

Additions to the Yemen Flora

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Fifty species of flowering plants new to the mainland of Yemen are reported from field trips undertaken in 1992, 1995 and 1998. The species roughly fall into three ecological groups, (1) species from the coastal zone of Hadramaut and Mahrah regions, (2) species from the escarpment mountains and plateau in Hadramaut and adjacent areas, and (3) species from the monsoon woodlands of eastern Mahrah close to the Oman border. The species in group (1) were previously mostly believed to be endemics either of Oman or Somalia. Most of the species in group (2) are previously known from Oman and/or Somalia, and sometimes also from eastern Ethiopia and beyond. The largest group is group (3), with species from the "Dhofar fog oasis". The fog moisture here supports a woodland that is denser than anywhere else in Yemen. This vegetation is well known in the Dhofar region in Oman, but in Yemen it has remained practically unknown up to now. Many of the species in this group have previously been regarded as endemics of the Dhofar region of Oman, but some of them have more or less wide distributions in tropical Asia or in north-eastern tropical Africa.

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Introduction

Three major botanical field trips to the mainland of Yemen have been undertaken during the 1990's in collaboration between the Department of Systematic Botany at Uppsala University, Sweden, and the Department of Biology, University of Aden, Yemen. The first trip took place in October 1992, and concentrated mainly on the Hadramaut region in

southern Yemen. The second trip took place in November 1995, and concentrated mainly on the Ibb and Taizz regions in northern Yemen. The third trip took place in November 1998, and concentrated mainly on the Mahrah region in southern Yemen. Various results from these field trips have so far been reported in the following papers: Thulin & Al-Gifri (1994), Thulin (1994a, 1994b), Hjertson (1995),

Thulin (1995a, 1995b), Thulin & Al-Gifri (1995), Thulin & Hjertson (1995), Petrusson & Thulin (1996a), Thulin (1998), Thulin (1999a) and Lönn (1999).

These papers mainly concern new species described from Yemen and other taxonomic novelties, but in Thulin (1995b) *Indigofera eremophila* Thulin was reported from Yemen for the first time on the basis of material collected in 1992, and Miller (1996a) reported *Commicarpus reniformis* Chiov. from Yemen for the first time, also on the basis of material collected on our trip in 1992.

In this paper 50 further species new to the mainland of Yemen are reported from these trips. The new records have all been made in southern Yemen, within the Arabian part of the Somalia-Masai regional centre of endemism (White & Léonard 1991), and in areas not covered by the recent *A handbook of the Yemen Flora* (Wood 1997). The area is covered by *Flora of the Arabian Peninsula and Socotra* of which the first volume has been published (Miller & Cope 1996). Another basic work for the area is *Flora des tropischen Arabien* by Schwartz (1939). The species in the present account are arranged alphabetically within the families, and the families are arranged alphabetically as well.

The species may also be arranged ecologically into the following three groups:

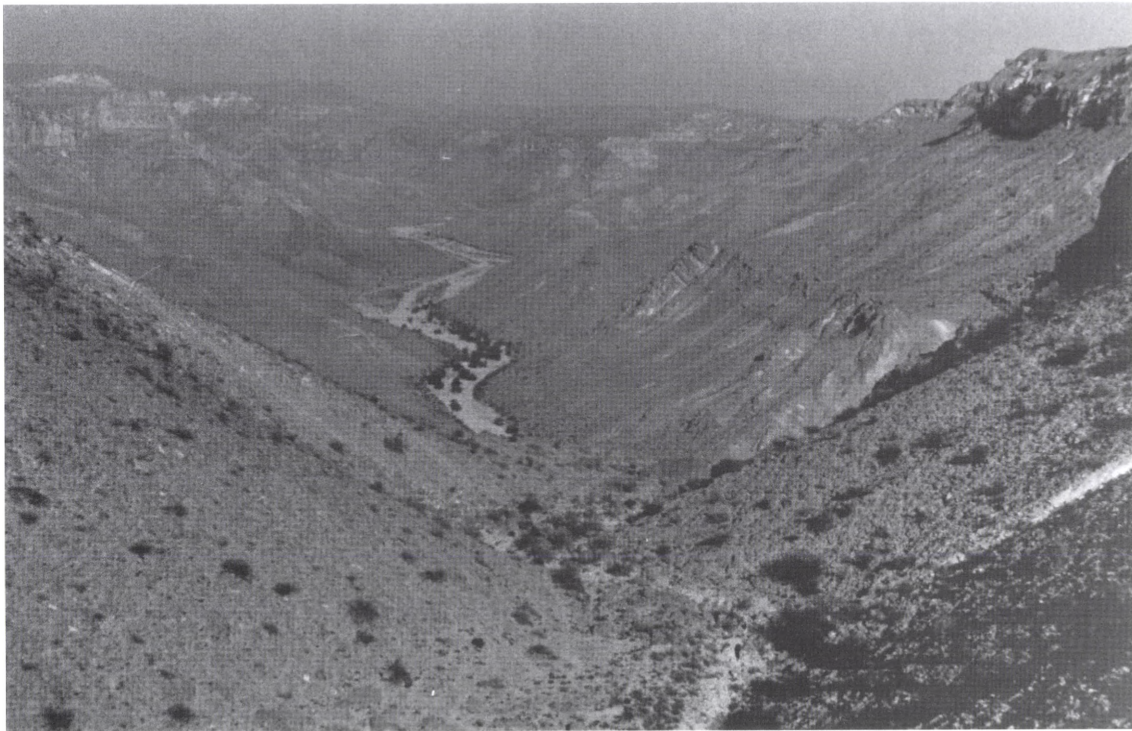
- (1) species from the coastal zone mainly of the Hadramaut and Mahrah regions,
- (2) species from the escarpment mountains and plateau (Jol) in Hadramaut and adjacent areas, and
- (3) species from the monsoon woodlands of eastern Mahrah along the escarpments close to the Oman border.

The species in group (1) include *Basananthe berberoides*, *Cleome albescens* (subsp. *omanensis*), *Cocculus balfourii*, *Commiphora foliacea*, *C. playfairii*, *Conocarpus lancifolius*, *Gymnocarpus rotundifolius*, *Indigofera nephrocarpa*, *Microcharis disjuncta* (var. *fallax*), *Schweinfurthia spinosa*, *Suaeda moschata*, and *Zygophyllum smithii*. These all grow in the stony semi-desert plains, hill-sides or wadis at more or less low altitudes along the coast of Hadramaut and/or Mahrah (Fig. 1 above), and most of them were previously believed to be endemics either of Oman or Somalia. Only *Microcharis disjuncta* has a wider distribution in Africa.

The species in group (2) include *Azima tetracantha*, *Bauhinia ellenbeckii*, *Ceratonia oreothauma*, *Cordia nevillei*, *Crotalaria dumosa*, *Cyclocheilon somalense*, *Indigofera sedgewickiana*, *Indigofera volkensii*, *Nannorrhops ritchieana*, *Pappea capensis*, and *Sporobolus ruspolianus*. Most of these species are found in Yemen either on the steep, periodically mist-covered escarpments above the coastal plain in Hadramaut, or on the plateau itself. *Indigofera sedgewickiana* is an exception, as it is so far only known from the mountains of Lahij rather than from Hadramaut. Phytogeographically it is a rather mixed group, but most of the species are previously known from Oman and/or Somalia (and eastern Ethiopia and beyond). Only *Pappea capensis* and *Azima tetracantha* are widespread species in Africa, with *Azima tetracantha* extending also to tropical Asia.

The largest group is group (3), which includes *Anogeissus dhofarica*, *Blepharis dhofarensis*, *Blepharispermum hirtum*, *Corallocarpus epigaeus*, *Commicarpus boissieri*, *Croton confertus*, *Cucumis sativus*, *Dhofaria macleishii*, *Diplocyclos palmatus*, *Dyerophytum indicum*, *Euphorbia smithii*, *Gossypium stocksii*, *Impatiens balsamina*,

Fig. 1. Above: view of Wadi Arf in the foothills near the coast of Hadramaut, with trees of *Conocarpus lancifolius* visible as dark dots along the wadi. Photo by M. Thulin, 5.X.1992. Below: view of the escarpment woodland in eastern Mahrah, near Sadfan, with branches of *Euphorbia smithii* in the foreground. Photo by M. Thulin, 11.X.1998.



Jatropha dhofarica, *Justicia diffusa*, *Lavandula dhofarensis*, *Leucas dhofarensis*, *Ocimum dhofarense*, *Ormocarpum dhofarense*, *Pulicaria omanensis*, *Remusatia vivipara*, *Rungia pectinata*, *Ruttya fruticosa*, *Sida cordata*, *Trichodesma hildebrandtii*, *Vatovaea pseudolablab*, and *Withania qaraitica*. These species are all found on the fog-affected escarpment mountains of southern Arabia called the "Dhofar fog oasis" (Miller 1994), which are covered by dense woodlands on the seaward-facing slopes (Fig. 1). The area is in the monsoon belt and from about mid-June to mid-September each year the area comes under the influence of the south-west monsoon that causes dense fog to build up against the seaward-facing escarpments. The high quantities of drip-precipitation from fog moisture, in addition to the rainfall (Miller 1994), support woodland that is denser than anywhere else in Yemen. This vegetation is well known in the Dhofar region in Oman, and many of the plants found there are described and illustrated in the book by Miller & Morris (1988). In Yemen, where this vegetation covers a narrow band for about 30 km along the coast west of the Oman border, it has remained practically unknown because of the remoteness and inaccessibility of the area.

Our results show that all the dominant woody plants of these woodlands in Oman, such as *Anogeissus dhofarica*, *Blepharispermum hirtum*, *Croton confertus*, *Euphorbia smithii* and *Jatropha dhofarica*, are present and have the same role also in Yemen. Of these, all, except *Croton confertus*, which is known from Somalia, were previously believed to be endemics of Oman. Many other plants of these woodlands that were previously believed to be endemics of Oman are also present on the Yemen side, and surely there are still more to be found.

The monsoon woodlands in Yemen are still largely intact, although flatter areas have often been opened up for the cultivation of sorghum, etc. On the whole it is possible,

though, that this unique vegetation is better preserved in Yemen than in Oman, where it is said to be under serious threat (Miller 1994).

During our trip in 1998 we also discovered some very isolated patches of a depauperate kind of monsoon woodland at about 800-850 m altitude near the top of Ras Fartak some 150 km from the Oman border. These woodland fragments contained fewer woody species than those close to the Oman border, and mainly *Acokanthera schimperi* (not seen closer to Oman), *Anogeissus dhofarica*, *Euclea schimperi*, *Croton confertus*, and *Olea europaea* subsp. *cuspidata*, were noted.

All the species listed above in this group are previously known from Oman, and many of them have been regarded as endemics of the Dhofar region of Oman. However, some of them, such as *Cucumis sativus*, *Dyerophytum indicum*, *Impatiens balsamina*, *Remusatia vivipara*, *Rungia pectinata* and *Sida cordata*, also have wider distributions in tropical Asia, and *Remusatia vivipara* is relatively widespread also in tropical Africa. *Ruttya fruticosa*, *Trichodesma hildebrandtii* and *Vatovaea pseudolablab* all have more or less wide distributions in north-eastern tropical Africa.

Acanthaceae

Blepharis dhofarensis A.G. Miller

Yemen. Mahrah: Sadvan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, Thulin, Beier & Mohammed Hussein 9715 (K, UPS); escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, Thulin, Beier & Mohammed Hussein 9778 (K, UPS); near Yemen/Oman border crossing NE of Hauf, 16°40'N, 53°05'E, 12.XI.1998, Thulin, Beier & Mohammed Hussein 9748 (UPS).

Blepharis dhofarensis is known previously only from the Dhofar region in Oman (Miller in Miller & Biagi 1988; Miller & Morris 1988), where "it is restricted to the wet escarpment

woodlands where it prefers dense thickets on the steeper more inaccessible slopes" (Miller & Morris 1988). The three collections cited above were collected in escarpment woodland at 420-1000 m altitude, and the species also in Yemen has a preference for more rocky and steep situations. The large white flowers were seen visited by large wasps.

***Justicia diffusa* Willd.**

Yemen. Mahrah: Ras Fartak, above Al Wadi, 15°40'N, 52°11'E, 7.XI.1998, *Thulin, Beier & Mohammed Hussein* 9603 (UPS); 28 km from Al Wadi along road to Tabut, 15°47'N, 52°00'E, 9.XI.1998, *Thulin, Beier & Mohammed Hussein* 9665 (UPS).

Justicia diffusa is a widespread species in southern Asia and Africa, but on the Arabian peninsula it was previously known only from the Dhofar region in Oman (Miller & Morris 1988). The two collections from Yemen reported here agree with the collections from Oman in being more or less prostrate, perennial plants with a more or less woody base. In other areas the species is an erect to ascending annual, and this difference should be studied further. In Yemen the plant was found on rocky slopes at 580-850 m altitude, where it was often growing in rock crevices.

***Rungia pectinata* (L.) Nees**

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9703 (K, UPS).

Rungia pectinata (L.) Nees (= *R. parviflora* (Retz.) Nees) is a tropical Asian species with its main area of distribution from India and Sri Lanka eastwards to China. On the Arabian peninsula it is known previously only from the Dhofar region of Oman (Miller & Morris 1988). The collection cited above was made on a rocky slope in *Anogeissus dhofarica* woodland at 420-540 m altitude.

***Ruttya fruticosa* Lindau**

Yemen. Abyan: Awdhillah escarpment, Thirah pass, 17.VI.1967, *Lavranos & Smith* 882 (K). Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9712 (K, UPS).

Ruttya fruticosa has its main distribution in eastern and north-eastern tropical Africa, and on the Arabian peninsula it is known from the escarpment woodlands in the Dhofar region in Oman (Miller & Morris 1988). Miller & Morris also stated that the species occurs in Hadramaut, but to our knowledge there are no specified reports of it from there. However, the second collection cited above represents a new record of the species from Mahrah, where it was found on rocky slopes in *Anogeissus* woodland at 420-540 m altitude. Also, a previous collection from Abyan is cited above, made at about 1950 m altitude.

Araceae

***Remusatia vivipara* (Roxb.) Schott**

Yemen. Mahrah: near Yemen/Oman border crossing NE of Hawf, 16°40'N, 53°05'E, 12.XI.1998, *sight record by M. Thulin*; along track NE of Hawf towards the Oman border crossing, 16°40'N, 53°05'E, 12.XI.1998, *sight record by M. Thulin*.

Remusatia vivipara is fairly widespread in western and central Africa, and a single record has also been made in western Ethiopia (Riedl 1997). The species is also distributed in southern Asia and in northern Australia. On the Arabian peninsula it is known previously only from the wet escarpment woodlands of Dhofar in Oman (Miller & Morris 1988), and the records from Yemen cited above are from the same vegetation type. In the first locality cited only a few individuals were seen at 850 m altitude, but the second locality, at 500 m altitude, had numerous plants. In both localities the species

was growing in rocky, shady situations. At the time of our visit the leaves had wilted, but the characteristic specialised bulbil-bearing shoots were present.

Arecaceae

Nannorrhops ritchieana (Griffith) Aitch.

Yemen. Mahrah: 213 km W of Al Ghaydah along track to Tarim, 16°26'N, 50°26'E, 16.XI.1998, *Thulin, Beier & Mohammed Hussein* 9830 (K, UPS).

Uhl & Dransfield (1987) gave the distribution of the monotypic genus *Nannorrhops* as "Iran, Afghanistan, Pakistan, and Arabia". They also provided a map that appears to show an Arabian distribution of the genus in Oman, as well as in the Hadramaut region of southern Yemen. Miller & Morris (1988) stated that "within Arabia it is recorded from Oman and S. Yemen", but without citing any specimens. As far as we are aware there is no, previously published, more exact record of this palm from Yemen. The collection cited above was made in the interior part of Mahrah region at about 670 m altitude, where *Nannorrhops* is common and locally dominant along wadis in the desert.

Asteraceae

Blepharispermum hirtum Oliv.

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9717 (K, UPS).

Blepharispermum hirtum has previously been regarded as an endemic of the Dhofar region in Oman (Miller & Morris 1988; Eriksson 1992), where "it is common at lower altitudes in the escarpment woodlands" (Miller & Morris 1988). The collection from Yemen cited above was made on rocky slopes in *Anogeissus dhofarica* woodland at 420-540 m altitude.

Pulicaria omanensis Gamal-Eldin

Yemen. Mahrah: along road between Al Fatk and Damqawt, 16°33'N, 52°48'E, 10.XI.1998, *Thulin, Beier & Mohammed Hussein* 9685 (K, UPS).

Pulicaria omanensis was previously known only from the Dhofar region in Oman (Gamal-Eldin 1981; Miller & Morris 1988). This first record from Yemen was made on a rocky slope at about 100 m altitude.

Balsaminaceae

Impatiens balsamina L.

Yemen. Mahrah: along track NE of Hawf towards the Oman border crossing, 16°40'N, 53°05'E, 12.XI.1998, *Thulin, Beier & Mohamed Hussein* 9762 (UPS).

Impatiens balsamina is a native of tropical Asia that is widely naturalised in Africa, as well as in other tropical and subtropical regions (Grey-Wilson 1980, 1982). On the Arabian peninsula it is known previously only from the escarpment woodlands of the Dhofar region in Oman (Miller & Morris 1988). In the locality in Yemen cited above the plant grows in a rocky, shady slope at 500 m altitude, where it certainly gives the impression of being part of the native flora. At the time of our visit the plants were fruiting, but a few plants still in flower were seen at about 700 m altitude at 16°39'N, 53°03'E on 13 November 1998.

Boraginaceae

Cordia nevillei Alston

Yemen. Hadramaut: 13 km N of Hemiar in the Masila oil field, 15°50'N, 49°12'E, 11.X.1992, *Thulin, Eriksson, Gifri & Långström* 8293 (K, UPS).

Cordia nevillei is relatively widespread in Africa and Asia, and on the Arabian peninsula it is known previously from the Dhofar region in Oman, and it is also known from Socotra (Warfa 1990). Miller & Morris (1988), in their

account of the species in Oman, used the name *C. perrottetii* Wight. Verdcourt (1991) used the name *C. quercifolia* Klotzsch, based on a collection from Mozambique, for this species, but *C. quercifolia* was by Warfa (1990) regarded as a synonym of the variable *C. sinensis* Lam. and we prefer to follow this view. The collection from Yemen cited above was made on a rocky slope along a wadi at about 900 m altitude.

***Trichodesma hildebrandtii* Gürke**

Yemen. Mahrah: escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, *Thulin, Beier & Mohammed Hussein* 9773 (K, UPS).

Trichodesma hildebrandtii is a species with a fairly wide distribution in Somalia, Ethiopia and northern Kenya (Verdcourt 1991), but on the Arabian peninsula it is known only from the Dhofar region in Oman (Miller & Morris 1988), where it for a long time was known as *T. cardiosepalum* Oliv. This first record from Yemen was made on the upper part of the escarpment at about 1000 m altitude, where *T. hildebrandtii* was found growing on rocky ground along with, e.g. *Monothea buxifolia*.

Burseraceae

***Commiphora foliacea* Sprague**

Yemen. Abyan: 30 km N of Zinjibar, 13°22'N, 45°20'E, 23.XI.1998, *sight record by M. Thulin*. Shabwah: 89 km from crossing near Lawdar towards Mahfis, 13°58'N, 46°35'E, 2.X.1992, *Thulin, Eriksson, Gifri & Långström* 7969 (Aden Univ., E, FT, K, UPS). Hadramaut: 23 km on the pipeline route starting 15 km NE of Riyan, 14°50'N, 49°31'E, 4.X.1992, *Thulin, Eriksson, Gifri & Långström* 8046 (UPS). Mahrah: 34 km from Sayhut along road to Qishn, 15°18'N, 51°24'E, 16.X.1992, *Thulin, Eriksson, Gifri & Långström* 8439 (K, UPS); 60 km from Al Wadi along road to Tabut, 15°33'N, 52°04'E, 9.XI.1998, *Thulin, Beier & Mohammed Hussein* 9676 (K, UPS).

Commiphora foliacea was regarded as an endemic of Oman by Miller & Morris (1988), but the species is actually widespread in Somalia (Thulin 1999c), as well as along the coast of southern Yemen. The collections cited above were made on rocky, stony, gravelly or sandy ground, often along wadis, where *C. foliacea* is a fairly common and locally dominant species at 100-400 m altitude.

***Commiphora playfairii* (Hook.f. ex Oliv.) Engl.**

Yemen. Hadramaut: 26-27 km on the pipeline route starting 15 km NE of Riyan, 14°52'N, 49°30'E, 3.X.1992, *Thulin, Eriksson, Gifri & Långström* 8022 (K, UPS); 25 km on the pipeline road starting 15 km NE of Riyan, 14°52'N, 49°30'E, 4.XI.1998, *Thulin, Beier & Mohammed Hussein* 9524 (K, UPS).

Commiphora playfairii was known previously only from the coastal parts of northern Somalia (Thulin 1999c). The two collections cited above appear to be conspecific with the Somali plant and were made on open stony ground along small wadis at 200-220 m altitude.

Capparaceae

***Cleome albescens* Franch. subsp. *omanensis* Chamberlain & Lamond**

Yemen. Mahrah: along road between Jadib and Damqawt, 16°36'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9723 (K, UPS); 13 km from Sayhut along road to Qishn, 15°15'N, 51°20'E, 16.X.1992, *Thulin, Eriksson, Gifri & Långström* 8412 (UPS).

Cleome albescens has long been regarded as an endemic of northern Somalia (Kers & Thulin 1993), but Chamberlain & Lamond (1994) published subsp. *omanensis* from Oman. Chamberlain & Lamond (1996) also recorded this taxon from southern Yemen on the basis of the collection *Guichard* KG/HAD/418 from Hadramaut, but this probably represents a dis-

tinct undescribed species. However, the collections from the Mahrah region cited above agree completely with *C. albescens* subsp. *omanensis*, and this taxon therefore is a member of the Yemeni flora after all. The Yemeni collections were made on a rocky slope and along a wadi near the sea at 10-50 m altitude.

***Dhofaria macleishii* A.G. Miller**

Yemen. Mahrah: escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, *Thulin, Beier & Mohammed Hussein* 9782 (E, K, UPS).

The monotypic genus *Dhofaria* was described as an endemic of the Dhofar region in Oman (Miller 1988, Miller & Morris 1988), but Nyberg (1996) also mentioned its occurrence in adjacent parts of Yemen. However, no specimens were cited. The collection cited above was made on a rocky slope with *Monothea buxifolia* at about 1000 m altitude.

Caryophyllaceae

***Gymnocarpus rotundifolius* Petrusson & Thulin**

Yemen. Hadramaut: 25 km W of Al Ridah, 14°56'N, 50°15'E, 4.XI.1998, *Thulin, Beier & Mohammed Hussein* 9531 (UPS).

Gymnocarpus rotundifolius was described by Petrusson & Thulin (1996a) from Oman, where it occurs on open, desertic, rocky ground and gravel plains at 0-100 m altitude (Petrusson & Thulin 1996a, 1996b). The collection from Yemen cited above is from a gravelly hillside at about 50 m altitude, some 350 km from the Oman border.

Chenopodiaceae

***Suaeda moschata* A.J. Scott**

Yemen. Mahrah: 26 km from Al Wadi along road to Tabut, 15°47'N, 52°00'E, 9.XI.1998, *Thulin, Beier & Mohammed Hussein* 9661 (K, UPS); 28 km from Al Wadi along road to

Tabut, 15° 47'N, 52° 00'E, 9.XI.1998, *Thulin, Beier & Mohammed Hussein* 9966 (K, UPS).

Suaeda moschata Scott (1981) was described from Oman, where it is known from sandy beaches, coastal dunes and wadi-beds at 0-600 m altitude (Boulos 1996). The two collections cited above are both from rocky slopes of the inland part of Ras Fartak at 450-580 m altitude, about 150 km from the Oman border.

Combretaceae

***Anogeissus dhofarica* A.J. Scott**

Yemen. Mahrah: Ras Fartak, above Al Wadi, 15°40'N, 52°11'E, 7.XI.1998, *Thulin, Beier & Mohammed Hussein* 9606 (K, UPS).

Anogeissus dhofarica was described from Oman by Scott (1979), and Miller & Morris (1988) stated that "it is endemic to Dhofar and it is probably the commonest tree of the escarpment woodlands where it is frequently the dominant species, often forming almost pure stands". *A. dhofarica* is common and often dominant in the escarpment woodlands also where we saw it on the Yemen side of the border close to Oman, but the collection cited above is from one of the small isolated patches of woodland found at 600-850 m altitude on Ras Fartak, some 140 km from the Oman border.

***Conocarpus lancifolius* Engl. & Diels**

Yemen. Hadramaut: 1 km above Al Barah village, 30 km on the pipeline route starting 15 km NE of Riyan, 14°58'N, 49°31'E, 5.X.1992, *Thulin, Eriksson, Gifri & Långström* 8083 (Aden Univ., E, K, UPS). Mahrah: Wadi Masilah, 15°19'N, 51°04'E, 15.X.1992, *Thulin, Eriksson, Gifri & Långström* 8396 (UPS).

Conocarpus lancifolius was described from northern Somalia and is also today generally assumed to be an endemic of Somalia (e.g. Wood 1997), although it is cultivated as a valuable tree in various other countries, for ex-

ample in Ethiopia, Kenya, and in various countries on the Arabian peninsula, including Yemen. However, the report of the species by Schwartz (1939) from Wadi Hadjr in Hadramaut, on the basis of the collection Wissman 1177, in our opinion most probably represents a native occurrence of *Conocarpus lancifolius* in Yemen. On our trip in 1992 we saw clearly native populations of the species along Wadi Arf in Hadramaut from Al Arshah and down to about 1 km above Al Barah (at about 250 m altitude). Particularly in the narrow uppermost part of Wadi Arf there are good stands of the tree (Fig. 1 above). Also along Wadi Masilah in Mahrah region at about 100 m altitude, obviously native stands of the tree were seen in 1992. On the basis of these findings Thulin (1993b) mentioned *Conocarpus lancifolius* as native in Yemen, but so far no details of this record have been published.

Cucurbitaceae

Corallocarpus epigaeus (Rottl.) C.B. Cl.

Yemen. Mahrah: escarpment NE of Hauf, 16°39'N, 53°03'E, 13.XI.1998, Thulin, Beier & Mohammed Hussein 9770 (K, UPS).

Corallocarpus epigaeus is fairly widespread in tropical Africa and is known also from Saudi Arabia (Collenette 1985), Oman, Pakistan and India (Jeffrey & Thulin 1993). The collection from Yemen cited here was made in *Anogeissus* woodland at about 700 m altitude.

Cucumis sativus L.

Yemen. Mahrah: near Yemen/Oman border crossing NE of Hawf, 16°40'N, 53° 05'E, 12.XI.1998, Thulin, Beier & Mohammed Hussein 9739 (K, UPS).

Miller & Morris (1988) described and illustrated a wild form of *Cucumis sativus* with bitter fruits from the "monsoon woodlands" of the Dhofar region in Oman. The same form is here reported from the escarpment woodlands

in Yemen, where it is a common climber up to several meters long with very bitter, green fruits with whitish longitudinal lines. The collection cited above was made at 800-850 m altitude, but the species was seen down to about 400 m. Kirkbride (1993) stated *C. sativus* to grow wild in Burma, China (Yunnan Province), India, Sri Lanka and Thailand, but no mention was made of any occurrences on the Arabian peninsula.

Diplocyclos palmatus (L.) C. Jeffrey

Yemen. Mahrah: near Yemen/Oman border crossing NE of Hawf, 16°40'N, 53° 05'E, 12.XI.1998, Thulin, Beier & Mohammed Hussein 9740 (UPS).

Diplocyclos palmatus is widespread in the Old World tropics (Jeffrey 1967), but on the Arabian peninsula it has previously been recorded only from the Dhofar region in Oman (Miller & Morris 1988). The collection from Yemen cited here was made in *Anogeissus-Acacia etbaica* woodland at 800-850 m altitude.

Cyclocheilaceae

Cyclocheilon somalense Oliv.

Yemen. Hadramaut: 42 km along the pipeline route from the crossing with the Ressib road, 15°11'N, 49°16'E, 13.X.1992, Thulin, Eriksson, Gifri & Långström 8364 (Aden Univ., E, FT, K, UPS).

Cyclocheilon somalense has previously been regarded as an endemic of northern Somalia (Marais 1981), and this record from Yemen represents the first finding of a member of *Cyclocheilon* outside Africa. The genus, with its three species, was previously known only from Somalia and eastern Ethiopia (Marais 1981). In the Yemeni locality the plant was found on a rocky limestone slope at about 1250 m altitude.

Euphorbiaceae

Croton confertus Baker

Yemen. Mahrah: Ras Fartak, above Al Wadi, 15°40'N, 52°11'E, 7.XI.1998, *M. Thulin*, *sight record*; Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *M. Thulin*, *sight record*.

Croton confertus was described from Dhofar in Oman, where it "is common at lower altitudes in the wet escarpment woodlands" (Miller & Morris 1988). The species is also known from northern Somalia (Thulin 1993c). The first collection cited above was made in a patch of woodland near the top of Ras Fartak at 800-850 m altitude, whereas the second one was made in *Anogeissus dhofarica* woodland at about 500 m altitude.

Euphorbia smithii S. Carter

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin*, *Beier & Mohammed Hussein* 9713 (K, UPS).

Euphorbia smithii was previously regarded as an endemic of the Dhofar region in Oman, where it is said to be "one of the commonest small trees at lower altitudes in the escarpment woodlands" (Miller & Morris 1988). It is also common in the corresponding woodlands of eastern Mahrah in Yemen, where *E. smithii* seems to be particularly prominent on rocky slopes (Fig. 1 below).

Jatropha dhofarica A.R.-Sm.

Yemen. Mahrah: escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, *Thulin*, *Beier & Mohammed Hussein* 9767 (K, UPS).

Jatropha dhofarica was previously regarded as an endemic of the Dhofar region in Oman, where it is said to be "one of the most common and widespread species" (Miller & Morris 1988). This is equally true for the escarpment areas on the Yemen side of the border, where *J. dhofarica* is one of the dominant woody plants from near sea level up to about 800 m altitude.

Fabaceae

Bauhinia ellenbeckii Harms

Yemen. Hadramaut: Mola Matar area, near Bayn Al-Jibal, 14°47'N, 48°54'E, 6.X.1992, *Thulin*, *Eriksson*, *Gifri & Långström* 8130 (Aden Univ., E, FT, K, UPS); Mola Matar Pass, 16.VIII.1949, *Guichard* KG/HAD/199 (EA, photo at K).

Bauhinia ellenbeckii is in Africa known from Somalia and eastern Ethiopia (Polhill & Thulin 1983, 1988, Thulin 1993d). The species was said to occur also in Yemen by Thulin (1993d), but no specimens were cited. Two collections are now known, both from the Mola Matar area, one recent made among limestone rocks along a large wadi at 1950 m altitude, and one from 1949 from stony wadis at 1800 m altitude. The latter specimen was identified as "most probably *B. ellenbeckii*" by Brennan on a determination label from 24 Oct. 1960. The Mola Matar area is the area in Hadramaut with the highest altitude and presumably also the highest precipitation.

Ceratonia oreoethauma Hillc., Lewis & Verdc. subsp. *oreoethauma*

Yemen. Hadramaut: Mola Matar area, Kawr Sayban, 14°51'N, 48°47'E, 7.X.1992, *Thulin*, *Eriksson*, *Gifri & Långström* 8159 (Aden Univ., E, K, UPS).

Ceratonia oreoethauma was described by Hillcoat *et al.* (1980), with subsp. *oreoethauma* in Oman and subsp. *somalensis* Hillc., Lewis & Verdc. in northern Somalia. Subsp. *oreoethauma* was stated to occur also in southern Yemen by Thulin (1993d), but no specimen was cited. The collection cited above was made on limestone rocks in the mist zone at about 1900 m altitude. Only a single sterile tree was seen, 3 m tall, with a thick gnarled trunk.

Crotalaria dumosa Franch.

Yemen. Hadramaut: above Al Arshah, 15°00'N, 49°23'E, 13.X.1992, *Thulin*, *Eriksson*, *Gifri & Långström* 8383 (K, UPS).

Crotalaria dumosa is in Africa known from Somalia, Djibouti, eastern Ethiopia, and northern Kenya, but Polhill (1982) and Thulin (1993d) also stated it to occur in "Arabia". However, no record from Arabia seems to have been published previously and the species was not included in the checklist of legumes of West Asia by Lock & Simpson (1991). The collection from Hadramaut cited above was made on stony ground at about 900 m altitude.

***Indigofera nephrocarpa* Balf.f.**

Yemen. Mahrah: Ras Fartak, 15°40'N, 52°13'E, 9.XI.1998, Thulin, Beier & Mohammed Hussein 9650 (UPS); 39 km from Jadib along road towards Al Fatk, 16°31'N, 52°43'E, 14.XI.1998, Thulin, Beier & Mohammed Hussein 9794 (UPS).

Indigofera nephrocarpa was originally described from Socotra, but has been recorded also from Oman and north-eastern Somalia (Miller & Morris 1988, Thulin 1993d), and from Pakistan (Small *et al.* 1988). This is the first record of the species from the mainland of Yemen. Both collections cited above are from rocky slopes at 5-20 m altitude near the sea.

***Indigofera sedgewickiana* Vatke & Hildebr.**

Yemen. Lahij: Yaffa area, Wadi Yahar, above Harada, 13°47'N, 45°15'E, 9.XI.1995, Thulin, Ghebrehiwet & Gifri 9253 (E, K, UPS); Yaffa, X.1993, Amira 1 (UPS).

Indigofera sedgewickiana has previously been regarded as an endemic of northern Somalia (Thulin 1993d). The material cited here was in fruit when collected, but flowers have been produced on plants grown from seeds in the greenhouses of the Botanical Garden of Uppsala University. The Yaffa area used to be very isolated, but in the early 1990's a tarmac road was built reaching up to the mouth of the steep-sided gorge formed here by Wadi Yahar. *I. sedgewickiana* here grows in rocky gullies at 1600-1700 m altitude. The Yemeni population has relatively large leaves with more numerous

leaflets compared to the Somali populations (most leaves with 9-13 leaflets versus often only 5-7 leaflets in Somalia), but the variation in these and other respects appears to be continuous.

***Indigofera volkensii* Taub.**

Yemen. Abyan: near Juhayn, 13°34'N, 45°50'E, 18.X.1992, Thulin, Eriksson, Gifri & Långström 8458 (UPS). Hadramaut: 14 km from the turning to the Masila field on the road from Al Mukalla to Sayun, 15°01'N, 48°49'E, 7.X.1992, Thulin, Eriksson, Gifri & Långström 8179 (K, UPS).

Indigofera volkensii is widespread in eastern and north-eastern Africa (Thulin 1993d), but has not previously been recorded from the Arabian peninsula. The collections cited above were made on rocky hillsides at respectively 900 m and 1430 m altitude.

***Microcharis disjuncta* (Gillett) Schrire var. *fallax* (Gillett) Schrire**

Yemen. Mahrah: 16 km from Sayhut along road to Qishn, 15°15'N, 51°21'E, 16.X.1992, Thulin, Eriksson, Gifri & Långström 8421 (K, UPS).

Microcharis disjuncta (= *Indigofera disjuncta* Gillett) was known previously from Namibia and adjacent parts of South Africa in southern Africa, and from Mauretania in the West to Sudan and Saudi Arabia in the East. There is also a population on Socotra that has been recognized as var. *fallax* (Gillett) Schrire. Var. *fallax* is said to differ mainly in having smaller leaves with some of the upper leaves 3-foliate, whereas in var. *disjuncta* all leaves are simple (Gillett 1956). The collection from Yemen cited above is geographically nearest associated with the population on Socotra and also has small leaves with some of the upper leaves 3-foliate. The Yemeni collection, which was made on a rocky slope along a wadi at about 75 m altitude, therefore is here placed in var. *fallax*.

***Ormocarpum dhofarense* Hillc. & Gillett**

Yemen. Mahrah: near Yemen/Oman border crossing NE of Hawf, 16°40'N, 53°05'E, 12.XI.1998, *Thulin, Beier & Mohammed Hussein* 9746 (K, UPS).

Ormocarpum dhofarense was regarded as an endemic of the Dhofar region in Oman by Miller & Morris (1988). Lock & Simpson (1991) and Wood (1997) also reported it from northern Yemen, but the specimen cited by Wood (Wood 2012) is actually a lush specimen of *O. yemenense* Gillett. The collection cited above was made in *Anogeissus dhofarica*-*Acacia etbaica* woodland at 800-850 m close to the Oman border.

***Vatovaea pseudolablab* (Harms) Gillett**

Yemen. Mahrah: along road between Jadib and Damqawt, 16°36'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9689 (K, UPS).

Vatovaea pseudolablab is fairly widespread in eastern and north-eastern Africa, where it is known from Sudan, Ethiopia, Somalia, northern Uganda, Kenya, and Tanzania (Thulin 1993d). On the Arabian Peninsula it has previously only been reported from the Dhofar region in Oman (Miller & Morris 1988). The collection from Yemen cited above was made on a rocky slope with *Commiphora* and *Jatropha dhofarica* at about 100 m altitude.

Lamiaceae

***Ocimum dhofarense* (Sebald) A. Paton**

Yemen. Mahrah: escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, *Thulin, Beier & Mohammed Hussein* 9764 (K, UPS).

Ocimum dhofarense (= *Becium dhofarense* Sebald 1987) is known previously only from the escarpment woodlands of the Dhofar region in Oman, "where it frequently occurs as an understorey shrub below *Anogeissus dhofarica*" (Miller & Morris 1988). The collection from Yemen

cited above was made in *Anogeissus dhofarica* woodland at 800 m altitude.

Lavandula dhofarensis* A.G. Miller subsp. *dhofarensis

Yemen. Mahrah: along road between Jadib and Damqawt, 16°36'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9693 (K, UPS).

Lavandula dhofarensis is known previously only from the Dhofar region in Oman (Miller 1985, Miller & Morris 1988). Two subspecies are recognized, subsp. *dhofarensis* and subsp. *ayunensis* A.G. Miller. The collection cited above agrees with subsp. *dhofarensis*. The locality in Yemen is on a rocky slope with *Commiphora* and *Jatropha dhofarica* near the foot of the escarpment at about 100 m altitude.

***Leucas dhofarensis* Hedge & Sebald**

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9699 (K, UPS).

Leucas dhofarensis has previously been regarded as an endemic of the Dhofar region in Oman (Hedge & Sebald in Hedge 1982, Miller & Morris 1988). The collection from Yemen cited above was made on a rocky slope in *Anogeissus dhofarica* woodland at 420-540 m altitude.

Malvaceae

***Gossypium stocksii* Mast.**

Yemen. Mahrah: along road between Jadib and Damqawt, 16°36'N, 52°56'E, 10.XI.1998, *M. Thulin, sight record*.

Gossypium stocksii was known previously from northern Somalia, Oman and Pakistan (Thulin 1999b). In Oman it is known from the coastal plains and foothills of the Dhofar region (Miller & Morris 1988), and the record cited above is from rocky ground near the mouth of a wadi close to the sea at about 20 m altitude.

Sida cordata (Burm.f.) Borss. Waalk.

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9704 (K, UPS).

Sida cordata (= *S. veronicifolia* Lam.) is an Asian species that on the Arabian peninsula previously is known only from Oman (Miller & Morris 1988). The collection from Yemen cited above was made on a rocky slope in *Anogeissus dhofarica* woodland at 420-540 m altitude.

Menispermaceae

Cocculus balfourii Schweinf. ex Balf.f.

Yemen. Mahrah: Ras Fartak, above Al Wadi, 15°40'N, 52°11'E, 7.XI.1998, *M. Thulin, sight record*.

This species, regarded by Forman (1980) as "the most remarkable species in the Menispermaceae", was described from Socotra, but material believed to be conspecific from the Dhofar region of Oman was reported by Forman. Miller (1996b) stated that the species also occurs in southern Yemen, but no material was specified.

The record cited above from Yemen is from rocky limestone slopes at about 800 m altitude, but the plant was also seen at lower altitudes in several other places. The plants in Yemen agree with those in Oman in having relatively narrow cladodes, and it might still be questioned whether the form on the Arabian peninsula is conspecific with the form on Socotra.

Nyctaginaceae

Commicarpus boissieri (Heimerl) Cuf.

Yemen. Mahrah: escarpment NE of Hawf, 16°39'N, 53°03'E, 13.XI.1998, *Thulin, Beier & Mohammed Hussein* 9787 (K, UPS).

Commicarpus boissieri is known previously from Pakistan, India, Oman and Socotra (Miller 1996a). This first collection from the

mainland of Yemen was made in *Anogeissus dhofarica* woodland at 700 m altitude close to the Oman border.

Passifloraceae

Basananthe berberoides (Chiov.) W.J. de Wilde

Yemen. Hadramaut: 12 km along road from Riyan to Al Mukalla, 14°45'N, 49°13'E, 3.X.1992, *Thulin, Eriksson, Gifri & Långström* 7993 (Aden Univ., K, UPS); near Zagfa, 7 km on the pipeline route starting 15 km NE of Riyan, 14°45'N, 49°31'E, 3.X.1992, *Thulin, Eriksson, Gifri & Långström* 8010 (Aden Univ., K, UPS); near Riyan airport, 14°39'N, 49°21'E, 9.X.1992, *Thulin, Eriksson, Gifri & Långström* 8223 (Aden Univ., K, UPS); 59 km from Hami along road to Sayhut, 14°59'N, 50°18'E, 9.X.1992, *Thulin, Eriksson, Gifri & Långström* 8240 (Aden Univ., E, K, UPS). Mahrah: 16 km from Sayhut along road to Qishn, 15°15'N, 51°21'E, 16.X.1992, *Thulin, Eriksson, Gifri & Långström* 8418 (Aden Univ., UPS); 31 km NE of Sayhut, 15°18'N, 51°24'E, 5.XI.1998, *Thulin, Beier & Mohammed Hussein* 9541 (UPS).

Basananthe berberoides is known previously from northern and central Somalia and from eastern Ethiopia (Thulin 1993a; de Wilde & Gilbert 1995). This record from southern Yemen is the first report of the genus *Basananthe* outside Africa. In Hadramaut and Mahrah *B. berberoides* grows on rocky hillsides, along wadis, and on stony or sandy plains close to the coast, and it is locally common. The known altitudinal range in Yemen is 10-75 m.

Plumbaginaceae

Dyerophytum indicum (Gibs. ex Wight) O. Ktze.

Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier &*

Mohammed Hussein 9718 (K, UPS); along track NE of Hawf towards the Oman border crossing, 16°40'N, 53°05'E, 12.XI.1998, *Thulin, Beier & Mohammed Hussein* 9761 (K, UPS).

Dyerophytum indicum is known previously from Oman, United Arab Emirates, western India and Socotra. The collections from Yemen cited above were made in rocky places in *Anogeissus dhofarica* woodland at 420-540 m altitude.

Poaceae

Sporobolus ruspolianus Chiov.

Yemen. Hadramaut: 6 km from the turning to the Masila field on the road from Sayun to Al Mukalla, 14°57'N, 48°53'E, 7.X.1992, *Thulin, Eriksson, Gifri & Långström* 8188 (Aden Univ., K, UPS).

Sporobolus ruspolianus is previously known from Ethiopia, Somalia, Socotra and Oman (Cope 1995, Phillips 1995). This first collection of the species (identification by T. Cope) from the mainland of Yemen was made on a rocky hillside on limestone at about 1300 m altitude.

Salvadoraceae

Azima tetracantha Lam.

Yemen. Hadramaut: 14 km from the turning to the Masila field on the road from Al Mukalla to Sayun, 15°01'N, 48°49'E, 7.X.1992, *Thulin, Eriksson, Gifri & Långström* 8182 (UPS); 42 km along the pipeline route from the crossing with the Ressib road, 15°11'N, 49°16'E, 13.X.1992, *Thulin, Eriksson, Gifri & Långström* 8347 (UPS). Mahrah: Ras Fartak, above Al Wadi, 15°40'N, 52°11'E, 7.XI.1998, *M. Thulin, sight record*.

Azima tetracantha is widespread in Africa and extends to India, Sri Lanka and the Philippines (Verdcourt 1968). On the Arabian peninsula it is previously known from Oman (Miller & Morris 1988). The two collections from Hadramaut cited above were made on rocky slopes at about

respectively 1430 m and 1250 m altitude, whereas the sight record from Mahrah was made at about 800 m altitude.

Sapindaceae

Pappea capensis Eckl. & Zeyh.

Yemen. Hadramaut: 9 km W of Thilah al Ulya, 14°38'N, 49°02'E, 20.XI.1998, *Thulin, Beier & Mohammed Hussein* 9890 (K, UPS); Mola Matar area, Kawr Sayban, 14°51'N, 48°47'E, 6.X.1992, *Thulin, Eriksson, Gifri & Långström* 8141 (Aden Univ., UPS).

Pappea capensis is widespread in eastern Africa, where it is known from Eritrea, Ethiopia and Somalia in the north to South Africa in the south. On the Arabian peninsula it has previously been recorded from a single locality in Oman (Miller & Morris 1988: 258). The two collections from Hadramaut cited above were made in rocky limestone areas exposed to mist at about 640 respectively 1900 m altitude. In both localities only a single sterile tree was found.

Scrophulariaceae

Schweinfurthia spinosa A.G. Miller, M.J.

Short & D.A. Sutton

Yemen. Hadramaut: 13 km on the pipeline route starting 15 km NE of Riyan, 14°47'N, 49°31'E, *Thulin, Eriksson, Gifri & Långström* 8016 (UPS); 23 km on the pipeline route starting 15 km NE of Riyan, 14°50'N, 49°31'E, 4.X.1992, *Thulin, Eriksson, Gifri & Långström* 8041 (K, UPS); 29 km on the pipeline route starting 15 km NE of Riyan, near Al Barah village, 14°57'N, 43°31'E, 4.X.1992, *Thulin, Eriksson, Gifri & Långström* 8054 (Aden Univ., K, UPS); 26 km along the pipeline route from the crossing with Ressib road, 15°18'N, 49°11'E, 13.X.1992, *Thulin, Eriksson, Gifri & Långström* 8322 (K, UPS); 25 km W of Al Ridah, 14°56'N, 50°15'E, 4.XI.1998, *Thulin, Beier & Mohammed*

Hussein 9533 (UPS). Mahrah: Al Ghaydah, wadi just E of town, 16°13'N, 42°12'E, 14.XI.1998, *Thulin, Beier & Mohammed Hussein* 9803 (UPS).

Schweinfurthia spinosa was known previously only from the Dhofar region in Oman (Miller, Short & Sutton 1982; Sutton 1988). The collections from Yemen cited above were made on stony ground along wadis and on rocky hillsides at 30-200 m altitude, except *Thulin & al.* 8322, which was collected on a gypsum hill on the Hadramaut plateau at about 1020 m altitude.

Solanaceae

Withania qaraitica A.G. Miller & J. Biagi
Yemen. Mahrah: Sadfan, along road between Jadib and Damqawt, then inland along track, 16°38'N, 52°56'E, 11.XI.1998, *Thulin, Beier & Mohammed Hussein* 9705 (K, UPS).

Withania qaraitica has previously been regarded as an endemic of the Dhofar region in Oman (Miller & Biagi 1988, Miller & Morris 1988, Hepper 1991). The collection from Yemen cited above was made on a rocky slope in *Anogeissus dhofarica* woodland at 420-540 m altitude.

Zygophyllaceae

Zygophyllum smithii Hadidi

Mahrah: 12 km NE of Itab, 15°25'N, 51°30'E, 5.XI.1998, *Thulin, Beier & Mohammed Hussein* 9553 (K, UPS); Ras Fartak, 15°40'N, 52°13'E, 9.XI.1998, *Thulin, Beier & Mohammed Hussein* 9649 (UPS).

When *Zygophyllum smithii* was described (El Hadidi 1980) it was known only from the type from the Masirah Island in Oman and since then two further collections have been made that are present at Kew. The two collections from Yemen cited above were made on stony hillsides at 280 m respectively 5-20 m altitude.

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