

NORBERT KILIAN, PETER HEIN &amp; MOHAMED ALI HUBAISHAN

## New and noteworthy records for the flora of Yemen, chiefly of Hadhramout and Al-Mahra

### Abstract

Kilian, N., Hein, P. & Hubaishan, M. A.: New and noteworthy records for the flora of Yemen, chiefly of Hadhramout and Al-Mahra. – Willdenowia 32: 239-269. 2002. – ISSN 0511-9618.

Based on own collections made in the southern governorates of the Republic of Yemen between 1997 and 2002, 110 new and noteworthy records of vascular plants are provided. Five taxa, *Iphigenia oliveri*, *Kleinia squarrosa*, *Parthenium hysterophorus*, *Rhus glutinosa* subsp. *neoglutinosa* and *Poskea socotrana* are recorded as new for the Arabian Peninsula, and *Pistacia aethiopica* is confirmed; 23 species are recorded as new and four are confirmed for mainland Yemen; 77 species are recorded as new for the southern governorates of Yemen or larger parts of them. Brief comments are given on the phytogeography of the taxa. *Rhus flexicaulis*, a species hitherto considered an endemic of SW Arabia, is found conspecific with the widespread African *R. vulgaris*, and provides, for priority reasons, the correct name for this species; the most recently described *R. gallagheri* from Oman is also conspecific with it. *Justicia areysiana* is accepted as the correct name for the S Arabian endemic formerly known as *Bentia fruticulosa*.

### Introduction

Still in the early nineties of the 20th century, Al-Mahra, the easternmost governorate (Fig. 1) of the Republic of Yemen and neighbouring the province Dhofar of the Sultanate of Oman, was considered by Miller & Nyberg (1991) the botanically least known region of the Arabian Peninsula. In fact, Al-Mahra was rarely visited by botanists until the last decade of the 20th century. Small plant collections were made by the few early explorers, viz. the Berlin physician Leo Hirsch, from February to March 1893 (Sayhut and Qishn area in western Al-Mahra, see Hirsch 1897), the naturalists S. Paulay and Oskar Simony of the Austrian South Arabia expedition in the Fartak Mts in March 1899 (Rebel 1907) and the Austrian philologist Wilhelm Hein with his wife Marie in the Qishn area from January to March 1902 (Hein 1914). The material of these collectors was incorporated in the "Flora des tropischen Arabiens" by Schwarz (1939), which had remained the only flora of Yemen until the flora of the northern Yemen, the former Arab Republic of Yemen, was published (Wood 1997). Also during most of the 20th century, hardly any botanical exploration or collecting were done in Al-Mahra; the only exception known to us is Wilfred Thesiger, explorer of the deserts of S Arabia, who made a few collections in northern Al-Mahra in the 1940s, e.g. 1946 (Thesiger 1959).



Fig. 1. Yemen, administrative divisions (muhafazah = governorates) and principal mountainous palaeo-African refugia explored. – Based on the ‘Administrative boundaries map’ of the Survey Authority, Sana’a 2002.

A first survey of the remarkable monsoon woodlands in the Hawf Mts, close to the border with Oman, was undertaken by A. S. Bilaidi and Luigi Guarino on behalf of the Ministry of Agriculture and Agrarian Reforms of the former People’s Democratic Republic of Yemen, only in 1989 (Bilaidi 1989), at a time thus when a first inventory of the flora of the neighbouring Dhofar was already published (Miller & Morris 1988). A further investigation of the principal composition and extent of the monsoon woodlands in Al-Mahra, additionally based on remote sensing data, was carried out in the frame of a Woodland Resources Mapping Project for the then united Republic of Yemen in the early 1990s (Hunting Technical Services 1992-93).

For floristic investigations, Al-Mahra was visited in October 1992 by Abdul Nasser Al-Gifri, Aden, and Mats Thulin, Uppsala, in October 1993 by Tony Miller, Edinburgh (Miller 1996, Miller & Cope 1996), in November 1998 again by Mats Thulin and his Yemeni and European co-workers (Thulin & al. 2001, further results published are cited herein). The present authors visited Al-Mahra in 1998, 1999, 2000, 2001 and 2002, accompanied by their co-workers, in the frame of a Yemeni-German research project on palaeo-African refugia in southern Yemen, which has been funded since 2001 as the BIOTA [Biodiversity Monitoring Transect Analysis] Yemen Project by the German Ministry of Research and Education in the program Biodiversity and Global Change (BIOLOG) (Anon. 2001; see also Kilian 1999, Kilian & Hein 1999, El-Mashjary & al. 2001, Sipman 2002, Kilian & Hubaishan 2002, Kilian & al. 2002). In 2000 the Fartak Mts were also visited by John J. Lavranos, Bruno Mies and Tom McCoy (Lavranos & Mies 2001, Mies & Lavranos 2001). Hence, our knowledge of the flora, phytogeography and vegetation of southeastern Yemen is considerably increasing, finally.

The flora of the other southeastern governorates, Hadhramout and Shabwa (Fig. 1), is, in general, better known, but many regions are still undercollected or have even never been visited. This is noticeable when the distribution maps in the first volume of the “Flora of the Arabian Peninsula and Socotra” (Miller & Cope 1996) are studied. Due to the lack of plant collections from Al-Mahra and other, vast areas of southern Yemen, also the preliminary checklists by Gabali & Al-Gifri (1990) and Gabali (1995) gave incomplete inventories only. The recently published checklist of the flora of Yemen (Khulaidi 2000), listing 2810 vascular plant species (incl. cultivated and introduced species), provides the most comprehensive inventory of the Yemen flora currently available, but still shows a considerable lack of distribution data for the southern and especially the southeastern Yemen.

This paper adds 110 new records of vascular plants, partly for the entire Arabian Peninsula, for mainland Yemen, for the southern governorates of Yemen or larger parts of them, in particular from Hadhramout and Al-Mahra. This paper also supplements a recent contribution by Thulin & al. (2001) of 50 new records for Yemen, mainly from Al-Mahra and including a number of species formerly considered endemic to the neighbouring Omani province of Dhofar.

The following list is a result of our field work between 1996 and 2002. Specimens cited and other collections are deposited in the herbarium of the Botanic Garden and Botanical Museum Berlin-Dahlem (B), Germany, and the herbarium of the Agricultural Research and Extension Authority (AREA) in Dhamar, Yemen; duplicates of these collections and other material referring to the new records is being distributed to Edinburgh (E) and other herbaria. New or confirming records for the Arabian Peninsula are marked with a double asterisk, \*\* and (\*\*\*) respectively, new records for mainland Yemen are marked with a single asterisk \* or (\*). All others are new records for the southern or southeastern governorates, filling larger distributional gaps, usually of rare and/or phytogeographically noteworthy taxa.

Only representative collections are cited; specimen citation is abbreviated and partly standardised; “YP” preceding collection numbers indicates the collection of the BIOTA Yemen Project, numbers preceded by the initials “NK” and “PH” indicate the separate collections of the first and second author on their trips during 1996-2000. Following collectors (in alphabetical order) joined the various collecting teams, in all or part of the time, during the different field trips:

- March 1996: Peter Hein & Eckhard von Raab-Straube
- March-April 1997: Abdul N. Al-Gifri, Peter Hein, Norbert Kilian, Milan Smalla
- September 1998: Shahina A. Ghazanfar, Peter Hein & Norbert Kilian
- November-December 1999: Saleh O. Bahah, Salim M. A. Bashmeilah, Ali F. Bin Nesr, Mohamed El-Mashjary, Peter Hein, Mohamed A. Hubaishan, Norbert Kilian, Saad A. S. Kodah
- October-November 2000: Saleh O. Bahah, Ali F. Bin Nesr, Peter Hein, Mohamed A. Hubaishan, Norbert Kilian, Saad A. S. Kodah
- September-October 2001: Saleh O. Bahah, Nadja G. Mohamed, Peter Hein, Mohamed A. Hubaishan, Norbert Kilian, Saad A. S. Kodah, Jörg Meister, Markus Reisch
- March-April 2002: Abdul N. Al-Gifri, Mohamed T. Al-Nusheiri, Yaslim Ba-Muaile, Abdul Halib, Peter Hein, Mohamed A. Hubaishan, Norbert Kilian, Simone Kipka, Harald Kürschner, Abdulla Mukran, C. Oberprieler, Mohamed H. Omar, Abdul E. Shafer
- August-September 2002: Frank Bolz, Peter Hein, Geshe Hohlstein, Mohamed A. Hubaishan, Norbert Kilian, Saad A. S. Kodah, Katharina Rabe.

### New and noteworthy records

#### *Pteridophyta*

#### *Selaginellaceae*

#### *Selaginella imbricata* (Forssk.) Spring

The species has been recorded on the Arabian Peninsula only from the W Arabian mountains and Dhofar (Miller & Cope 1996: 38, map 8). It is recorded here also for Hadhramout and Al-Mahra.

HADHRAMOUT: Upper Wadi Hajar, from Wadi es Siyel to the Jol, c. 20 km NW of the village Mintaq, 850 m, 14°38'N, 47°58', 3.11.2000, *NK6621*; Wadi Dowan, track out of Wadi Dowan 1 km S of Al Khuraybah to Huwayrah, 15°08'N, 48°21'E, 1100 m, E facing slope in small tributary, 12.11.1999, *NK5974*.

AL-MAHRA: Hawf Mts, Damqaut-Al-Fatq track, c. 0.5 km W of the junction with the Shah'rut track, 16°33'30.9"N, 52°48'37.8"E, 200-250 m, 4.10.2001, *YP821*.

### *Ophioglossaceae*

*Ophioglossum polyphyllum* A. Braun

This widespread tropical species (Burrows in Burrows & Johns 2001: 11) is the only member of *Ophioglossaceae* recorded with certainty from the Arabian Peninsula (Miller & Cope 1996: 41). It is known from the western mountains in Saudi Arabia and Yemen, from the northeast of the peninsula and from few gatherings in N Oman and Dhofar (Miller & Cope 1996: map 13, Wood 1997: 56). Our records are the first from the southern governorates of Yemen. A second species of *Ophioglossum*, not known from the Arabian Peninsula, occurs in the Fartak Mts (*YP3234*) but is not identified so far.

HADHRAMOUT: Kor Seiban, summit plateau, immediately below the highest point, 14°49'40.3"N, 48°48'42.6"E, 2060 m, on sand with gravel, 13.9.2002, *YP3512*.

AL-MAHRA: N Fartak Mts, between 15°49'18.1"N, 51°57'46.0"E, 620 m, and 15°49'04.7"N, 51°57'46.2"E, 450 m, small narrow wadi, gravelly wadi bed, 1.9.2002, *YP3269*.

### *Parkeriaceae*

*Ceratopteris cornuta* (P. Beauv.) Le Prieur

This palaeotropical aquatic fern is known only from few localities in the Arabian Peninsula (Miller & Cope 1996: 43, map 16) and here recorded for the first time from southern Yemen, from a single population in the only permanent streamlet of the Hawf mountains, originating from the spring Ain Ayn.

AL-MAHRA: Hawf Mts, rivulet with permanent water below the spring Ain Ayn, 16°38'N, 52°57'E, 460 m, 23.11.1999, *NK6312*, *PH6787*; id., 1.10.2001, *YP653*.

### *Actiniopteridaceae*

*Actiniopteris semiflabellata* Pic. Serm.

Known from the W Arabian mountains, from Dhofar and from Jabal Akhdar and Musandam in N Oman, the species is here confirmed for Hadhramout and for the first time recorded from Al-Mahra (cf. Miller & Cope 1996: 45, map 18).

HADHRAMOUT: Mukalla-Sayun road, Jol escarpment c. 30 km N of Riyan, last turn above the village Abdallah Karib, steep rocky slopes with huge boulders, open woodland (*Commiphora*, *Jatropha*, *Acacia*), 550-600 m, 14°54'N, 49°03'E, 8.11.1999, *NK5863*.

AL-MAHRA: Hawf Mts, track from Uteq to Kon, *Acacia etbaica* woodland, c. 4 km E of 16°39'42.1"N, 52°59'54.8"E, shallow and rather wide gorge, 900-950 m, 29.9.2001, *YP546*.

### *Adiantaceae*

*Adiantum incisum* Forssk.

The species is rather frequent in the W Arabian mountains (SW Saudi Arabia, NW Yemen) and also known from Dhofar, Oman (Miller & Cope 1996). The cited records are the first for SE Yemen. The species is not yet recorded from Hadhramout.

AL-MAHRA: Hawf Mts, somewhat E of Kon, 16°39'45.4"N, 53°04'52.1"E, 730 m, 29.9.2001, *YP538*.

\**Adiantum lunulatum* Burm. f. [Syn.: *A. philippense* sensu auct., non L.]

This pantropical fern was in the Arabian Peninsula previously known only from the *Anogeissus* woodlands in Dhofar, Oman (Miller & Cope 1996: 53, map 32). Its predicted occurrence in the

neighbouring Al-Mahra in Yemen (Miller & Cope 1996: 53, Khulaidi 2000: 16) is confirmed here by records from moist and shaded sites in the *Anogeissus* woodland.

AL-MAHRA: Hawf Mts, somewhat E of Kon, 16°39'45.4"N, 53°04'52.1"E, 730 m, 29.9.2001, YP539; Hawf Mts, environment of the locality called Shah'rut [i.e. 16°33'55.4"N, 52°46'27.1"E], 650-700 m, 2.10.2001, YP763.

### ***Pteridaceae***

*Pteris vittata* L.

Found in wet places only, the species has been known so far from the western mountains (SW Saudi Arabia, NW Yemen), from Dhofar and the eastern mountains (N Oman). Here it is added for Hadhramout and Al-Mahra (cf. Miller & Cope 1996: 55, map 37).

HADHRAMOUT: Northern tributary of Wadi Araf (near village Haglay), entered by a track branching to the right from the pipeline rd., 15°02'51.9"N, 49°27'06.9"E, c. 500 m, 16.9.2001, YP89.

AL MAHRA: Near the spring Ain Ayn, 16°38'N, 52°57'E, 460 m, 23.11.1999, PH6793.

### ***Dryopteridaceae***

*Hypodematium crenatum* (Forssk.) Kuhn

Known in the Arabian Peninsula only from the mountainous southwest and from Dhofar (Miller & Cope 1996: 67, map 58) the species is added here for SE Yemen.

AL-MAHRA: Coastal mountains NW of Jadib, slope with boulders (0.2-1 m diam.) immediately below the escarpment from the summit plateau of Jabal Chatan, limestone, c. 800 m, 16°39'N, 52°57'E, mixed *Anogeissus* woodland with evergreen elements, 13.11.2000, NK6823, PH8112.

### ***Gymnospermae***

#### ***Ephedraceae***

*Ephedra foliata* Boiss. ex C. A. Mey.

A widespread species in the dry regions of the Arabian Peninsula, but not yet recorded from Hadhramout and Al-Mahra (see Miller & Cope 1996: 79, map. 71). Our specimens (with immature cones) close this gap.

HADHRAMOUT: Track from Al Mukalla to Bayn al Jibal, 14°37'N, 49°02'E, 550 m, rocky slopes with regular mist precipitation, foot of rock face, 9.11.1999, NK5885; Mukalla-Sayun road, escarpment of the Jol plateau, 14°54'N, 49°03'E, 550-600 m, steep rocky slopes with huge boulders, 8.11.1999, PH6172.

AL-MAHRA: Plateau around the settlement Sarif, 16°51'N, 51°50'E, c. 900 m, shallow depression with sandy-silty soil, mosaic of scattered shrubs and small trees and after rain therophyte vegetation, 7.11.2000, PH7938.

\**Ephedra milleri* Freitag & Maier-Stolte

In 1992 described and hitherto only known from Dhofar, Oman. As predicted (Miller & Cope 1996: 80, Khulaidi 2000: 93) the species has now been found also in Yemen.

AL-MAHRA: N Fartak Mts, dissected table-land near the track W below J. Karmoun (with the disused radio tower), 15°49'39.2"N, 51°58'14.4"E, 600-650 m, 8.10.2001, YP1110.

### ***Dicotyledoneae***

#### ***Acanthaceae***

*Barleria acanthoides* Vahl

Known already from SW Saudi Arabia (Collenette 1999: 3, Chaudhary 2000: 7), NW Yemen (Wood 1997: 271, Khulaidi 2000: 11) and Hadhramout (Schwartz 1939: 252) as well as from Dhofar, Oman (Miller & Morris 1988, Ghazanfar 1992: 15). Our records from Al-Mahra close the gap in its known distribution between the latter two regions.

AL-MAHRA: N Fartak Mts, W flank of J. Karmoun, c. 15°25'16,7"N, c. 51°59'57,1"E, 450-600 m, 6.10.2001, *YP971*; S Fartak Mts, above Kadifut, wadi running W to E-SE and rocky ridge at the upper W end of the wadi, 15°38'57.1"N, 52°12'04.6"E, 650 m, 10.10.2001, *YP1163*.

*Dicliptera verticillata* (Forssk.) C. Chr. [Syn.: *D. micranthes* Nees]

A widespread weedy herb, on the Arabian Peninsula so far known only from the areas of high rainfall in the western escarpment of Yemen (Schwartz 1939: 255, Wood 97: 276, Khulaidi 2000: 12). The record from Al-Mahra is from loamy soil around a cistern, with strong influence of trampling cattle.

AL-MAHRA: Coastal mountains between Al Faydami and Hawf, locality called Takka NE Hawf, 16°39'N, 53°03'E, 200 m, mosaic of *Anogeissus* woodland, *Dodonaea* shrubland and *Apluda mutica* pastures, 11.11.2000, *PH8026b*.

\**Dyschoriste dalyi* A. G. Mill.

This species of the pantropical genus *Dyschoriste* described as an endemic of Dhofar, Oman (see Miller & Morris 1988: 10), is here recorded for the first time for Yemen.

AL-MAHRA: Summit plateau of Jabal Chatan NE of the permanent spring Ain Ayn, at c. 16°38'N, 52°57'E, 1200-1300 m, gravel, *Euphorbia balsamifera* cushion scrub, 23.11.1999, *NK6343*, *PH6787*.

*Ecbolium strictum* O. Schwartz

The only endemic species of *Ecbolium* in the Arabian Peninsula, which is closely related to *E. amplexicaule* S. Moore from coastal Kenya and Tanzania (Vollesen 1989), has been recorded previously from Shabwa and Hadhramout (Schwartz 1939: 257, Khulaidi 2000: 13). Our records from Al-Mahra constitute a range extension of some 300 km to the east.

AL-MAHRA: Jabal Fartak between Haswayn and Al Ghaydah, W facing slopes of the summit plateau with disused radio tower, c. 15°50'N, 52°00'E, 550-950 m, 26.11.1999, *NK6361*, *PH6837*.

*Hypoestes forskoolii* (Vahl) R. Brown

The species is known from SW Saudi Arabia (Collenette 1999: 7, Chaudhary 2000: 15), the western escarpment of Yemen (Schwartz 1939: 256, Wood 1997: 277), from Hadhramout (without citation of specimens, Khulaidi 2000: 13) and Dhofar (Miller & Morris 1988: 12, Ghazanfar 1992: 15). Our records confirm its occurrence in Hadhramout and close the gap in its known distribution between the latter two regions.

HADHRAMOUT: Track from the village As Safal in the upper Wadi Fuwwah [= Wadi Al Muhammedin] to Jol Berka, 14°34'N, 48°44'E, 1100-1150 m, 14.11.1999, *NK6002*.

AL MAHRA: Coastal mountains between Al Faydami and Hawf, locality called Takka NE from Hawf, 16°39'N, 53°03'E, 200 m, 11.11.2000, *PH8022*.

*Justicia areysiana* Defflers 1896 [Syn.: *Justicia bentii* V. A. W. Graham 1988, **syn. nov.**  $\equiv$  *Bentia fruticulosa* Rolfe 1894, non *J. fruticulosa* Lindau 1894; *J. calyculata* sensu Ghazanfar (1992: 15) non Defflers]

This beautifully flowering shrub (see Miller & Morris 1988: 5 as *Bentia fruticulosa*) was originally described by Rolfe in the monospecific genus *Bentia* on material from the Jol escarpment in Hadhramout, collected on the Theodore and Marble Bent's expedition in 1893-94. Almost at the same time it was also collected farther west by Defflers on the sea facing flank of Jabal Urays in the governorate Abyan and subsequently described as *J. areysiana*. This latter binomial has to be adopted as the correct name in *Justicia*, because the combination with the older epithet *fruticulosa* in *Justicia* would result in a younger homonym of *J. fruticulosa* Lindau for a different species, and because it clearly antedates the nomen novum *J. bentii* of 1988. The species is endemic to southern Arabia and has been recollected recently by us both at Jabal Urays and in Hadhramout, and recorded for the first time also from Al-Mahra (without quotation of specimens mentioned by Khulaidi 2000: 13). The species is not rare where it occurs but often strongly browsed by camels, which are especially fond of it.

AL-MAHRA: Footpath from the village Con on the second plateau over the steep escarpment up to the summit plateau of Jabal Chatan, c. 16°40'N, 53°02'E, 900-1100 m, rock faces and ledges, 22.11.1999, *NK6291*, *PH6700*.

*Justicia heterocarpa* T. Anders.

This annual with unusual dimorphic fruits is known from northern Yemen (Schwartz 1939: 258, Wood 1997: 275, Khulaidi 2000: 13) and Dhofar (Miller & Morris 1988, Ghazanfar 1992). We add here records for Abyan and Al-Mahra, where the species is not rare in the climatically favoured coastal escarpments.

ABYAN: Jabal Urays, rocky ridge between Wadi Asurie and Wadi Lobob to the west, W facing slope into Wadi Lobob at the basis of the rock faces, between 13°27'29.5"N, 45°54'57.3"E and 13°27.7'N, 45°54.9'E, c. 500-570 m, 14.3.2002, *YP1645*.

AL-MAHRA: Hawf Mts, Uteq, S facing slope with big boulders, 16°38'57.5"N, 52°57'39.2"E, 800 m, 29.9.2001, *YP479*.

*Megalochlamys linifolia* (Lindau) Lindau

Mainly distributed in the Horn of Africa region, the species has been recorded once each from Shabwa and Hadhramout (Schwartz 1939: 257, Boulos 1988: 553, Vollesen 1989: 632, map 11). Very similar to the case of *Ecbolium strictum* (see above) constitutes our record a range extension of some 300 km to the east.

AL-MAHRA: Jabal Fartak, on the track between Haswayn and Al Ghaydah, near the pass, 15°49'N, 51°57'E, 600-650 m, rocky ridges and S-SW slopes affected by monsoonal mist, 19.11.1999, *NK6155*.

*Megalochlamys violacea* (Vahl) Vollesen [Syn.: *Ecbolium violaceum* (Vahl) Hillcoat & Wood]

This tropical NE African (Ethiopia, Kenya, Somalia, Sudan, Eritrea Djibouti) -S Arabian species has been known so far from NW Yemen, SW Saudi Arabia and Dhofar, Oman, only (Vollesen 1989: 610, map 2). Our records from Al-Mahra are the first for the entire southern Yemen.

AL-MAHRA: Hawf Mts, rocky slopes with dense *Jatropha-Commiphora* woodland c. 10-15 km W of Jadib, 150-250 m, 16°38'N, 52°55'E, 26.9.1998, *PH5044*.

*Lepidagathis calycina* Nees

Known from Ethiopia, NW Yemen (Wood 1997: 273) and Oman (as *Lepidagathis* sp. nov. aff. *calycina*, Miller & Morris 1988: 335, Ghazanfar 1992: 16). Our records are the first for the eastern part of Yemen.

AL-MAHRA: Coastal mountains between Al Faydami and Hawf, plateau of Jabal Chatan N of the village Con, 16°40'N, 53°04'E, 1100-1150 m, 22.11.1999, *PH6717*; id., 700-860 m, 14.11.2000, *NK6842a*.

*Peristrophe paniculata* (Forssk.) Brummitt [Syn.: *P. bicalyculata* (Vahl) Nees]

This widespread species was reported on the Arabian Peninsula so far only from SW Saudi Arabia, W Yemen (Collenette 1999: 9, Wood 1997: 276, Boulos 1988: 553) and Oman (Miller & Morris 1988: 335, Ghazanfar 1992: 16). Our records from Abyan and Al-Mahra partially close the gap between the known occurrences.

ABYAN: NNE of Shuqra, volcanic plateau, flat wadi near Djahayn, 13°29'N, 45°46'E, 720 m, 25.3.1997, *NK4551*.

AL-MAHRA: Hawf Mts, locality called Takka NE from Hawf, 200 m, 16°39'N, 53°03'E, mosaic of *Anogeissus* woodland and *Dodonaea* shrubland, 11.11.2000, *PH8029*.

**Amaranthaceae**

*Saltia papposa* (Forssk.) Moq.

This monospecific genus endemic to the southwesternmost edge of the Arabian Peninsula

(Miller & Cope 1996: 305, map 409) has recently been mentioned (Khulaidi 2000: 23), without quotation of specimens, also from Hadhramout and Ras Fartak. The occurrence in Hadhramout is here substantiated by own collections.

HADHRAMOUT: Track from Al Mukalla to Bayn al Jibal, Wadi Shuhurah, 14°40'N, 48°56'E, 700 m, 17.11.1999, *NK6077*, *PH6439*; near the village Maula Matar (below the Maula Matar gorge), rocky SW slope, 14°46'27.8"N, 48°47'08.1"E, 1700 m, 21.9.2001, *YP273*.

*Psilotrichum virgatum* C. C. Townsend

Initially regarded as endemic to NE Somalia (Townsend in Thulin 1993: 159), the shrubby species has been recorded by Miller & Cope (1996: 300, map 399) also for the Arabian Peninsula (Al-Mahra and neighbouring Dhofar). We record the species here for the first time from Hadhramout, where it was met as a shrub to 2 m tall and 3 m in diameter.

HADHRAMOUT: Track from Buweish to Bein al Gebal, gorge NW of Shahora, narrow wadi between steep cliffs, gravelly substrate, 14°40'12.3"N, 48°55'03.6"E, 780 m, 20.9.2001, *YP241*.

**Anacardiaceae**

\**Lannea triphylla* (A. Rich.) Engl. [Syn.: *Odina triphylla* A. Rich.]

This tropical E African shrub or small tree has been known outside Africa so far only from Dhofar, Oman (Miller & Morris 1988: 27, Thulin 1999: 256). Our records from the coastal mountains in eastern Al-Mahra are the first for Yemen; the material of our six collections shows a wide variability in the stellate indumentum of the fruits (from densely tomentose to subglabrous), but with inflorescences to 2.8 cm long (*YP3074*) the plants clearly belong to *L. triphylla* and not to the similar *L. malifolia* (cf. Thulin 1999: 256).

AL-MAHRA: Hawf Mts, southeastwards below the locality called Shah'rut, *Acacia-Commiphora* woodland, 16°34'40.0"N, 52°48'35.5"E, 450 m, 4.10.2001, *YP851*; *ibid.*, SE of Ka'ab, 16°36'28.8"N, 52°55'48.2"E, 300 m, 26.7.2002, *YP3074*; *ibid.*, Wadi Chard, 16°36'49.4"N, 52°55'07.7"E, 100 m, 28.8.2002, *YP3132*.

(\*\*) *Pistacia aethiopica* Kokwaro

Our collection confirms the single previous report (Khulaidi 2000: 25) of this species for the Arabian Peninsula. The evergreen *P. aethiopica* is otherwise distributed in tropical E Africa from N Somalia, Djibouti and Eritrea southwards to N Tanzania (Friis 1992: 82, fig. 22(1), 204, map 102, Thulin 1999: 265). Jabal Eraf, close to the Yemeni south coast (see Fig. 1) is so far the only known locality of *P. aethiopica* in the entire Arabian Peninsula. J. Eraf shelters a remarkable relic stand of a mixed evergreen *Juniperus procera* woodland, being its southernmost stand on the Arabian Peninsula.

LAHJ: Jebel Eraf, between 13°06'44.1"N, 44°14'57.4"E, 1330 m and 13°06'32.4"N, 44°15'14.5"E, 1430 m, 10.3.2002, *YP1448*.

*Pistacia falcata* Mart.

This species, closely related with *Pistacia chinensis* Bunge and *P. palaestina* Boiss. is in E Africa confined to Ethiopia, Djibouti and N Somalia (Friis 1992: 205, map 103, Thulin 1999: 267) and in the Arabian Peninsula known from the southwestern mountains (SW Saudi Arabia and NW Yemen, see Collette 1999: 41, Wood 1997: 199, Khulaidi 2000: 24) and further east from Dhofar, Oman (Miller & Morris 1988: 26, Ghazanfar 1992: 19). Our records from Hadhramout and Al-Mahra are the first from SE Yemen in between both occurrences.

HADHRAMOUT: Kor Seiban, larger wadi S of the highest point and running W-E to the vertical escarpment, c. 14°49'09" N, 48°48'42"E, 1850 m, 22.9.2001, *YP352*.

AL-MAHRA: Hawf Mts, upper escarpment to the Jabal Chatan N of the village Con, 16°40'N, 53°04'E, 1000-1100 m, 22.11.1999, *PH6705*; NW of Jadib, slope with boulders (0.2-1 m diam.), immediately below the escarpment from the summit plateau of Jabal Chatan, *Anogeissus* woodland with evergreen elements, 800-950 m, 16°39'N, 52°57'E, 13.11.2000, *NK6819*.



*Rhus flexicaulis* Baker 1895 [Syn.: *R. vulgaris* Meikle 1951, **syn. nov.**, *R. gallagheri* Ghaz. 2002, **syn. nov.**, *R. villosa* sensu auct., non L.f.]

Originally described from Hadhramout on the basis of a collection made by Leo Hirsch in 1893, the species is also known from the southwestern governorates Abyan (J. Urays: Deflers 1895 and Schwarz 1939 sub *R. villosa*; our own collections YP1535, YP1917) and Lahj (J. Eraf: Khulaidi 2000: 24; our own collection YP1481) and from NW Yemen (Wood 1997: 199, Khulaidi 2000: 24), but so far not from further north or east. Our collections from the Fartak and Hawf mountains in Al-Mahra therefore constitute a considerable range extension up to the border with Oman. Since, however, the most recently described *R. gallagheri* Ghaz., considered an endemic of E Dhofar (Ghazanfar 2002), is clearly conspecific with *R. flexicaulis*, these Omani records mark its actual easternmost occurrence. *R. flexicaulis*, usually considered endemic to the Arabian Peninsula (Wood 1997, Khulaidi 2000), has recently (Boulos 2000: 75) also been reported for Egypt and Sudan. In the Arabian Peninsula *R. flexicaulis* exhibits considerable variability in habit (procumbent to erect shrubs or small trees), in leaf characters such as the size of the leaflets (the median 0.5-7 cm long), the density of the indumentum (loosely to densely hairy), the difference in the colour of the upper and lower side of the leaflets (somewhat bicolourous with darker upper side to concolourous). Comparing our species with those from tropical E Africa, a striking similarity to *R. vulgaris* Meikle becomes obvious. Closer examination of material from the wide range of this and other species more or less similar to *R. flexicaulis*, such as *R. natalansis* Krauss, *R. tenuinervis* Engl. and *R. longipes* Engl., as well as consultation of the most recent regional revisions (Meikle 1951, Kokwaro 1986, Gilbert 1989, Thulin 1999) clearly revealed that *R. vulgaris* and *R. flexicaulis* are conspecific. When Meikle (1951) searched in vein for a valid binomial to properly name the species usually misnamed "*R. villosa* L.f." and newly described it thus as *R. vulgaris*, he apparently overlooked Baker's name of 1895 for the Arabian material. The correct name for this widespread Sudano-Zambesian-SW Arabian species (see, e.g., Wickens 1976: 124, map 95; distributed from S Egypt and Sudan westwards to Cameroun and from Ethiopia [surprisingly not present in Somalia, cf. Thulin 1999] southwards to Mozambique) is thus *R. flexicaulis* Baker, as it has been correctly used already by Boulos (2000).

AL-MAHRA: N Fartak Mts, SW-facing slopes of the mountain and plateau with the radio tower, 15°50'N, 52°00'E, 650-950 m, 26.11.1999, PH6913; *ibid.*, NE flank, SW above Nishtun, c. 300 m, narrow steep wadi, 16.11.2000, NK6879; S Fartak Mts, above Ras Fartak, mountain ridge along the E coast at c. 15°38'28"N, 52°12'54.3"E, 350-450 m, 10.10.2001, YP1189; Hawf Mts, close to the locality called Uteq [at 16°38'57.5"N, 52°57'39.2"E], 800-850 m, 30.9.2001, YP600.

*Rhus glutinosa* subsp. *abyssinica* (Oliver) M. Gilbert [Syn.: *R. abyssinica* Oliver, *R. petition* A. Rich., *R. folios* A. Rich.] – determination confirmed by Mike Gilbert

*R. glutinosa*, of which three subspecies can be distinguished (Gilbert 1986a-b, 1989), is confined in Africa to the Ethiopian highlands with a single outpost in the mountains of Djibouti (Friis 1992: 205, map 104). Outside Africa it has been recorded so far only from the Air Mts in SW Saudi Arabia (Collenette 1999: 41, as *R. abyssinica* Oliver) and from the northern governorates of Yemen (Wood 1997: 199, Khulaidi 2000: 25). In Yemen it is considered as very rare, since only two localities and no recent collections are known (Wood 1997: 199). The occurrence of the taxon in the southern coastal mountains of Yemen, though only 300 km further southeast of the nearest known locality, appears therefore noteworthy. Apart from the small size of the leaves, our sterile material is very similar to the Ethiopian plants (M. Gilbert, pers. comm., 28.10.2002).

ABYAN: Jabal Urays, uppermost Wadi Made ran, from 13°30'18.1"N, 45°57'23.9", 1290 m, down to c. 1000 m, open, mainly evergreen woodland (*Olea*, *Dodonaea*, *Tarchonanthus*, etc.), 18.3.2002, YP1955.

**\*\**Rhus glutinosa* subsp. *neoglutinosa*** (M. Gilbert) M. Gilbert – determination confirmed by Mike Gilbert

This subspecies, which is clearly distinct from subsp. *abyssinica* by its glabrous and strongly glutinose leaves and young twigs, has been considered so far endemic to the Ethiopian highlands (Gilbert 1986a-b, 1989). “Compared with the Ethiopian material, the Yemeni material is distinctly on the small side and slightly atypical because the leaves are not as clearly acuminate as is typical in Ethiopian plants, but this might be a byproduct of the collection’s somewhat depauperate state, as it is otherwise nicely typical” (M. Gilbert, pers. comm., 28.10.2002). Its occurrence in the Kor Seiban, thus far east from its African distribution area, is surprising, since the taxon is not known to occur across the Gulf of Aden in the N Somali Mts (Friis 1992: 205, map 104, Thulin 1999: 260), which continue the Ethiopian highlands eastwards; a similar case is *R. flexicaulis* Baker (see above). This subspecies is only one of a considerable number of woody taxa with an isolated relic occurrence in the Kor Seiban area making it an outstanding refugium of a palaeo-African flora in the southern coastal mountains of Yemen.

HADHRAMOUT: Kor Seiban, summit plateau, W to E running wadi south of the highest point, close to the fall down the escarpment, somewhat E of 14°49'04.8"N, 48°49'03.9"E, c. 1850 m, 22.9.2001, YP360; *ibid.*, wadi running N to S between 14°50'10.2"N and 48°48'44.6"E, c. 2000 m, evergreen woodland relics, 14./15.9.2002, YP3567.

***Rhus natalensis*** Krauss – determination confirmed by Mike Gilbert

Being with *R. flexicaulis* Baker (formerly *R. vulgaris* Meikle, see above) one of the most widespread African *Rhus* species, *R. natalensis* is known also from the western mountains of the Arabian Peninsula (Collenette 1999: 42, Wood 1997: 199, Khulaidi 2000: 25). Our record from the southern coastal mountains is the first for the southern governorates of Yemen and from more than 1000 km east of the hitherto known Arabian localities. *R. natalensis* is also known from the N Somali Mts (Thulin 1999: 260) across the Gulf of Aden and is so another indicator for the close phytogeographical relationship of both mountain chains.

HADHRAMOUT: Kor Seiban, summit plateau, wadi S of the highest point, 14°48'54.0"N, 48°48'22.0"E, 1910 m, evergreen woodland relics, 13.9.2002, YP3503.

**\**Rhus somalensis*** Engl.

This sclerophyllous shrub or small tree is an element of the evergreen scrub and *Juniperus* forest in the N Somali mountains and has been known outside N Somalia only from Dhofar, Oman (Ghazanfar 1992: 19, Thulin 1999: 263). Our record from the upper zone of the *Anogeissus* woodland both in the neighbouring Hawf area and 100 km farther west on Jabal Fartak are the first records of this species from Yemen.

AL-MAHRA: N Fartak Mts, W flank of J. Karmoun, ascent to the disused radio tower at 15°50'19.1"N, 52°00'25.1"E, 650-900 m, 7.10.2001, YP1044; footpath through the vertical escarpment to the summit plateau of Jabal Chatan NE of the permanent spring Ain Ayn, c. 16°38'N, 52°57'E, c. 950-1200 m, small terraces, 23.11.1999, NK6335, PH6725.

***Apocynaceae* (incl. *Asclepiadaceae*)**

***Carissa spinarum*** L. [Syn.: *Carissa edulis* Vahl]

This palaeotropical shrub of the small, mainly S and E African genus (Leeuwenberg & Dilst 2001) has been known so far on the Arabian Peninsula from the SW mountain chain (NW Yemen and SW Saudi Arabia) and from Jabal Samhan in E Dhofar, Oman (Miller & Morris 1988: 32, Ghazanfar 1992: 20). Our records from Al-Mahra are the first for the southern governorates of Yemen (compare Leeuwenberg & Dilst 2001: 41, map 6).

AL MAHRA: Coastal mountains between Al Faydami and Hawf, uppermost plateau of Jabal Chatan N of the village Con, 16°40'N, 53°04'E, 1100-1150 m, 22.11.1999, PH6711.

***Ceropegia bulbosa*** Roxb.

In the wider sense of Bruyns (1988a: 311) and Meve (2002: 70) a widespread species, distributed

from Tanzania, Kenya, Ethiopia and Somalia across the southern Arabian Peninsula to Pakistan, India and Bangladesh. On the Arabian Peninsula it was known so far from two widely disjunct relic occurrences, one in the western mountains, in N Yemen and SW Saudi Arabia, and one in the central south coast, in Dhofar, Oman (Bruyns 1988a: 289, map 1 & 311). The latter subpopulation extends, according to our findings, into the southern governorates of Yemen.

AL-MAHRA: Shahrut, 16°34'17.9"N, 52°47'19.3"E, 580 m, open *Anogeissus* woodland, 23.8.2002, YP2946; below Shahrut, 16°34'15.8"N, 52°48'35.0"E, 380 m, 24.8.2002, YP3008.

*Ceropegia subaphylla* K. Schum. [Syn.: *Ceropegia botrys* K. Schum. (fide Meve & Mangelsdorff 2001), *C. mansouriana* Chaudhary & Lavranos (fide Bruyns 1988a)]

The species, distributed in E Africa and SW Arabia, has been known on the Arabian Peninsula so far from SW Saudi Arabia (Collenette 1999: 56) and NW Yemen (Bruyns 1998a: 304, Wood 1997, Khulaidi 2000: 31). Our record from Hadhramout is the first from the entire southern Yemen.

HADHRAMOUT: Kor Seiban, below the Maula Matar gorge and El Hesi, rocky limestone slope, 1500 m, 30.10.2000, NK6559.

\**Cibirhiza dhofarensis* C. Bruyns

This genus of two species with a remarkable, disjunct distribution in Tanzania and in S Arabia (Bruyns 1988b, Kunze & al. 1994) has been known so far only from Dhofar, Oman, and is here recorded now also from the neighbouring Al-Mahra. We found it both in coastal slopes at medium altitudes of c. 400 m and in the upper zone of the *Anogeissus* woodland, where evergreen species such as *Olea europaea* subsp. *cuspidata*, *Euclea schimperi*, *Sideroxylon mascatense*, *Sageretia thea*, *Rhus somalensis*, but also *Pistacia falcata*, are merged with it.

AL MAHRA: Hawf Mts, slopes N of the village Damqaut, 16°34'N, 52°48'E, 400 m, 12.11.2000, PH8063; Hawf Mts, NW of Jadib, slope with boulders (0.2-1 m diam.), immediately below the escarpment from the summit plateau of Jabal Chatan, 850-900 m, 16°39'N, 52°57'E, *Anogeissus* woodland mixed with evergreen elements, 13.11.2000, NK6816.

*Cryptolepis yemenensis* Venter & R. L. Verh.

Recently described from the governorate of Shabwa (Venter & Verhoeven 1999), the species is actually common on mist-affected mountain flanks also in Hadhramout and Al-Mahra.

HADHRAMOUT: Track from Al Mukalla to Bayn al Jibal, 14°37'N, 49°02'E, 400-500 m, 9.11.1999, PH6199; track out of Wadi Dowan 1 km S of Al Khuraybah to Huwayrah, 15°08'N, 48°21'E, 1100 m, E facing slope in small tributary, 12.11.1999, NK5969, PH6289.

AL-MAHRA: Jabal Sharwayn 10 km W of Qeshn, 15°24'N, 51°35'E, 180 m, 24.9.1998, PH4879a; N Fartak Mts, northeastern flank, rocky slopes SE above Nishtun, 350 m, 16.11.2000, NK6876; S Fartak Mts, mountain ridge along the W coast, 15°38'28.9"N, 52°12'54.3"E, 400-450 m, 10.10.2001, YP1180; Jabal Faydami, 15 km W of Al Fatk, southern flank, 16°30'N, 52°35'E, 350-450 m, 8.11.2000, NK6700, PH7993.

*Echidnopsis globosa* Thulin & Hjertson

This species, which is quite distinctive for its globose corolla with a very small mouth, was described only a few years ago (Thulin & Hjertson 1995) and has been known so far only from two collection made in the Jol plateau of Hadhramout. Our records proof its presence also in Al-Mahra. On the Fartak Mts it is not rare at higher altitudes (700-900 m).

AL-MAHRA: N Fartak Mts, track between Haswayn and Ghaydah, pass, 15°49'N, 51°57'E, 620 m, 24.9.1998, NK5137, PH4912.

*Gomphocarpus fruticosus* subsp. *setosa* (Forssk.) Goyder & Nicholas [*Asclepias setosa* Forssk.]

The subspecies has been known on the Arabian Peninsula from the SW Arabian mountains (Saudi Arabia, Air, NW Yemen), from Hadhramout and from Dhofar, Oman (Goyder & Nicholas 2001: map 1). Our records close the gap in Al-Mahra.

AL-MAHRA: Hawf Mts, NE of Hawf, c. 1 km above junction of the tracks to Kon and to border with Oman, towards Kon, *Anogeissus dhofarica* woodland, 670 m, c. 16°39'N, 53°02'E, 11.11.2000, NK6755, PH8037.

*Periploca somalensis* Browicz [Syn.: *P. brevicoronata* Goyder & Boulos]

This twining vine has been known so far only from the high mountains of N Somalia and the southwestern mountains of the Arabian Peninsula (SW Saudi Arabia and NW Yemen), where it occurs at altitudes above 2000 m and in evergreen woodland (Venter & Verhoeven 1993). The occurrence of this species in evergreen woodland relics on the Kor Seiban in Hadhramout, opposite the N Somali mountains, fits well its general distribution (Venter & Verhoeven 1993: fig. 4). HADHRAMOUT: Kor Seiban, larger wadi S of the highest point and running W-E to the vertical escarpment, c. 14°49'09" N, 48°48'42"E, 1850 m, 15.10.2001, YP1246.

### **Boraginaceae**

*Cordia crenata* Del. subsp. *crenata*

A small tree chiefly distributed in E Africa and so far known on the Arabian Peninsula only from a valley forest at Jabal Burra, NW Yemen, and from Dhofar, Oman (Warfa 1989: 614, fig. 2). Our record from closed *Anogeissus dhofarica* woodland with a canopy of 5-6 m in Al-Mahra is the first for the entire southern Yemen.

AL-MAHRA: Hawf Mts, Uteq, S facing slope with big boulders, 16°38'57.5"N, 52°57'39.2"E, 800 m, 29.9.2001, YP456.

*Cordia monoica* Roxb. [Syn.: *C. ovalis* DC. & A. DC.]

This small tree, widespread in tropical Africa, on the Indian subcontinent and Sri Lanka (Verdcourt 1991: 17), is commonly reported on the Arabian Peninsula from the southwestern mountain chain (SW Saudi Arabia and NW Yemen) and from Dhofar, Oman (Warfa 1988: 33, fig. 5A). An additional isolated occurrence in the western part of the Yemeni south coast in the climatically favoured Jabal Urays, reported by Schwartz (1939: 204 sub *C. ovalis*) on the basis of collections made by Deflers in 1893 and repeated by Khulaidi (2000: 52 sub *C. ovalis*), is confirmed here.

ABYAN: Jabal Urays, Wadi Asurie, southwest facing slope, 13°28'22.9"N, 45°55'02.6"E, 700-820 m, 13.3.2002, YP1537.

*Cordia nevillei* Alston [Syn: *C. perrottettii* sensu Wight]

Basically an element of the Somali-Masai floristic region with a few isolated outposts in the western Indian subcontinent and on Sri Lanka (Warfa 1990: 652, fig. 4), this species has been known on the Arabian Peninsula so far only from southern Oman (Miller & Morris 1988: 73, Warfa 1990: fig. 4) and Hadhramout (Thulin & al. 2001: 142). We add it for Al-Mahra.

AL-MAHRA: Jabal Faydami [also called J. Lusaka], southern flank, ascent from the coastal plain northeastwards to 16°30'12.0"N, 52°35'06.2"E, woodland patch in small valley at 450-550 m, 5.10.2001, YP890.

*Echiochilon longiflorum* Benth.

This annual (to perennial) herb was originally described from the northwestern part of the Aden peninsula (Hooker's Icon. Pl.: ad t. 1277. 1879) and for a long time this was regarded as its only locality on the Arabian Peninsula (Johnston 1957: 271). Otherwise present in Somalia and Ethiopia, the species has recently also been recorded from Dhofar, Oman (Lönn 1999: 212, fig. 13, 226). On the Arabian Peninsula only an annual race seems to be present, informally circumscribed as 'group A plants' (Lönn 1999: 226). To the two distantly situated populations on the south coast of the Arabian Peninsula we add a third one, in Hadhramout, and assume that the species is probably more widespread in the southern governorates. In contrast to previous observations (see, e.g., Johnston 1957 and Lönn 1999) that the plants would not be common where they occur, we observed in both Yemeni populations seen by us, dozens (Aden Peninsula) and hundreds (Hadhramout) of individuals, respectively.

ADEN: Al Kalo'a, 12°47'N, 45°00'E, 50-90 m, rocky slopes (volcanic rocks) with therophyte vegetation between shrubs, 23.3.1997, *NK4507*, *PH3522*.

HADHRAMOUT: Wadi Skoui, 15°15'12.5"N, 50°39'26.0"E, 400-450 m, S exposed rocky slopes (limestone), 16.8.2002, *YP2734*.

### *Capparaceae*

#### *Boscia arabica* Pestalozzi

This conspicuous tree with a characteristically flat-topped crown, which is not rare in the dry deciduous woodlands of southern Arabia, was not recorded so far from eastern Hadhramout and Al-Mahra (Miller & Cope 1996: 371, map 505), although mentioned, without citation of specimens, for the Hawf region by Bilaidi (1989: 8) and Khulaidi (2000: 66).

HADHRAMOUT: N of Ras Sharma, Wadi Bidisch 10 km N of the Al Ghaydah junction, 100 m, 14°59'N, 50°00'E, on rocky and gravelly ground in the wadi, 19.11.2000, *NK6906*, *PH8278*.

AL MAHRA: Ras Fartak, near Nishtun, lower part of the wadi 2 km S of the town, 20-80 m, 15°48'N, 52°11'E, 27.9.1998, *PH5071*; track from Ghaydah to Sarif spring, lower Wadi Hablah, c. 200 m, 16°40'N, 52°E, foot of wadi escarpment, 25.9.1998, *NK5146*, *PH4935*.

#### \**Cadaba baccarinii* Chiov.

This remarkable small tree of Oman and Somalia (Miller & Cope 1996: 379, map 516, Thulin 1993: 50) is here recorded the first time for Yemen; on the coastal mountains of southeastern Yemen it is locally not rare in dry *Acacia-Commiphora* shrubland.

HADHRAMOUT: Lower Wadi Hajar, c. 20 km SE of the village Jauf Bahawa (Masna'a), 14°21'N, 48°24'E, c. 400 m, steep rocky slopes of the narrow gorge, 15.11.1999, *NK6039*, *PH6385*; track from Al Mukalla to Bayn al Jibal, 5 km N of the village Nuweina, 14°37'N, 49°09'E, 500-600 m, 17.11.1999, *NK6064*, *PH6426*; escarpment of the Jol plateau c. 30 km N of Ar Riyan, above the village Abdollah Karib, 14°54'N, 49°03'E, 560 m, 21.3.1996, *PH334*; at Mogged, 14°51'23.8"N, 49°48'30.3"E, c. 100 m, 14.9.2001, *YP41*.

AL-MAHRA: S Fartak Mts, wadi above Kadifut, 15°38'21.4"N, 52°10'24.2"E, 50-80 m, 5.9.2002, *YP3375*.

#### *Maerua angolensis* DC. subsp. *angolensis*

From the Arabian Peninsula known so far only from a few gatherings from the inner plateau of the southwestern Yemeni mountains (Miller & Nyberg 1991, Kers 1993: 50-54, Miller & Cope 1996: 368, map 500). Our records from Hadhramout are the first for the entire southern coastal mountain chain.

HADHRAMOUT: Kor Seiban, Maula Matar gorge, 14°47'38.8"N, 48°46'47.2"E, 1670 m, 16.10.2001, *YP1294*; Kor Seiban, summit plateau, wadi S of the highest point, 14°48'46.8"N, 48°48'10.9"E, 1940 m, 13.9.2002, *YP3500*.

### *Caryophyllaceae*

#### (\*)*Sclerocephalus arabicus* Boiss.

This Saharo-Arabian species, distributed from the Cape Verde Islands and Mauritania to Iraq and Iran, has been reported on the Arabian Peninsula by Miller & Cope (1996: 187, map 223) from Saudi Arabia, Kuwait, UAE, Qatar, Bahrein and Oman but not from Yemen, and is also not given by Wood (1997). A collection from the northwestern governorate of Saada was, however, reported already by Podlech (1982: 406) and is mentioned by Khulaidi (2000: 70). Our collections from near southern edge of the Rub-al-Khali confirm its occurrence in Yemen and are the first records from the south central Arabian Peninsula.

HADHRAMOUT: Road from Tarim to Thamud, Wadi Wahshah, 16°21'28.5"N, 49°32'27.7"E, 770 m, wide sandy wadi bed, 19.9.2002, *YP2803*; road from Tarim to Thamud, 16°38'08.0"N, 49°29'11.2"E, 1000 m, sandy wadi, 19.9.2002, *YP2835*.

**Celastraceae***\*Maytenus dhofarensis* Sebsebe

Originally described from Dhofar, where it is an important constituent of the scrub of the upper montane zone (Miller & Morris 1988), the species is also widespread in neighbouring Al-Mahra, from where it has been mentioned without quotation of specimens previously by Khulaidi (2000: 72).

AL-MAHRA: Fartak Mts, summit plateau with the disused radio tower, c. 15°50'N, 52°00'E, 550-950 m, near summit ridge, 26.11.1999, *NK6376*, *PH6515*; coastal mountains NW of Damqaut, 16°34'N, 52°48'E, *Acacia-Commiphora-Blepharispermum* woodland, 400-450 m, coast facing slope, limestone, 12.11.2000, *NK6780*, *PH8065*; Hawf Mts, slopes immediately below the rock face of the summit escarpment and base of the rock face, above the locality called Uteq [at 16°38'57.5"N, 52°57'39.2"E], c. 900 m, 1.10.2001, *YP629*.

**Cistaceae***\*Helianthemum citrinum* Ghaz.

Recently described from Dhofar, Oman (Ghazanfar 2002: 69), this endemic of the south central coast of the Arabian Peninsula is also present in Al-Mahra.

AL-MAHRA: Fartak Mts, W facing slopes of the summit plateau with the disused radio tower, c. 15°50'N, 52°00'E, 550-950 m, 26.11.1999, *NK6382*, *PH6882*.

**Compositae***Acanthospermum hispidum* DC.

An introduction from America and now spreading on the Arabian Peninsula. First mentioned for northern Yemen by Wood (1997: 296) and for Oman by Ghazanfar (1992: 41). The species is a locally common weed also in the seasonally humid *Anogeissus* woodland in Al-Mahra and spread by the browsing livestock.

AL-MAHRA: Hawf Mts, plain c. 3 km W of the permanent spring Ain Ayn towards the village Ghab, secondary grassland (*Apluda mutica*) with *Dodonaea* shrubs, c. 500 m, 2.10.2001, *YP735*.

*\*Centaurea dhofarica* Baker

Hitherto known from few collections in Dhofar (Schwartz: 1939: 194, Wagenitz 1984: 461, Miller & Morris 1988: 336, Ghazanfar 1992: 43), this distinct species was found in clearings of *Anogeissus* woodland in Al-Mahra.

AL MAHRA: Coastal mountains between Al Faydami and Hawf, plateau and slopes with dense *Anogeissus* woodland, 16°39'N, 53°02'E, 250-500 m, 22.11.1999, *NK6261*, *PH6682a*.

*Kleinia odora* (Forssk.) DC.

A widespread species known from most regions of Yemen and also from Dhofar (Schwartz 1939: 289, Halliday 1984, Miller & Morris 1988: 336, Ghazanfar 1992: 45), but not yet recorded from Al-Mahra.

AL-MAHRA: N Fartak Mts, wadi at 15°47'N, 52°E, 270 m, 24.9.1998, *NK5101*; Jabal Shubeid [Shubut, Shabit], 16°50'N, 51°50'E, c. 1000 m, only c. 50 m overtopping the plateau, upper edge of the escarpment, 25.9.1998, *NK5154*; Hawf Mts, bottom and lower slopes of steep gorge almost parallel to the S-SE facing summit escarpment, between c. 52°39'E and 16°39'14.3"N, 52°57'27"E, 1150-1250 m, 28.9.2001, *YP454*.

*Kleinia pendula* (Forssk.) DC.

Known so far from southwestern Yemen (Schwartz 1939: 289, Halliday 1984, Khulaidi 2000: 43) only. Erroneously reported for Dhofar, Oman, by Miller & Morris (1988: 336) and Ghazanfar (1992: 45) due to misidentification of a collection by R. Fiennes, actually referable to *K. saginata* (pers. comm. S. Ghazanfar, September 2002).

AL-MAHRA: Jabal Sharwayn, pass between Qishn and Itab, monsoon affected rocky ridge 550-650 m, 15°22'N, 51°36'E, 28.9.1998, *NK5257*, *PH4880a*; Jabal Fartak, SW-facing slopes of

the mountain with the disused radio tower, 15°50'N, 52°00'E, 550-950 m, *Euphorbia balsamifera* scrub, 26.11.1999, PH6872.

\**Kleinia saginata* P. Halliday

Originally described from Dhofar and since regarded as endemic to Oman (Halliday 1984, 1988, 1989, Miller & Morris 1988: 336, Ghazanfar 1992: 45). Our record from the neighbouring Al-Mahra is the first from Yemen.

AL-MAHRA: Hawf Mts, upper escarpment to Jabal Chatan, N of the village Con, 16°40'N, 53°04'E, 1000-1100 m, vertical rocks and ledges, 22.11.1999, PH6699 [orange flowered form].

\*\**Kleinia squarrosa* Cufod.

Hitherto thought to be confined to NE tropical Africa, this species is here reported for the first time from the Arabian Peninsula, where it has a scattered distribution in the succulent-rich dwarf scrubs (mostly *Euphorbia balsamifera* scrub) of the coastal mountains of Hadhramout and Al-Mahra. Collections of this species were made in Al-Mahra in the 1990s independently also by Adul Nasser Al-Gifri, Tony Miller and Mats Thulin. The identity of this uniformly violet flowered species with *K. squarrosa* was first established by Mats Thulin (pers. comm. 13.12.2000). A conspicuous feature of this species is that on drying the branches leave oily marks on the paper of the plant press, which is never the case with *K. odora*, the only species on the Arabian Peninsula habitually somewhat similar.

HADHRAMOUT: Jol Berka plateau, rocky plateau with small shrubs and rich succulent vegetation, 1250 m, 14°35'N, 48°40'E, 30.11.1999, NK6481, PH6983; Jol, plateau of a table mountain and on its slopes, c. 15°06'N, 49°24'E, 1350-1450 m, 17.9.2001, YP123.

AL-MAHRA: Fartak Mts, track between Haswayn and Ghaydah, pass, 620 m, 15°49'N, 51°57'E, rocky slopes, 24.9.1998, NK5135; S Fartak Mts, at c. 15°38'28"N, 52°12'54.3"E, 350-450 m, 10.10.2001, YP1191.

*Launaea castanosperma* F. G. Davies

This endemic of the central southern coast of the Arabian Peninsula was hitherto known from Dhofar and from Al-Mahra as far west as the Fartak Mts (Kilian 1997: 309). The finding of populations in western Al-Mahra and eastern Hadhramout, see below, appeared not unusual. The most recent discovery of plants of this conspicuous species immediately at roadsides of the main road from Mukalla to Wadi Hadhramout, just at the seaside edge of the Jol plateau, in contrast, is very surprising. This is not only one of the best collected areas in Hadhramout, but we had passed there regularly in previous years without noticing the species. The Mukalla-Sayun road is, however, the most important road in all Hadhramout, and the assumption that the species had been overlooked there appears much less likely to us than the assumption that its observed occurrence there results from a rather recent anthropogenic dispersal event.

HADHRAMOUT: Upper Wadi Skoui, 15°15'12.5"N, 50°39'26.0"E, 400-450 m, S exposed rocky slopes, 16.8.2002, YP2737; road from Mukalla to Sayun, ascent on the Jol, roadsides, 14°51'14.4"N, 49°08'18.3"E, 880 m, 14.10.2001, YP1207.

AL-MAHRA: Jabal Sharwayn, 10 km W of Qishn, NW facing rocky slopes, 15°24'N, 51°29'E, 120-250 m, 28.9.1998, NK5244, PH5121.

*Launaea hafunensis* Chiov.

This tropical E African-S Arabian species has been known from very few Arabian collections, from Hadhramout and from Dhofar only (Kilian 1997: 147). The species is, however, not actually rare in the coastal limestone mountains but of scattered distribution. For its small edible tuber the plant is collected by the local people in Hadhramout, Al-Mahra and Dhofar (for the latter region see also Miller & Morris 1988: 294, colour plate on 295 sub "*Crepis* sp.", actually referring to *L. hafunensis*). We add a first record for Al-Mahra.

AL-MAHRA: Jabal Fartak between Haswayn and Al Ghaida, SW-facing slopes of the mountain and plateau with the radio station, 15°50'N, 52°00'E, 550-950 m, 26.11.1999, NK6366, PH6824.

**\*\**Parthenium hysterophorus* L.**

This native of the Caribbean is an aggressive colonizer of fallows, roadsides, wasteland and overgrazed pastures and a noxious weed today introduced to many subtropical and tropical countries in Africa, Asia, Australia and the Pacific islands, being a major weed in India and Australia (Parson & Cuthbertson 2001: 292-296). Livestock usually avoids the plant, if not, then the meat becomes badly tainted and unfit for the table. Regular long term skin contact with the plant produces acute dermatitis and asthma in humans (Parson & Cuthbertson 2001: 292-296). In the Middle East the species has been reported so far from Palaestina and Israel (Heller & Heyn 1993) but not from the Arabian Peninsula. We collected the species for the first time in 1998 in Dhofar, Oman, and most recently we traced the first plants across the border in Al-Mahra, Yemen, most likely introduced from Dhofar through the new road between both countries.

AL-MAHRA: 0.3 km W of Jadib, on track to Damqaut, roadsides, 25.8.2002, *YP3044*.

OMAN: DHOFAR: Jabal Qara, along track between Raysut and Qaftwawt, open *Anogeissus-Commiphora* woodland, 750 m, 17°03'N, 53°54'E, 3.10.1998, *NK5331, PH5229*.

**\**Pulicaria nobilis* Gamal-Eldin**

Described as endemic to the coastal mountains of Dhofar, Oman (Gamal-Eldin 1981, 1984: 470), this beautiful subshrub could be found recently also in southeastern Yemen.

AL-MAHRA: Jabal Fartak between Haswayn and Nishtun, near the highest point of the track, rocky ridges affected by monsoonal mist, 15°49'N, 51°57'E, 600-800 m, 19.11.1999, *NK6154, PH6534*.

***Sclerocarpus africanus* Jacq.**

This widespread palaeotropical, often weedy perennial was known so far from western Yemen (Schwartz 1939, Wood 1997: 297) and Dhofar (Miller & Morris 1988: 336, Ghazanfar 1992: 49) and is here recorded also for Al-Mahra, where it occurs in the *Anogeissus* woodland.

AL-MAHRA: Hawf Mts, slopes below the summit escarpment and above the locality called Uteq [16°38'57.5"N, 52°57'39.2"E, at 820 m], 850 m, 30.9.2001, *YP575*.

***Convolvulaceae***

**\**Ipomoea turbinata* Lag. [Syn.: *I. muricata* (L.) Jacq. (1803), nom. illeg., non Cav. 1799]**

Originating from Central America this climber has been widely naturalised in the tropical regions of the Old World (Verdcourt 1963: 1301, Wiersema & León 1999). On the Arabian Peninsula the species has been known only from Dhofar (Miller & Morris 1988: 114, Ghazanfar 1992: 54). Our record from a disturbed site in the *Anogeissus-Commiphora* woodland in Al-Mahra is ecologically very similar to its habitats in the neighbouring Dhofar. *I. turbinata* differs by its fleshy awns of the sepals, hard, laterally flattened expansions on the stem and the conspicuous violet flowers opening at night and early morning from the day flowering *I. nil* and *I. cairica*, which grow sympatric with *I. turbinata* in Al-Mahra, and the otherwise similar *I. alba*.

AL-MAHRA: Coastal mountains, below Shah'rut, 16°34'15.8"N, 52°48'35.0"E, 380 m, 24.8.2002, *YP3019*.

***Cyclocheilaceae***

***Cyclocheilon somalense* Oliver**

This is the second report of this genus and species from Yemen after Thulin & al. (2001: 145, see also Khulaidi 2002: 86), who recorded it from Hadhramout, and it is the first from Al-Mahra.

AL-MAHRA: Fartak Mts, W facing slopes of the summit plateau with the disused radio tower, c. 15°50'N, 52°00'E, 550-950 m, 26.11.1999, *NK6410a*

***Euphorbiaceae***

**\**Euphorbia orbiculifolia* S. Carter**

Hitherto, this attractive, white-flowered, small woody perennial has been considered an endemic of Dhofar, Oman (Ghazanfar 1992: 62, Govaerts & al. 2000: 793), with the easternmost locality known to us at Ras Nuss (17°14'N, 55°13'E, *NK5518*). It is here recorded for the first time for



Yemen. In both Dhofar and Al-Mahra the species seems largely confined to open, coast-near slopes below c. 700 m and grows chiefly on rocks (boulders, rock faces, rocky slopes).

AL-MAHRA: Damqaut Al-Fatk track, hills forming the eastern delimitation of the coastal flat few km W of Damqaut, 16°33'17.0"N, 52°48'20.0"E, 100-150 m, 4.10.2001, YP823; 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, 26.9.1998, NK5203.

### Gentianaceae

*Enicostema axillare* (Lam.) A. Raynal [Syn.: *E. litorale* Blume, *E. verticillare* (Retz.) Baill.]

This palaeotropical species (Raynald 1969) is known on the Arabian Peninsula from the south-western mountain chains (SW Saudi Arabia and W Yemen, Schwartz 1939: 185, Collenette 1999: 331, Wood 1997, Khulaidi 2000: 14) and from Dhofar, Oman (Miller & Morris 1988: 337, Ghazanfar 1992: 76). The species is here reported for the first time from SE Yemen.

HADHRAMOUT: El Hami, environment of the ruins of Old Hami, situated 1-2 km NW of the present town, 14°49'40"N, 49°50'02"E, 20-50 m, 12.9.2001, YP3.

### Globulariaceae

\*\**Poskea socotrana* (Balf. f.) Taylor [Syn.: *Cockburnia socotrana* Balf. f.]

*Poskea* is distributed with three species in Somalia, of which one, *P. socotrana* is also present on Socotra (Taylor 1933, Morucchio 1970: 628). Our finding of *P. socotrana* in a deep wadi of the Fartak Mts in Al-Mahra is the first record of this genus from the Arabian Peninsula.

AL-MAHRA: N Fartak Mts, S of Nishtun, 15°46'N, 52°09'E, 500 m, in the upper narrow part of a N-S-stretching wadi, on gravelly and rocky ground, 16.11.2000, NK6853, PH8261.

### Labiatae

*Leucas urticifolia* (Vahl) R. Br. var. *urticifolia*

This annual is largely confined to the Sudanian subregion of the Sudano-Zambesian floristic region, distributed from Mauritania to the Horn of Africa and Socotra and on the Arabian Peninsula from SW Saudi Arabia, NW Yemen and S Oman (Sebald 1980: 135, Ghazanfar 1992: 79, Collenette 1999: 450). For the Yemen flora the species is recorded from the western highlands (Sebald 1980: 133-134, Khulaidi 2000: 120). We add first records for southern Yemen, from Abyan and Al-Mahra, where the species is not rare.

ABYAN: Jabal Urays, middle Wadi Asurie, *Sterculia africana* zone, 13°28'N, 45°55'E, 550-650 m, 17.3.2002, YP1787.

AL-MAHRA: Southern Fartak Mts, above Kadifut, W exposed *Anogeissus dhofarica* woodland patch, 15°39'06.8"N, 52°12'05.7"E, 780 m, 10.10.2001, YP1146; 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, 26.9.1998, NK5205.

*Otostegia fruticosa* subsp. *schimperi* (Benth.) Sebald [Syn.: *Otostegia arabica* Jaub. & Spach]

*Otostegia fruticosa* is an eastern Sudanian species known from numerous localities in Africa, on Sinai and from the SW Arabian mountains in Saudi Arabia and Yemen (Schwartz 1939: 225, Wickens 1976: map 156, Collenette 1999: 456). Subsp. *schimperi* is restricted to the eastern part of the species' distribution area, occurring in the mountains on both sides of the Red Sea, northwards to Sinai, and in southern Yemen; only few records, however, are known from the south-eastern part of its distribution area (Sebald 1973: 20, fig. 17, Wickens 1976: map 156). Sebald (1973: 68) gives subsp. *schimperi* for Abyan and Hadhramout, but there are no records from Dhofar (Miller & Morris 1988, Ghazanfar 1992). Our collections from Al-Mahra indicate therefore the easternmost occurrence of subsp. *schimperi* known.

AL-MAHRA: N Fartak Mts, wadi SW of Nishtun, 15°48'N, 52°10'E 100-160 m, 20.11.1999, NK6169; S Fartak Mts, above Kadifut, W exposed *Anogeissus dhofarica* woodland patch, 15°39'06.8"N, 52°12'05.7"E, 780 m, 10.10.2001, YP1139.

*Stachys yemenensis* Hedge

Belonging to *Stachys* sect. *Ambleia*, which is distributed in Central Asia, SW Asia and E Africa,

the species is known from numerous collections in the former Yemen Arab Republic (Hedge 1982: 71). We record it here for the first time from the southern governorates of the Republic of Yemen. HADHRAMOUT: Maula Matar gorge, between boulders and on the foot of cliffs of the mountain to the west above the N part of the gorge, 14°48'06.4"N, 48°46'25.4"E, 1900 m, 21.9.2001, YP297.

### **Leguminosae**

*Dichrostachys cinerea* (L.) Wight & Arn.

In the Arabian Peninsula this tropical African and tropical Asian shrub or small tree is not rare in the western mountains (SW Saudi Arabia and NW Yemen, Wood 1997), but has only once been recorded from farther east, from Dhofar, Oman (see Ghazanfar 1992: 89), a record not considered by Lock & Simpson (1991). Our records from the *Anogeissus dhofarica* woodland in Al-Mahra, where the species is very rare, confirms its relic occurrence in the south central coastal mountains of the Arabian Peninsula.

AL MAHRA: Track from Hawf towards NE up to the first plateau, 16°39'N, 53°03'E, first plateau, c. 450 m, 22.11.1999, NK6254, PH6673.

### **Loganiaceae**

\**Mitreola petiolata* (J. F. Gmel.) Torr. & Gray [Syn.: *Cynoctomum mitreola* (L.) Britton]

On the Arabian Peninsula hitherto known only from Dhofar, Oman (Miller & Morris 1988: 338, Ghazanfar 1992: 82). Our record from *Anogeissus* woodland in Al-Mahra is the first of the genus from Yemen.

AL-MAHRA: Hawf Mts, environment of the locality called Shah'rut [i.e. 16°33'55.4"N, 52°46'27.1"E], 650-700 m, 2.10.2001, YP749.

### **Malvaceae**

(\*)*Gossypium stocksii* Masters

Based on a sight report in E Al-Mahra in November 1998, the species has been reported as new for Yemen by Thulin & al. (2001: 148). Its occurrence in Yemen is here confirmed and substantiated by specimens collected between September 1998 and October 2001. *G. stocksii*, which was before only known from S Pakistan, S Oman and N Somalia (Schwartz 1939, Vollesen 1987, Miller & Morris 1988, Thulin 1999) and which is closely related to *G. incanum* and *G. areysianum* from S Yemen and *G. somalense* from N Somalia (Saunders 1961, Vollesen 1987), extends in Al-Mahra even as far W as the Fartak Mts, where it grows sympatric with the easternmost populations of *G. incanum* (YP1124). Although artificial fertile hybrids between both species have been achieved in cultivation (Saunders 1961), no hybrids or introgressive forms were found at this locality.

AL MAHRA: 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, 26.9.1998, NK5200; N Fartak Mts, dissected table-land W below Jabal Karmoun with the disused radio tower, 15°49'39.2"N, 51°58'14.4"E, 600-650 m, 6.10.2001, YP911.

### **Menispermaceae**

*Tinospora bakis* (A. Rich.) Miers

This woody climber, distributed in the Horn of Africa region, in tropical E Africa and the Sudanian zone westwards to Mauritania (Thulin 1993: 28), was recorded only once with certainty from the Arabian Peninsula (Miller & Cope 1996: 322): Collette (1999: 563) presents photographs of a flowering and fruiting plant from SW Saudi Arabia, and a sterile plant was collected in the NW Yemen (Wood 1997: 66), which may also represent *Tinospora bakis*. Recently we found several, also sterile, *Tinospora* plants 1000 km further east, in Al-Mahra, which match well the consulted descriptions and illustrations of *T. bakis* (Troupin 1956: 18, 1962: 195, Thulin 1993: 27, fig. 14h, Miller & Cope 1996: 321, fig. 60A, Collette 1999: 563). *T. bakis* is known from rather diverse habitats, in Africa from "deciduous bushland and semi-desert scrub" (Troupin 1956: 18), from sand dunes (Thulin 1993: 28), in the Arabian Peninsula from sandy wa-

dis (Miller & Cope 1996) and from a “shallow tree lined wadi in volcanic ash” (Collenette 1999: 563). In Al-Mahra the plants grow in deciduous monsoon woodland with, e.g. *Anogeissus dhofarica*, *Acacia senegal*, *Commiphora gileadensis*, *C. kua*, *Blepharispermum hirtum*, *Lansea triphylla*, *Maytenus dhofarensis*, which is rather open due to lopping and browsing.

AL-MAHRA: Below Shahrut NW of Damqaut, 16°34'24.6"N, 52°48'33.9"E, 380 m, 23.8.2002, YP2976; *ibid.*, 16°34'37.6"N, 52°48'22.8"E, 520 m, 24.8.2002, YP2985.

### **Oleaceae**

*Olea europaea* subsp. *cuspidata* (Wall ex G. Don) Cif. [Syn.: *Olea europaea* subsp. *africana* (Mill.) P. S. Green, *O. chrysophylla* Lam.]

The African olive forms in the western escarpments of the SW Arabian mountains (Collenette 1999, Wood 1997, Khulaidi 2000, Green 2002) an evergreen woodland zone below and partly merged with the *Juniperus excelsa* woodlands (König 1987), as in E Africa. A phytogeographically somewhat different type of evergreen woodland with *Olea* is present in N Oman in the Jabal Akhdar massif. In the mountains along the south coast of the Arabian Peninsula fragments of a contracted evergreen zone with *Olea* are present in refugia in the western half with strong affinity to the corresponding woodland types of the N Somali mountains across the Gulf of Aden. In the monsoon-affected region of the south central coast an evergreen woodland zone is not developed, evergreen elements, in contrast, are merged into the upper zone of the *Anogeissus* or *Acacia-Commiphora* woodlands. Hitherto, the African olive has been reported for southern Yemen from Hadhramout (Schwartz 1939: 182, based on *Hirsch* 27, s.loc.; Green & Wickens 1989: 290, fig. 2), was mentioned by Bilaidi (1989) for the Hawf Mts and by Thulin & al. (2001: 140) for the Fartak Mts, Al-Mahra. We confirm and substantiate, respectively, the reports for Hadhramout and Al-Mahra and record it the first time from the southwestern governorates.

ABYAN: Jabal Urays, southwest slopes, below the rock faced closing Wadi Asurie, 820-900 m, 13.3.2002, YP1584.

HADHRAMOUT: Kor Seiban, summit plateau immediately below the highest point, 14°49'41.1"N, 48°48'41.2"E, 2000-2050 m, 22.9.2001, YP313.

AL-MAHRA: Jabal Fartak, SW-facing slopes of the mountain with the disused radio tower, 15°50'N, 52°00'E, 650-950 m, semi-evergreen *Anogeissus* woodland patches, 26.11.1999, NK6414, PH6921; Hawf Mts, steep slopes just below the upper escarpment of Jabal Chatan, 16°38'N, 52°57'E, 950 m, 23.11.1999, NK6327, PH6722.

### **Oxalidaceae**

*Oxalis radicata* A. Rich.

Members of the genus *Oxalis* have not been reported from coastal south central Arabia (cf. Miller & Morris 1988: 339, Ghazanfar 1992: 94), whereas one or two species, depending on the species concept, are found elsewhere on the Arabian Peninsula: the cosmopolitan, weedy *O. corniculata* L. has been reported as the single, widespread species in Saudi Arabia (Collenette 1992: 591) and N Oman (Ghazanfar 1992: 94). Wood (1997: 205), gives for N Yemen besides *O. corniculata* also *O. radicata*, which is, according to Kabuye (1971), apparently a Sudano-Zambesian species extending towards India, usually confused with *O. corniculata* but distinguishable by the lack of stipules and by rooting at the nodes. Our records from Al-Mahra match *O. radicata* and are the first of *Oxalis* from southern Yemen.

AL-MAHRA: Hawf Mts, near the village Kon, 16°39'N, 53°02'E, 700-900 m, *Anogeissus* woodland grading into *Acacia* woodland, 22.11.1999, NK6282.

### **Portulacaceae**

*Talinum portulacifolium* (Forssk.) Asch. ex Schweinf.

On the Arabian Peninsula the species was known so far from the W Arabian mountains and Dhofar, and is also recorded from Socotra (Miller & Cope 1996: 170, map 205). This is the first record for SE Yemen.

AL MAHRA: Track from Ghaydah to Hawf, *Jatropha-Commiphora* monsoon woodland, 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, 26.9.1998, NK5192.

### **Primulaceae**

*Samolus valerandii* L.

Reported from the northern governorates by Wood (1997: 132) and Khulaidi (2000: 170), from Hadhramout by Schwartz (1939: 180) and from Dhofar by Ghazanfar (1992: 98) and Miller & Morris (1996: 339). This first record for Al-Mahra is from the only permanent brook in the Hawf area, where also *Lemna perpusilla* and *Potamogeton nodosus* are present.

AL-MAHRA: Hawf Mts, Ain Ayn, open, browsed and grazed *Anogeissus* woodland with *Apluda mutica*, close to the permanent spring, 16°38'14.2"N, 52°56'36.1"E, c. 500 m, 2.10.2001, YP732.

### **Ranunculaceae**

*Clematis hirsuta* Guillemain & Perr.

The widespread Afrotropical species is on the Arabian Peninsula hitherto known only from the western highlands of Yemen (Miller & Cope 1996: 380, map 415, Khulaidi 2000). This first record for Abyan extends its known distribution a little farther southeast. We found several luxurious plants in flower, the stems scrambling on trees and reaching 3-5 m length.

ABYAN: Jabal Urays, W facing slope into the wadi, below rock face, 13°28'23.7"N, 45°55'19.9"E, 860-890 m, 19.3.2002, YP1987.

### **Resedaceae**

*Caylusea hexagyna* (Forssk.) M. L. Green [Syn.: *C. canescens* (L.) A. St. Hil.]

Miller & Cope (1996: 448, map 630) report this chiefly Saharo-Arabian species, which is successful as a weed of cultivations and as a ruderal, for the north of the Arabian Peninsula, the W Arabian mountains, and also for Socotra. Our record from Hadhramout is the first from the entire SE Yemen.

HADHRAMOUT: Jol plateau, on the pipeline rd. from Wadi Araf to Tawila fields, immediately S of the highest point and watershed, 15°09'53.8"N, 49°22'37.1"E, 1620 m, 18.9.2001, YP211.

*Ochradenus arabicus* Chaudhary, Hillc. & A. G. Mill.

A conspicuous shrub with inflated, yellow, papery fruits endemic to and widespread on the Arabian Peninsula (Miller & Cope 1996: 453, map 632). From Yemen so far recorded only from Hadhramout. We add the species for Al-Mahra.

AL-MAHRA: Fartak Mts, road from Hashwein to Al-Ghaida, wadi S of the pass crossing road, 15°48'17.8"N, 51°58'46.5"E, 320 m, 8.10.2001, YP1116.

### **Rhamnaceae**

*Helinus integrifolius* (Lam.) Kuntze [Syn.: *H. arabicus* Jaub. & Spach]

A small genus of five species, all being woody climbers, distributed from S Africa to India. Only *H. integrifolius* from E and S Africa (Thulin 1999: 150) is present in the Arabian Peninsula. The three Arabian records known are all from mountains with high precipitation in the northern governorate of Taiz (Schwartz 1939: 153, Wood 1997: 192, Khulaidi 2000: 172). Its occurrence in the hinterland of Mukalla, c. 500 km eastwards from its hitherto known occurrence, on the lower sea-facing Jol escarpment in a small woodland patch favoured by mist precipitation together with other relics such as *Pappea capensis*, is therefore significant. A very similar distribution pattern shows *Maerua angolensis* DC. subsp. *angolensis*, outside Africa only known from the Taiz and the Kor Seiban areas, see above.

HADHRAMOUT: Old track from Mukalla to Bayn al Jibal, 14°37'N, 49°02'E, 550 m, foot of rock face, 11.9.2002, YP3444.

*Sageretia thea* (Osbeck) C. M. Johnston

The evergreen, spiny shrub is the only species of this predominantly Asian genus reaching the

Arabian Peninsula and E Africa, where it occurs in the higher, predominantly sclerophyllous escarpment woodlands (Wood 1997: 192, Thulin 1999: 152, Friis 1992: 39, König 1987: 52). In the Arabian Peninsula it is known from the Jabal Akhdar range in N Oman above 1800 m (Ghazanfar 1992: 100, sub *S. spiciflora* (A. Rich.) Hutch. & Druce) and from the W Arabian mountains in Yemen and Saudi Arabia above 1000 m (Wood 1997, Collenette 1999: 643); the easternmost Yemeni records are from Jabal Urays (at c. 46°E) in Abyan (Schwartz 1939: 152 sub *Berchemia yemensis* Deflers, confirmed by our collection YP1959). Our records cited below are the first for the entire central southern mountains, since the species is also not reported from Dhofar. The single population in Al-Mahra known to us grows at the shaded bottom of a steep, narrow, monsoon exposed gorge, where, emphasizing the oddity of this site, a similar isolated and relic population of *Galium spurium* subsp. *africanum* Verdc. (see next entry) exists in its immediate neighbourhood. The other occurrence, so far a single individual only, in a wadi on the highest mountain of Hadhramout is among fragments of evergreen montane woodland with *Ceratonia oreothauma* subsp. *oreothauma*, *Sideroxylon mascatense*, *Olea europaea* subsp. *cuspidata*, *Bauhinia ellenbeckii*, *Tarchonanthus camphoratus*, *Periploca somalensis*, etc.

HADHRAMOUT: Kor Seiban, summit plateau, wadi running N to S between 14°50'10.2"N and 48°48'44.6"E, c. 2000 m, upper part of the wadi, 14./15.9.2002, YP3554.

AL-MAHRA: Hawf Mts, Uteq, S facing slopes with big boulders, below the vertical rock face of the summit escarpment, 16°38'57"N, 52°57'39"E, 1000-1100 m, 29.9.2001, YP501; *ibid.*, 30.9.2001, YP563.

### **Rubiaceae**

*Galium spurium* subsp. *africanum* Verdc. [Syn.: *Galium aparinoides* Forssk. p.p. sensu Schwartz, *Galium aparine* var. *hamatum* (Hochst.) Hook. f. p.p. sensu Schwartz]

Apart from Africa, where it is widespread (Puff 1978: 271), the species is known only from the western mountains of the Arabian Peninsula, in Yemen (Wood 1997: 282, Schwartz 1939: 263-264) and Saudi Arabia (Chaudhary 2000: 72). Found in Al-Mahra only in one wooded, damp gorge (with *Sideroxylon mascatense* and *Sageretia thea*), this population, some 1000 km east from these other known localities, represents the isolated, easternmost outpost of this taxon.

AL-MAHRA: Hawf Mts, Uteq, S facing slopes with big boulders, below the vertical rock face of the summit escarpment, 16°38'57"N, 52°57'39"E, 1000-1100 m, 29.9.2001, YP493; *ibid.*, 30.9.2001, YP583.

*Pyrostria phyllanthoidea* (Baill.) Bridson [Syn.: *Canthium phyllanthoideum* Baillon, *Rytigynia phyllantoidea* (Baill.) Bullock, *Plectronia bogosensis* Martelli, *Canthium bogosense* (Martelli) Penzig]

The evergreen shrub with unisexual flowers and conspicuous bilobed drupes is reported from Somalia, Ethiopia, Kenya and Tanzania (Verdcourt & Bridson 1991: 891) as well as from the Asir Mts in SW Saudi Arabia (Collenette 1999: 660) and the western escarpment of NW Yemen (Wood 1997: 280, Khulaidi 2000: 174). Since the species is so far not known from Oman (Ghazanfar 1992: 102), our collections from the upper, semi-evergreen *Anogeissus dhofarica* woodland zone in Al-Mahra represent its easternmost occurrence, some 1000 km distant from the populations in the western mountains. The collections from the moist woodland in the Hawf Mts have leaves up to 40 × 8 mm; in the upper zone of the *Anogeissus* woodland some evergreen or sclerophyllous trees and shrubs are mixed into the otherwise deciduous monsoon woodland, such as *Euclea schimperi*, *Hybanthus durus*, *Sideroxylon mascatense*, *Olea europaea* subsp. *cuspidata*, *Sageretia thea*, *Cadia purpurea*, etc. Most of these species are also present in the *Anogeissus* woodland patches in the Fartak Mts, but under the comparatively harsh climatic conditions there, they are commonly extremely small-leaved (to 0.8 × 0.2 cm); flowers and fruits are very rare and were found by us only during the monsoon season. Wood (1997: 280) mentions for NW Yemen a flowering period of only about a week.

AL-MAHRA: N Fartak Mts, 15°50'N, 52°00'E, 650-950 m, SW facing slopes, semi-evergreen *Anogeissus* woodland patches, 26.11.1999, *PH6922*; Hawf Mts, NW of Jadib, 16°39'N, 52°57'E, 800-900 m, slope with boulders immediately below the escarpment from the summit plateau of Jabal Chatan, semi-evergreen *Anogeissus* woodland, 13.11.2000, *NK6806*; Hawf Mts, slopes above Uteq [at 16°38'57.5"N, 52°57'39.2"E], 860-900 m, 1.10.2001, *YP680*.

### *Santalaceae*

\**Osyris* sp. A. sensu Miller & Cope (1996: 119)

Miller (in Miller & Cope 1996: 119) provides a short description of this unpublished species based on the only two incomplete (only one female flower) collections known, from Dhofar close to the Yemeni border. The species is distinct from the only other *Osyris* species on the Arabian Peninsula by being a small shrub with smaller leaves and a densely puberulous indumentum. We found a fruiting individual of this species on the summit plateau of Jabal Chatam not far from the border with Oman.

AL-MAHRA: Hawf Mts, summit plateau of Jabal Chatan, 16°40'00.6"N, 52°58'04.0"E, 1370-1425 m, 28.9.2001, *YP455*.

### *Sapindaceae*

(\*)*Pappea capensis* Eckl. & Zeyh.

Described from S Africa, the monospecific genus is widely distributed across the south and east of Africa and is characterized, in the Horn of Africa region, by Friis (1992: 195) as an element of the (semi)deciduous to evergreen montane woodland. Not earlier than in the 1980ies the presence of this evergreen, up to 10 m tall tree was detected in Dhofar, Oman (Miller & Morris 1988: 258, Ghazanfar 1992: 103). Friis & Vollesen (in Thulin 1999: 235) reported it also for Yemen but without locality, Thulin & al. (2001: 150) recorded two sterile trees from Hadhramout. Dozens of individuals, among them also fruiting ones, were discovered by us in *Bauhinia-Tarchonanthus* woodland relics on the Kor Seiban.

HADHRAMOUT: Kor Seiban, bed of the wadi (running N to S) immediately W of the highest point, 14°49'37.2"N, 48°48'21.3"E, 1850-1900 m, 22.9.2001, *YP326*; track from Al Mukalla to Bayn al Jibal, 14°36'N, 49°06'E, fog-affected cliffs, 550-600 m, 9.11.1999, *PH6196a*.

### *Sapotaceae*

*Sideroxylon mascatense* (A. DC.) Penn. [Syn.: (fide Pennigton 1991, Govaerts & al. 2001): *Monothea buxifolia* (Falc.) A. DC. [Syn.: *Monothea mascatensis* A. DC., *Reptonia mascatensis* (A. DC.) Schwartz]

The evergreen shrub or small tree has a main distribution in the Hindukush and few, disjunct occurrences in the Arabian Peninsula, Djibouti, Ethiopia and N Somalia (Kürschner 1986: 556, fig. 11, Friis 1992: 226, map 125). It is an element of the sclerophyllous montane woodland (associated with, in particular, *Olea* and *Juniperus*) in Arabia and E Africa. In the Arabian Peninsula the species has been known from three regions: (1) from Jabal Akhdar (N Oman), (2) from Dhofar (S Oman) (Ghazanfar 1992: 104) and (3) from the southwestern mountains, with occurrences in the southernmost Asir Mts in SW Saudi Arabia (Kürschner 1986: 556, Collenette 1999: 669) and the Qabaytah (13°15'N, 44°27'E) and Majz (17°04'N, 43°35'E) areas in W Yemen (Wood 1997: 129). Our records from refugia of the xerotropical flora in Hadhramout and Al-Mahra are the first from SE Yemen and confirm its former wide distribution in the southern Arabian Peninsula. HADHRAMOUT: Kor Seiban, wadi (running S to N) parallel to the vertical escarpment into Wadi Howeirah, 14°48'54"N, 48°49'07"E, 1950-2000 m, 15.10.2001, *YP1218*.

AL-MAHRA: Fartak Mts, dissected table-land W below Jabal Karmoun, with the old radio tower, 15°49'39.2"N, 51°58'14.4"E, 600-650 m, bottom and rocky slopes of a narrow, steep wadi, 8.10.2001, *YP1073*; Hawf Mts, Uteq, 16°38'57"N, 52°57'39"E, 1000-1100 m, S facing slopes with big boulders, below the vertical rock face of the summit escarpment, 29.9.2001, *YP500*.

**Scrophulariaceae***Alectra parasitica* Hochst.

Known on the Arabian Peninsula so far from S Saudi Arabia (Collenette 1999: 671), NW Yemen (Wood 1997, Khulaidi 2000), SW Yemen (Schwartz 1939: 246), Dhofar, Oman (Miller & Morris 1988, Ghazanfar 1992: 104), and here recorded for the first time from SE Yemen.

AL-MAHRA: Hawf Mts, slopes below the summit escarpment, above Uteq [16°38'57.5"N, 52°57'39.2"E, at 820 m] towards 16°39'14.3"N, 52°57'27.2"E, 950-1220 m, 30.9.2001, YP559.

*Anticharis linearis* (Benth.) Asch.

This species occurs only scattered on the Arabian Peninsula, occasionally in S Saudi Arabia, rare in NW Yemen (Wood 1997), in SW Yemen only reported from Shabwa (Gabali & Al-Gifri 1990: 382), not at all reported from Oman (Ghazanfar 1992). Our record from the central Jol, near Ghail bin Yamin, is apparently the first from southeastern Yemen.

HADHRAMOUT: Jol plateau, Wadi Yirib close to Ghayl bin Yamin, 15°31'36.3"N, 49°21'49.3"E, 870 m, 17.9.2001, YP144.

*Buchnera hispida* Buch.-Ham. ex D. Don

Recorded from NW Yemen (Wood 1997), SW Yemen (Schwartz 1939) and Dhofar, Oman (Miller & Morris 1988, Ghazanfar 1992). Here recorded the first time from SE Yemen.

AL-MAHRA: Hawf Mts, from Uteq [16°38'57.5"N, 52°57'39.2"E, at 820 m] northeastwards up to the summit escarpment, 800-1000 m, 28.9.2001, YP416; Hawf Mts, Shah'rut, between 16°33'55.4"N, 52°46'27.1"E and 16°34'37.7"N, 52°46'35.2"E, 650-700 m, 2.10.2001, YP707.

*\*Striga angustifolia* (D. Don) Saldanha

This semiparasitic annual is disjunctly distributed in tropical E Africa, where it occurs in seasonally wet grassland, and in India and Sri Lanka (Mohamed & al. 2001). Between both subareas an isolated occurrence is known from Dhofar, Oman (Musselman & Hepper 1988). The species is recorded here also from across the border with Yemen, from the lower monsoon-affected escarpments in Al-Mahra. The Dhofar Al-Mahra population of the species appears to be another example of Arabian relic occurrences of formerly continuously now disjunctly distributed tropical African-Asian species such as e.g. *Remusatia vivipara* Schott (*Araceae*).

AL MAHRA: Track from Ghaydah to Hawf, *Jatropha-Commiphora* monsoon woodland, 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, 26.9.1998, NK5202.

**Solanaceae***\*Hyoscyamus flaccidus* Baker

This cavernicolous annual, so far known as a local endemic of the wet woodland of Dhofar (Ghazanfar 1992: 108, Miller & Morris 1988: 268), has recently also been discovered in the same type of habitats in the neighbouring Al-Mahra.

AL-MAHRA: Hawf Mts, above the locality called Uteq [= 16°38'57.5"N, 52°57'39.2"E], c. 900 m slopes immediately below and at the base of the rock face of the summit escarpment, 1.10.2001, YP642.

*Physalis micrantha* Link [Syn.: *P. minima* L.]

Mentioned for the western escarpment of Yemen (Schwartz 1939: 234, Wood 1997: 229, Khulaidi 2000: 186) and W Saudi Arabia (Collenette 1999: 702), also known from Dhofar (Miller & Morris 1988: 340) and Socotra. We found this annual in the monsoon-affected Hawf mountains, in a loamy pan with therophyte vegetation and in strongly ruderalised vegetation of a cattle resting place.

AL MAHRA: Hawf Mts, bay 8 km W of Jadib, 16°37'N, 52°57'E, 2-5 m, 21.11.1999, PH6639a; Takka NE from Hawf, 200 m, 16°39'N, 53°03'E, 11.11.2000, PH8004.

**Verbenaceae**

*Avicennia marina* (Forssk.) Vierh.

Mangroves are common in some parts of the Red Sea Coast and also present in Dhofar (Miller & Morris 1988), but only few mangrove woods are known from the southeastern coast of Yemen. Beside the famous locality in the crater lake near Bir Ali in E Shabwa (reported already by Schwartz 1939: 217), only one other small stand is known to us on the eastern shore of the Fartak promontory, not mentioned so far in literature.

AL-MAHRA: Estuary with mangrove woods 2 km NW of Nishtun, 15°51'N, 52°10'E, sea level, 27.9.1998, NK5242, PH5091.

**Ulmaceae**

*Celtis africana* Burm. f. [Syn.: *Celtis kraussiana* Bernh.]

The three Arabian *Ulmaceae* species (two species of *Celtis*, one of *Trema*), all tropical (E-) African trees, have been thought to be restricted to the southwestern mountains in NW Yemen and SW Saudi Arabia (Schwartz 1939: 24, Wood 1997: 68, Miller & Cope 1996: 86, map 80). *C. africana* is a chiefly montane forest species widespread in E and S Africa and also present in the mountains of N Somalia (Friis 1992: 156, map 56, Fici in Thulin 1999: 89). A small relic population of both adult and young trees has, however, recently been discovered in the higher mountains in Hadhramout.

HADHRAMOUT: Kor Seiban, summit plateau, larger (W-E) wadi S of the highest point, on the last 100 m to the fall down the vertical escarpment, 14°49'01"N, 48°49'30"E, 1800-1850 m, 22.9.2001, YP357; *ibid.*, upper part of the wadi running N to S between 14°49'48.3"N, 48°49'10.0"E and 14°50'10.2"N, 48°48'44.6"E, at c. 2000 m, 14./15.9.2002, YP3566.

**Urticaceae**

*Forsskaolea viridis* Ehrenb.

This widespread, chiefly Sudano-Zambesian annual is rare on the Arabian Peninsula (Miller & Cope 1996: 115, map 118) and only known from the western mountains (in SW Saudi Arabia), the westernmost part of the Yemeni south coast (Schwartz 1939: 29, Boulos 1988: 583, Khulaidi 2000) and from Dhofar (Ghazanfar 1992: 115). We add first records for Hadhramout and Al-Mahra.

HADHRAMOUT: Ghayl Ba Wazir, near one of the natural ponds called 'hauma', now almost without water and ground covered with *Tamarix* scrub, 14°48'02.7"N, 49°22'50.8"E, 6.3.2002, YP1323.

AL-MAHRA: c. 5 km W of Al Fatk, c. 16°31'N, 52°41'E, steep coastal cliffs, c. 20 m, 26.9.1998, NK5185; Hawf Mts, slopes below the summit escarpment, above Uteq [16°38'57.5"N, 52°57'39.2"E, at 820 m] towards 16°39'14.3"N, 52°57'27.2"E, 950-1220 m, 30.9.2001, YP577.

**Violaceae**

\**Hybanthus durus* (Baker) Schwartz

Originally described from Dhofar, Oman, and thought to be endemic there (Miller & Morris 1988: 116), the species has also been reported from Ethiopia (Friis & al. 1987: 559) and Somalia (Thulin 1993: 76). In Yemen the species occurs both in the closed *Anogeissus* woodland near Hawf as in the *Anogeissus* woodland patches on Jabal Faydami and Jabal Fartak.

AL-MAHRA: S Fartak Mts, above Kadifut, 15°39'06.8"N, 52°12'05.7"E, 780 m, W exposed *Anogeissus dhofarica* woodland patch, 10.10.2001, YP1147; N Fartak Mts, W flank of J. Karmoun, 15°50'04.2"N, 51°59'43.3"E, 780 m, 6.10.2001, YP964; 15 km W of Al Fatk, southern flank of Jabal Faydami, 16°30'N, 52°35'E, 350-450 m, 8.11.2000, PH7985; Hawf Mts, bottom and lower slopes of steep gorge almost parallel to the S-SE facing summit escarpment, between c. 52°39'E and 16°39'14.3"N, 52°57'27"E, 1150-1250 m, 28.9.2001, YP452.

**Viscaceae**

*Viscum schimperi* Engl.

This chiefly tropical E African, on *Acacia* parasiting species (for its African distribution see



Polhill & Wiens 1998: 305, map 160) is known in the Arabian Peninsula only from a few records from the mountainous southwest (Miller & Cope 1996: 126, map 134). Our locality in Hadhramout lies hundreds of kilometres further east.

HADHRAMOUT: Track from the village Yuwan E to the Jol Berka plateau, 14°37'N, 48°36'E, steep rocky slopes, 1240 m, on *Acacia*, 14.11.1999, *NK6015*, *PH6353a*.

### **Monocotyledoneae**

#### **Amaryllidaceae**

*Pancratium maximum* Forssk.

Hitherto known from NW Yemen (Wood 1997) and Dhofar, Oman (Miller & Morris 1988, Ghazanfar 1992: 121) only, the species is here recorded also from Al-Mahra and Hadhramout. In cultivation in the Botanic Garden Berlin, the plant flowered for a short time only in the early morning hours.

HADHRAMOUT: Track from Mukalla to Bayn al Jibal, Wadi Shahora, 14°40'12.7"N, 48°55'-03.0"E, 790 m, edge of wadi bed, 12.9.2002, *YP3476*

AL-MAHRA: N Fartak Mts, narrow wadi close to the pass of the track Hashwein to Al Ghaida, between 15°49'18.1"N, 51°57'46.0"E, 450-620 m, 1.9.2002, *YP3255*; S Fartak Mts, *Anogeissus* woodland patch, 15°39'21.2"N, 52°12'02.8"E, 750 m, 4.9.2002, *YP3337*; Hawf Mts, environment of the locality called Shah'rut [i.e. 16°33'55.4"N, 52°46'27.1"E], 650-700 m, 3.10.2001, *YP769*.

#### **Colchicaceae**

\*\**Iphigenia olivieri* Engl.

This genus of about 15 species, distributed in Africa (incl. Madagascar and Socotra), S Asia, Australia and New Zealand, hitherto has not been known from the Arabian Peninsula. The plants collected in Abyan at the southern flank of the Jabal Urays match perfectly *I. olivieri*, which is a species widespread in tropical E Africa and also present across the Gulf of Aden in N Somalia (Thulin 1995a: 68-69, 1995b).

ABYAN: Jabal Urays, Wadi Asurie, ascent Bir Asurie, 13°28'14.0"N, 45°55'09.3"E, 450-700 m, 13.3.2002, *YP1506*.

#### **Gramineae**

*Sporobolus coromandelianus* (Retz.) Kunth – det. H. Scholz, Berlin

The species, widespread in the Old World tropics (Cope 1985: 31, Thulin 1995a: 193), has been known from Yemen only from a single locality, Hajaylah, in N Yemen (Wood 1997: 371); Wood therefore assumed it to be an introduction from India. Nevertheless, some records from Dhofar (Ghazanfar 1992: 139), plus our new record from the neighbouring Al-Mahra allow the conclusion of a native population at least in the monsoon-affected area on the south central coast.

AL-MAHRA: 5-10 km W of Hawf, c. 16°38'N, 52°57'E, 100-200 m, disturbed edge of woodland near track disturbed edge of woodland near track, 26.9.1998, *NK5223*.

\**Stipagrostis raddiana* (Savi) de Winter – det. H. Scholz, Berlin

Distributed in N Africa and SW Asia, known on the Arabian Peninsula so far only from Saudi Arabia (Cope 1985: 18, Collenette 1999: 421) and Dhofar (Ghazanfar 1992: 141).

AL-MAHRA: Fartak Mts, at 15°47'N, 52°E, 270 m, 24.9.1998, *NK5107*.

#### **Iridaceae**

\**Gladiolus candidus* (Rendle) Goldblatt [Syn.: *Acidanthera laxiflora* Baker, *G. ukambanensis* (Baker) Marais]

This E African species distributed from N Tanzania to N Somalia and Djibouti was hitherto known on the Arabian Peninsula only from Dhofar, Oman, where it is rather common in the *Anogeissus* woodland (Miller & Morris 1988: 151, Ghazanfar 1992: 126, Thulin 1995a: 66).

Across the border with Yemen, in eastern Al-Mahra, the species is frequently found in the same vegetation.

AL-MAHRA: Hawf Mts, environment of Shah'rut [i.e. 16°33'55.4"N, 52°46'27.1"E], 650-700 m, 3.10.2001, YP770; N of Jadib, steep slope with boulders (0.2-1 m diam.) directly below the Jabal Chatan escarpment, limestone, 800-850 m, 16°39'N, 52°57'E, 13.11. 2000, PH8111.

### **Lemnaceae**

#### *Lemna perpusilla* Torrey

Three species of *Lemna* are known from the western highlands of Yemen (Wood 1997: 316), among them *L. perpusilla*, which is distributed in all temperate or tropical regions of the world (Daubs 1965: 25). From neighbouring Dhofar only unclear records are mentioned, viz. *Lemna* sp. (Miller & Morris 1988) and *L. cf. gibba* (Ghazanfar 1992: 81). The plants we collected in the only permanent brook in the Hawf area, are clearly referable to *L. perpusilla*, providing its first record for SE Yemen.

AL-MAHRA: Hawf Mts, Ain Ayn, wadi bed at and above the permanent spring, 16°38'14.2"N, 52°56'36.1"E, c. 480 m, 1.10.2001, YP656.

### **Orchidaceae**

#### *Epipactis veratrifolia* Boiss.

The species is known from Egypt, Cyprus and Turkey eastwards to the Himalayas and Madhya Pradesh, then from two disjunct occurrences on the southern Arabian Peninsula, the one in the Akhdar Mts in N Oman, the other in the higher mountains of N Yemen and SW Saudi Arabia, and also from N Somalia and Ethiopia (Cribb 1978, Lal & Datt 1993, Thulin 1995a, Collenette 1999). Our record from the western Jol, in the governorate of Shabwa, is the first record from the S Arabian mountain chain.

SHABWA: Road from Mayfah to Habban, between Assan and Lamatar, 14°23'28.6"N, 47°17'51.9"E, 730 m, sandstone, sinter terrace on E facing slope with e.g. *Adiantum capillus-veneris*, 8.3.2002, YP1357.

#### *Eulophia guineensis* var. *purpurata* Reichb.f. ex Kotschy

This variety of the widespread *Eulophia guineensis* is distributed in Sudan, Ethiopia and the Arabian Peninsula. Here it has been known from NW Yemen (Cribb 1979: 673, 1987, Wood 1997: 411, Khulaidi 2000: 144) and Dhofar (Miller & Morris 1988: 218, Ghazanfar 1992). We collected this forest floor species recently also in the *Anogeissus* woodland of eastern Al-Mahra.

AL-MAHRA: Hawf Mts, from the locality called Uteq [16°38'57.5"N, 52°57'39.2"E, at 820 m] northeastwards up to the summit escarpment, 800-1000 m, 28.9.2001, YP435.

#### \**Habenaria keayi* Summerh.

This and the following two species of tropical African orchids have been known so far in the Arabian Peninsula only from a few records from Dhofar, Oman (Cribb 1987: 461, Miller & Morris 1988: 222-223). Our record of this species together with *H. myodes* and *Nervilia bicarinata*, see below, from the westernmost stands of *Anogeissus dhofarica* woodland, situated about 100 km W of the Hawf Mts in the Fartak Mts, in Al-Mahra, Yemen, is particularly remarkable, since these stands are isolated tiny patches of mostly some hundred square metres only, apparently restricted to sites where the limestone layers transport some water to the surface.

AL-MAHRA: S Fartak Mts, above Kadifut, 15°39'32.4"N, 52°12'12.8"E, 780 m, W exposed semi-deciduous *Anogeissus dhofarica* woodland patch, 5.9.2002, YP3344.

#### \**Habenaria malacophylla* Rehb.f.

As the aforementioned species hitherto only known on the Arabian Peninsula from occurrences in the *Euphorbia balsamifera* scrub in Dhofar, Oman (Cribb 1987: 462, Miller & Morris 1988: 223). Our collection from the neighbouring Al-Mahra from the upper, semideciduous *Anogeissus* woodland is the first record from Yemen.

AL-MAHRA: Hawf Mts, slopes above the locality called Uteq, at 16°38'57.5"N, 52°57'39.2"E, 860-900 m, *Commiphora-Anogeissus* woodland, 1.10.2001, YP681.

\**Habenaria myodes* Summerh.

As the two aforementioned species, it is so far only reported from Dhofar, Oman, where it was found growing in *Euphorbia balsamifera* scrub and the upper, semideciduous *Anogeissus* woodland with evergreen species such as *Euclea schimperi* (Cribb 1987: 462, Miller & Morris 1988: 220-221). One of our new records is from another tiny woodland patch in the S Fartak Mts (see under *H. keayi*), the other from the Hawf Mts close to the border with Oman.

AL-MAHRA: S Fartak Mts, above Kadifut, 15°39'06.8"N, 52°12'05.7"E, 780 m, W exposed semi-deciduous *Anogeissus dhofarica* woodland patch, 10.10.2001, YP1132; NE of Hawf, 16°39'43.7"N, 53°05'12.7"E, 680 m, *Anogeissus* woodland, 27.8.2002, YP3087.

*Nervilia bicarinata* (Blume) Schltr. [Syn.: *N. umbrosa* (Rehb. f.) Schltr.]

This species widespread in tropical African and has been known from the Arabian Peninsula from Dhofar, Oman and NW Yemen (Cribb 1979, Petterson 1991: 56-59, Ghazanfar 1992, Wood 1997: 410). This is the first record from the southern governorates of Yemen. The species was found in an *Anogeissus* woodland patch together with *Habenaria keayi* (see there).

AL-MAHRA: S Fartak Mts, above Kadifut, 15°39'32.4"N, 52°12'12.8"E, 780 m, W exposed semi-deciduous *Anogeissus dhofarica* woodland patch, 4.9.2002, YP3335.

#### **Potamogetonaceae**

*Potamogeton nodosus* Poiret

In S Arabia the species was known from NW Yemen (Wood 1997: 311) and Dhofar (Miller & Morris 1988: 342). Our collections from Hadhramout and Al-Mahra (here from the only permanent brook in the Hawf area, together with *Lemna perpusilla* and *Samolus valerandii*) demonstrate the scattered distribution.

HADHRAMOUT: Upper Wadi Charid, near the narrowest part of the S-N orientated gorge, gravelly wadi with running water, 15°01'N, 49°50'E, 380 m, 22.11.2000, PH8326.

AL-MAHRA: Hawf Mts, brook from the permanent spring Ain Ayn, 16°38'N, 52°57'E, 460 m, 23.11.1999, NK6313.

#### **Acknowledgements**

Special thanks for all the support we received are due to the head office of the Agricultural Research and Extension Authority (AREA) in Dhamar and its chairman, Dr Ismail A. Muharram, and to the research stations of AREA in Taiz and El Kod. Cordial thanks go to our field companions listed in the introduction of this paper, for their pleasant company. The research was funded by the German Ministry of Research and Education in the program Biodiversity and Global Change (BIOLOG) since 2001. Field work in the years 1998-2000 was financially supported by travel grants from the Mattfeld-Qadbeck-Stiftung to the first author. For expert advice on *Rhus* we thank Mike Gilbert (London) and on *Gramineae* Hildemar Scholz (Berlin), for valuable comments on an earlier version of this paper we thank Mats Thulin (Uppsala) and Shahina Ghazanfar (Kew).

#### **References**

- Anon. 2001: BIOTA East Africa. Yemen project group. – Published on the internet, [http://www.biota-africa.com/800/biota\\_east/subprojects/structure\\_east\\_abs.htm](http://www.biota-africa.com/800/biota_east/subprojects/structure_east_abs.htm)
- Boulos, L. 1988: A contribution to the flora of South Yemen (PDRY). – *Candollea* **43**: 549-585.
- 2000: Flora of Egypt **2**. – Cairo.
- Bilaidi, A. S. 1989: Houf forest (Al-Mahra Governorate). Report on a trip to Al-Mahra governorate September 20 - October 4, 1989. – Ministry of Agriculture and Agrarian Reforms,

- Agricultural Research Centre El-Kod, Forestry and Range-Management Section, 10 pp. – El Kod.
- Bruyns, P. V. 1988a: Studies in the flora of Arabia 24: The genus *Ceropegia* in Arabia. – Notes Roy. Bot. Gard. Edinburgh **45**: 287-326.
- 1988b: Studies in the flora of Arabia: 21. *Cibirhiza*, a new genus of *Asclepiadaceae* from Oman. – Notes Roy. Bot. Gard. Edinburgh **45**: 51-54.
- Chaudhary, S. A. 1999, 2000: Flora of the Kingdom of Saudi Arabia **1, 2(3)**. – Riyadh.
- Collenette, S. 1999: Wildflowers of Saudi Arabia. – Riyadh.
- Cope, T. A. 1985: A key to the grasses of the Arabian Peninsula. – Arab. Gulf J. Special Publ. **1**.
- Cribb, P. J. 1979: The orchids of Arabia. – Kew Bull. **33**: 651-678.
- 1987: New records of *Orchidaceae* for Arabia. – Kew Bull. **42**: 461-463.
- 1989: *Eulophia*. – Pp. 422-480 in: Polhill, R. M. (ed.), Flora of tropical East Africa, *Orchidaceae* **3**. – Rotterdam.
- Daubs, E. H. 1965: A monograph of *Lemnaceae*. – Illinois Biol. Monogr. **34**.
- El-Mashjary, M. S., Hein, P. & Kilian, N. 2001: The endangered fan palm *Livistona carinensis* in Yemen. – Yemeni J. Sci. **3(1)**: 21-25.
- Friis, I. 1992: Forests and forest trees of Northeast tropical Africa. – Kew Bull. Addit. Ser. **15**.
- , Gilbert, M. G. & Vollesen, K. 1987: Additions to the flora of Ethiopia, 2. – Willdenowia **16**: 531-564.
- Gabali, S. A. 1995: Plant life in Yemen. A general survey and preliminary checklist of the flowering plant species. – Publ. Univ. Aden, Reference Book Ser. **4**.
- 1998: Studies in the flora of Yemen, 4. The endemic species. – Candollea **53**: 73-92.
- & Al-Gifri, A.-N. 1990: Flora of South Yemen. *Angiospermae*. A provisional checklist. – Feddes Repert. **101**: 373-383.
- Gamal-Eldin, E. 1981: Revision der Gattung *Pulicaria* (*Compositae* - *Inuleae*) für Afrika, Makaronesien und Arabien. – Phanerog. Monogr. **14**.
- 1984: Studies in the Flora of Arabia: 8. A new *Pulicaria* from Oman. – Notes Roy. Bot. Gard. Edinburgh **41**: 467-471.
- Ghazanfar, S. A. 1992: An annotated catalogue of the vascular plants of Oman. – Scripta Bot. Belgica **2**.
- 2002a: A new species of *Helianthemum* (*Cistaceae*) from the Sultanate of Oman. – Willdenowia **32**: 69-72.
- 2002b: A new species of *Rhus* (*Anacardiaceae*) from the Sultanate of Oman, Arabia. – Kew Bull. **57**: 491-494.
- Gilbert, M. G. 1986a: *Rhus neoglutinosa* sp. nov. (*Anacardiaceae*) and *Teclea borenensis* sp. nov. (*Rutaceae*) from Ethiopia. – Nordic J. Bot. **6**: 139-141.
- 1986b: A reconsideration of the *Rhus glutinosa* complex (*Anacardiaceae*). – Nordic J. Bot. **6**: 571-572.
- 1989: *Anacardiaceae*. – Pp. 513-532 in: Hedberg, I. & Edwards, S. (ed.), Flora of Ethiopia **3**. – Addis Ababa, etc.
- Govaerts, R., Frodin, D. G. & Radcliffe-Smith, A. 2000: World checklist and bibliography of *Euphorbiaceae* (and *Pandaceae*) **2**. – Kew.
- , — & Pennington, T. D. 2001: World checklist and bibliography of *Sapotaceae*. – Kew.
- Goyder, D. J. & Nicholas, A. 2001: A revision of *Gomphocarpus* R. Br. (*Apocynaceae*: *Asclepiadeae*). – Kew Bull. **56**: 769-836.
- Green, P. S. & Wickens, G. E. 1989: The *Olea europaea* complex. – Pp. 287-299 in: Tan, K. & Hedge, I., The Davis and Hedge Festschrift. – Edinburgh.
- Halliday, P. 1984: The genus *Kleinia* (*Compositae*) in Arabia. – Kew Bull. **39**: 817-827.
- 1988: Noteworthy species of *Kleinia*. – Hooker's Icon. Pl. **39(4)**.
- 1989: *Kleinia saginata*. – Kew Mag. **6**: 151-156.
- Hedge, I. C. 1982: Studies in the flora of Arabia: 2. Some new and interesting species of *Labiatae*. – Notes Roy. Bot. Gard. Edinburgh **40**: 63-73.

- Hein, W. 1914: Südarabische Itinerare. – Mitt. der K.K. Geogr. Ges. Wien **57**: 32-58.
- Heller, D. & Heyn, C. C. 1993: *Conspectus florae orientalis*. An annotated catalogue of the flora of the Middle East **8**. – Jerusalem.
- Hirsch, L. 1897: *Reisen in Süd-Arabien, Mahra-Land und Hadramut*. – Leiden [Reprint 1995: *The Islamic world in foreign travel accounts 70*, Frankfurt a.M.].
- Hunting Technical Services Ltd. 1992-93: International Development Association; Government of the Republic of Yemen, Ministry of Agriculture and Water Resources, General Directorate of Forestry and Rangelands: National Land and Water Conservation Project: Woodland resources mapping project. [1.] Technical Manual, [2.] Final Report. – Hemel Hempstead.
- Johnston, I. M. 1957: Studies in the *Boraginaceae* 24. *Echiochilon* and related genera. – J. Arnold. Arbor. **38**: 255-293.
- Kabuye, C. H. S. 1971: *Oxalidaceae*. – In: Milne-Readhead, E. & Polhill, R. M. (ed.), *Flora of tropical East Africa*. – Nairobi & London.
- Kers, L. E. 1993: New taxa in *Maerua* (*Capparaceae*) proposed for the Flora of Ethiopia. – *Novon* **3**: 50-54.
- Khulaidi, A. A. al 2000: *Flora of Yemen, Sustainable Environmental Management Programme, YEM/97/100, Sub-Programme II*. – [s.l.].
- Kilian, N. 1997: Revision of *Launaea* Cass. (*Compositae, Lactuceae, Sonchinae*). – *Englera* **17**.  
— 1999: Studies in the *Compositae* of the Arabian Peninsula and Socotra – 1. *Pulicaria gamaleldinae* sp. nova (*Inuleae*) bridges the gap between *Pulicaria* and former *Sclerostephane* (now P. sect. *Sclerostephane*). – *Willdenowia* **29**: 167-185.  
— & Hein, P. 1999: Studies in the *Compositae* of the Arabian Peninsula and Socotra – 2. *Pulicaria samhanensis* sp. nova (*Inuleae*) from Dhofar and notes on other S Arabian species of the genus. – *Willdenowia* **29**: 187-196.  
— & Hubaishan, M. A. 2002: *Tephrosia dura*, *Leguminosae*. – *Curtis's Bot. Mag.* **19**: 241-246.  
— , Hein, P. & Bahah, S. O. 2002: A new species of *Campylanthus* (*Scrophulariaceae*) from Ras Fartak, Al-Mahra, and notes on other species of the genus in Yemen. – *Willdenowia* **32**: 271-279.
- König, P. 1987: *Vegetation und Flora im westlichen Saudi-Arabien*. – *Diss. Bot.* **101**.
- Kokwaro, J. O. 1986: *Anacardiaceae*. – In: Polhill, R. (ed.), *Flora of tropical East Africa*. – Rotterdam & Boston.
- Kunze, H., Meve, U. & Liede, S. 1994: *Cibirhiza albersiana*, a new species of *Asclepiadaceae*, and establishment of the tribe *Fockeeae*. – *Taxon* **43**: 367-376.
- Kürschner, H. 1986: Omanisch-makranische Disjunktionen. Ein Beitrag zur pflanzengeographischen Stellung und zu den florengeographischen Beziehungen Omans. – *Bot. Jahrb. Syst.* **106**: 541-562.
- Lal, B. & Datt, B. 1993: *Epipactis veratrifolia* Boiss.: a new record for the flora of Madhya Pradesh. – *J. Indian Bot. Soc.* **72**: 319-320.
- Lavranos, J. J. & Mies, B. 2001: A noteworthy new aloe from the Ra's Fartaq Mountains, south-east Yemen. – *Cact. Succ. J. (US)* **73**: 146-151.
- Leeuwenberg, A. J. M. & Dilst, F. J. H. van 2001: Series of revisions of *Apocynaceae*, XLIX. *Carissa* L. – *Wageningen Univ. Papers* **2001-1**.
- Lock, J. M. & Simpson, K. 1991: Legumes of West Asia. A check-list. – Kew.
- Lönn, E. 1999: Revision of the three *Boraginaceae* genera *Echiochilon*, *Ogastemma* and *Sericostoma*. – *Bot. J. Linn. Soc.* **130**: 185-259.
- Meikle, R. D. 1951: A new name for a common African *Rhus*. – *Kew Bull.* **6**: 290-293.
- Meve, U. 2002: *Ceropegia*. – Pp 64-107 in: Albers, F. & Meve, U. (ed.), *Illustrated handbook of succulent plants, Asclepiadaceae*. – Berlin, etc.  
— & Mangelsdorff, R. M. 2001: A new species of *Ceropegia* from Yemen, and reconsideration of the status of *C. arabica*, *C. barbiger* and *C. powysii* (*Apocynaceae: Asclepiadoideae-Ceropegieae*). – *Bot. J. Linn. Soc.* **137**: 99-105.

- Mies, B. A. & Lavranos, J. J. 2001: Die Pflanzenwelt am Ras Fartaq. – Kakt. Andere Sukk **52**: 174-177.
- Miller, A. G. 1985: The genus *Lavandula* in Arabia and tropical NE Africa. – Notes Roy. Bot. Gard. Edinburgh **42**: 503-528.
- 1996: Studies in the flora of Arabia: 29. Two new species from Yemen. – Notes Roy. Bot. Gard. Edinburgh **53**: 145-147.
- & Cope, T. A. 1996: Flora of the Arabian Peninsula and Socotra **1**. – Edinburgh.
- & Morris, M. 1988: Plants of Dhofar. The southern region of Oman. Traditional, economic and medical uses. – Muscat.
- & Nyberg 1991: Patterns of endemism in Arabia. – Fl. Veg. Mundi **9**: 263-279.
- Mohamed, K. I., Musselman, L. J. & Riches, C. R. 2001: The genus *Striga* (*Scrophulariaceae*) in Africa. – Ann. Missouri Bot. Gard. **88**: 60-103.
- Morucchio, G. B. 1970: Adumbratio florum aethiopicarum, 20. *Globulariaceae*. – Webbia **24**: 619-635.
- Musselman, L. J. & Hepper, F. N. 1988: Studies in the flora of Arabia: 20. The genus *Striga* in Arabia. – Notes Roy. Bot. Gard. Edinburgh **45**: 43-50.
- Parsons, W. T. & Cuthbertson, E. G. 2001: Noxious weeds of Australia, ed. 2. – Collingwood.
- Pennington, T. D. 1991: The genera of *Sapotaceae*. – Kew.
- Peterson, B. 1991: The genus *Nervilia* (*Orchidaceae*) in Africa and the Arabian Peninsula. – Orchid. Monogr. **5**.
- Podlech, D. 1982: Beiträge zur Kenntnis der Flora des Jemen (YAR). – Mitt. Bot. Staatssamml. München **18**: 401-442.
- Polhill, R. & Wiens, D. 1998: Mistletoes of Africa. – Kew.
- Puff, C. 1978: The genus *Galium* L. (*Rubiaceae*) in Southern Africa. – J. S. Afr. Bot. **44**: 203-279.
- Raynald, A. 1969: Révision du genre *Enicostema* Blume (*Gentianaceae*). – Adansonia, ser. 2, **9**: 57-85.
- Rebel, H. 1907: Lepidopteren aus Südarabien und von der Insel Sokótra. – Denkschr. Kais. Akad. Wiss. Wien, Math.-Naturwiss. Kl. **71(2)**: 31-130.
- Saunders, J. H. 1961: The wild species of *Gossypium* and their evolutionary history. – London, etc.
- Schwartz, O. 1939: Flora des tropischen Arabien. – Mitt. Inst. Allg. Bot. Hamburg **10**: 1-393.
- Sebald, O. 1973: Die Gattung *Otostegia* Benth (Labiatae) in Africa und auf der arabischen Halbinsel. – Stuttgarter Beitr. Naturk., A, **263**.
- 1980: Die Gattung *Leucas* R. Brown (Labiatae) in Africa und auf der Arabischen Halbinsel. – Stuttgarter Beitr. Naturk., A, **341**.
- Sipman, H. J. M. 2002: Lichens of mainland Yemen. – Willdenowia **32**: 127-136.
- Taylor, G. 1933: The genus *Poskea* Vatke. – J. Bot. **71**: 310-312.
- Thesiger, W. 1959: Arabian sands. – New York.
- Thulin, M. 1993, 1995a: Flora of Somalia **1, 4**. – Kew.
- 1995b: *Iphigenia socotrana* sp. nov. (*Colechicaceae*), with a note on *I. oliveri*. – Nordic J. Bot. **15**: 403-405.
- 1999: Flora Somalia **2**. – Kew.
- & Hjertson, M. 1995: *Echidnopsis globosa* sp. nov. (*Asclepiadaceae: Stapelieae*) from Yemen. – Nordic J. Bot. **15**: 261-262.
- , Al-Gifri, A. N., Husein, M. A. & Gabali, S. 2001: Additions to the Yemen flora. – Biol. Scr. **54**: 137-153.
- Troupin, G. 1956: *Menispermaceae*. – In: Turrill, W. B. & Milne-Redhead, E. (ed.): Flora of tropical East Africa. – London & Nairobi.
- 1962: Monographie des *Menispermaceae* africaines. – Mem. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd., Collect. 8vo., ser. 2, **13(2)**.
- Venter, H. J. T. & Verhoeven, R. L. 1993: The identity of *Periploca somaliense* (*Periplocaaceae*). – S. Afr. J. Bot. **59**: 215-217.

- & — 1999: A new species of *Cryptolepis* (*Periplocaceae*, *Apocynaceae*) from Arabia. – Bot. J. Linn. Soc. **131**: 417-422.
- Verdcourt, B. 1963: *Convolvulaceae*. – In: Hubbard, C. E. & Milne-Redhead, E. (ed.), Flora of tropical East Africa. – London.
- 1991: *Boraginaceae*. – In: Polhill, R. M. (ed.), Flora of tropical East Africa. – Rotterdam & Brookfield.
- & Bridson, D. 1991: *Rubiaceae*. – In: Polhill, R. M. (ed.): Flora of tropical East Africa. – Rotterdam & Brookfield.
- Vollesen, K. 1987: The native species of *Gossypium* (*Malvaceae*) in Africa, Arabia and Pakistan. – Kew. Bull. **42**: 337-349.
- 1989: A revision of *Megalochlamys* and *Ecbolium* (*Acanthaceae* : *Justicieae*). – Kew Bull. **44**: 601-680.
- Wagenitz, G. 1984: Studies in the flora of Arabia: 7. *Centaurea* in the Arabian Peninsula. – Notes Roy. Bot. Gard. Edinburgh **41**: 457-466.
- Warfa, A. M. 1988: *Cordia* (*Boraginaceae*) in N.E. tropical Africa and tropical Arabia. – Acta Univ. Upsal. **174**.
- 1989: Taxonomy and distribution of *Cordia crenata* (*Boraginaceae*). – Nordic J. Bot. **8**: 613-618.
- 1990: Taxonomy and distribution of *Cordia sinensis* and *C. nevillei* (*Boraginaceae*), a widespread species pair in Africa and Asia. – Nordic J. Bot. **9**: 649-656.
- Wickens, G. E. 1976: The flora of Jebel Mara (Sudan Republic) and its geographical affinities. – Kew Bull. Add. Ser. **5**.
- Wiersema, J. H. & León, B. 1999: World economic plants: a standard reference. – Boca Raton, etc.
- Wood, J. R. I. 1997: A handbook of the Yemen flora. – Kew.

## Addresses of the authors:

Norbert Kilian & Peter Hein, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Königin-Luise-Str. 6-8, 14195 Berlin; e-mail: n.kilian@bgbm.org, p.hein@bgbm.org

Mohamed Ali Hubaishan, Agricultural Research Station Fuwwa, Agricultural Research & Extension Authority (AREA) – Eastern Coastal Branch, Ministry of Agriculture and Irrigation, P.O. Box 8073, Mukalla, Yemen; e-mail: area-muk@y.net.ye