. of Pretoria (fl., fr.) *Werdermann & Oberdieck 1259* (A, B, PRE); Orange Free State: Rietspruit (fl.) *Smuts 3674* (K, PRE); Modderpoort (fl.) *Vahrmeyer 1443* (K, PRE); Natal: Pongola Irrig. Settlem. (fl., fr.) *Burtt Davy 18247* (BM, BOL); Rietfontein (fr.) *Smuts 1.VII.1929* (PRE); 4 kms N. of Warmbaths (fr.) *Winter 8455* (K, PRE); Cape Prov.: Bokspoort (fl.) *Galpin 11595* (BM, BOL, NY, P, PRE); Warmbad (fl.) *Story 1531* (BR, K, LD, PRE); Mooi Drift (fl.) *Leendertz 2268* (BR, K, M, MO, PRE, WU).

	Flowering period	Fruiting period
S. W. Africa	Oct. – Jan.	Jan. – July
Angola S.	Oct. – Jan.	(Oct.)Nov. – May
Angola N.	Aug. – Febr.	Nov. – July
Zaïre	July – Febr. (Mar.)	Jan. – July
Tanzania	July – Jan.(Apr.)	Aug. – July
Zambia	Aug. – Dec.	Oct. – July
Zimbabwe	Sept. – Febr. (May)	Jan. – July
Moçambique	Aug. – Mar.	Aug. – July
S. Africa	Oct. – Jan.	Oct. – May

Notes: *D. condylocarpon* is a very variable species, especially as to the shape and the indumentum of the leaves and inflorescences. The indumentum and the size of the flowers vary as well, but far less. The fruit and seeds are more or less constant.

None of the variable characters could be correlated with others. Moreover, intermediates could be found in all cases.

After comparison of many specimens the present author concluded that all specimens examined belong to a single species.

PHYTOCHEMISTRY OF DIPLORHYNCHUS

Alkaloids are present in both the stem bark and root bark of *D. condylocarpon*, the latter being the richer source. The structures of seven of them have been determined; they belong to three main groups: the isomeric yohimbine and β-yohimbine; nor-macusine B (= tombozine = diplorrhyne), stemmadenine, and condylocarpine; and 14-hydroxy-(-)-akuammicine (= mossambine = diplorrhyncine) and nor-fluorocurarine (D. STAUFFACHER, Helv. Chim. Acta *44*: 2006–2015 (1961); X. MONSEUR *et al.*, Bull. Soc. Chim. France *1962*: 1088–1092). Most of these compounds are known to occur in other members of the *Apocynaceae*. A total aqueous extract of the roots and stems is reported to be a useful sympatholytic (RAYMOND-HAMET, Chem. Abstr. *71*: 53587 (1969)).

N. G. BISSET

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A Cambridge, Massachusetts, U.S.A.: Arnold Arboretum.
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BM London, Great Britain: British Museum (Natural History).
BOL Cape Town, South Africa: Bolus Herbarium, University of Cape Town.
BP Budapest, Hungary: Museum of Natural History, Department of Botany.
BR Bruxelles, Belgium: Jardin Botanique de l'Etat.
C Kφbenhavn, Denmark: Botanical Museum and Herbarium.
COI Coimbra, Portugal: Botanical Institute of the University of Coimbra.
E Edinburgh, Great Britain: Royal Botanic Garden.
EA Nairobi, Kenya: The East African Herbarium.
FHO Oxford, Great Britain: Forest Herbarium, Department of Forestry, Commonwealth Forestry Institute, University of Oxford.
FI Firenze, Italy: Herbarium Universitatis Florentinae, Istituto Botanico.
G Genève, Switzerland: Conservatoire et Jardin botaniques.
GENT Gent, Belgium: Laboratorium voor Plantensystematiek.
GH Cambridge, Massachusetts, U.S.A.: Gray Herbarium of the Harvard University.
GOET Göttingen, Federal Republic of Germany: Systematisch-Geobotanisches Institut, Universität Göttingen.
HBG Hamburg, Federal Republic of Germany: Staatsinstitut für Allgemeine Botanik und Botanischer Garten.
K Kew, Great Britain: The Herbarium and Library.
L Leiden, the Netherlands: Rijksherbarium.
LD Lund, Sweden: Botanical Museum.
LE Leningrad, U.S.S.R.: Herbarium of the Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R.
LISC Lisboa, Portugal: Centro de Botánica da Junta de Investigaçoes do Ultramar.
LISJC Lisboa-Belem, Portugal: Jardim e Museu Agricola do Ultramar.
M München, Federal Republic of Germany: Botanische Staatssammlung.
MO Saint Louis, Missouri, U.S.A.: Missouri Botanical Garden.
NBG Cape Town, South Africa: Compton Herbarium, National Botanic Gardens.
NH Durban, South Africa: Natal Herbarium, Department of Agricultural Technical Services.
NY New York, U.S.A.: The New York Botanical Garden.

OXF Oxford, Great Britain: Fielding Herbarium, Druce Herbarium, Department of Botany.

P Paris, France: Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie.

PRE Pretoria, South Africa: Botanical Research Institute, National Herbarium.

S Stockholm, Sweden: Botanical Department, Naturhistoriska Riksmuseum.

SRGH Salisbury, Zimbabwe: National Herbarium.

TCD Dublin, Ireland: School of Botany, Trinity College.

UC Berkeley, U.S.A.: Herbarium of the University of California, Department of Botany.

UPS Uppsala, Sweden: Institute of Systematic Botany, University of Uppsala.

US Washington, D.C., U.S.A.: National Museum, Department of Botany.

WAG Wageningen, the Netherlands: Laboratory of Plant Taxonomy and Plant Geography.

WU Wien, Austria: Botanisches Institut und Botanischer Garten der Universität Wien.

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