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STUDIES ON THE FLORA OF YEMEN: 2-FLORA OF TOOR AL-BAHA DISTRICT, LAHEJ GOVERNORATE, YEMEN

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ABSTRACT:

Toor Al-Baha of Lahej governorate (Yemen) lies between latitudes 12° 58' - 13° 20' N, and longitudes 44° 11' - 44° 39' E, has been studied floristically. This region covers about 1883 sq km. Analysis of the floristic composition of the studied area have been carried out and proved that, about 560 taxa belong to 288 genera and 89 families of the vascular plants have been recorded. Of these, the largest families are: Poaceae, Asteraceae, Asclepiadaceae, Euphorbiaceae, Fabaceae, Acanthaceae, Capparaceae, Lamiaceae, Boraginaceae, Malvaceae, Solanaceae, Mimosaceae, Tiliaceae, Amaranthaceae, Cucurbitaceae, Convolvulaceae and Scrophulariaceae, while the largest genera are: *Euphorbia*, *Acacia*, *Grewia*, *Heliotropium*, *Indigofera*, *Barleria*, *Eragrostis*, *Aloe*, *Hibiscus*, *Solanum*, *Tephrosia*, *Cadaba*, *Crenulluma*, *Ficus*, *Justicia*, and *Senna*. It was also noted that the generic index = 1.94.

Sixty eight succulents taxa belong to eighteen families were recorded in the flora of the studied area, among these families six are the richest ones: Asclepiadaceae, Euphorbiaceae, Aloaceae, Aizoaceae, Crassulaceae and Vitaceae. Twenty eight taxa are endemic to flora of Yemen, among them *Rhytidocaulon splendidum* T. A. McCoy is endemic to Toor Al-Baha only. Another thirty four taxa are found to be near endemic to the flora of Yemen.

INTRODUCTION:

The Republic of Yemen lies in the southwestern corner of the Arabian Peninsula. It extends between latitudes 12° 40' to 19° 00' N. and longitudes 42° 30' to 53° 05' E. It is bordered by Kingdom of Saudi Arabia in the north, the Arabian Sea and the Gulf of Aden in the south, Sultanate of Oman in the east, and the Red Sea in the west (Fig. 1). Yemen contains

one of the most diverse floras of the Arabian Peninsula region (Wood, 1997 and Al-Dubai, 1998). The flora of this country is characterized by its high diversity and density, particularly in the South and West regions, that makes it a complex one. This flora having affinities with the floras of the Tropical African, Sudanese region, the Saharo-Arabian region, the Mediterranean countries and the Irano-

Turanian region (Zohary, 1973; Al-Hubaishi & Muller-Hohenstein, 1984; Takhtajan, 1986; White & Léonard, 1991; Akhan, 2007).

The flora of Yemen is very rich and diverse. Species diversity is a result of considerable climatic changes in former periods, which enabled different species to survive in the different ecological habitats. Previous studies reported that, there are about 2810 plant species belong to 1006 genera and 173 families in Yemen. Of these about 2559 are naturalized, 121 cultivated and 111 introduced (Al-Khulaidi, 2000). On the other hand, Yemen is rich in the endemic plants, with estimated to be 415 plant species (236 in Socotra). The majority of endemic taxa in Yemen are associated with mountainous areas, which provides a rich variety of ecological niches and offers a degree of environmental stability during periods of climate changes. Endemism is generally very high among the succulent plants. The largest numbers of endemic species are found within the Asteraceae, Euphorbiaceae, Acanthaceae, Boraginaceae and Apocynaceae taking into account the Stapeliad genera (*Caralluma*, *Duvalia*, *Huernia* and *Rhytidocaulon*) (Al-Khulaidi, 2000; Ministry of Water and Environment, 2010).

The study area is a district of Lahej governorate, located at the southwestern part of Yemen. This governorate is bounded in the east by Abyan governorate, in the west by Taiz governorate, in the north by Al-Bayda, Al-Dhala governorates and some parts of Taiz governorate, in the south by Aden governorate and the Gulf of Aden (Fig. 1). Lahej governorate

consists of 15 districts. Toor Al-Baha district is one of them. It extends between latitudes 12° 58' - 13° 20' of the North Latitude and 44° 11' - 44° 39' of the East Longitude, with an area of about 1883 sq km. It represents about 14.4 % of total area of the governorate. The central of this district distances from Al-Hawtah district (the capital of Lahej governorate) about 68 km east. Toor Al-Baha district is bordered by Al-Qubaytah district in the north, Al-Maqatrah district, Al-Madaribah and Ras Al-Aarah district in the west, Tuban district in the east and by Gulf of Aden and parts of Aden governorate in the south (Fig. 1).

The topography of the study area comprises different habitats. Of these are: mountains, intermountain basins (Wadis), alluvial plains, hills, slopes and sandy dunes, with altitudinal ranging between 200-1488 m a. s. l. The geology of study area is characterized by exposures of rock units from the Paleozoic ages (Proterozoic) to the Quaternary. The oldest units are of basement rocks composed in dominant from metamorphic rocks of schist and gneiss which intruded by granite, diorite and grano-diorite bodies, this type of rocks exposed particularly in the most northern part of the studied area (Strojexport Foreign Trade Corporation, 1988).

There are a few studies on the flora and vegetation of Toor Al-Baha, as a distinct area, were carried out, of these are: White & Sloane (1937); Albers & Meve (2002) and McCoy (2003). Some other scholars studied the flora of Toor Al-Baha among the southern governorates of Yemen such as: Gabali & Al-Gifri (1990); Al-Gifri & Gabali (1991).

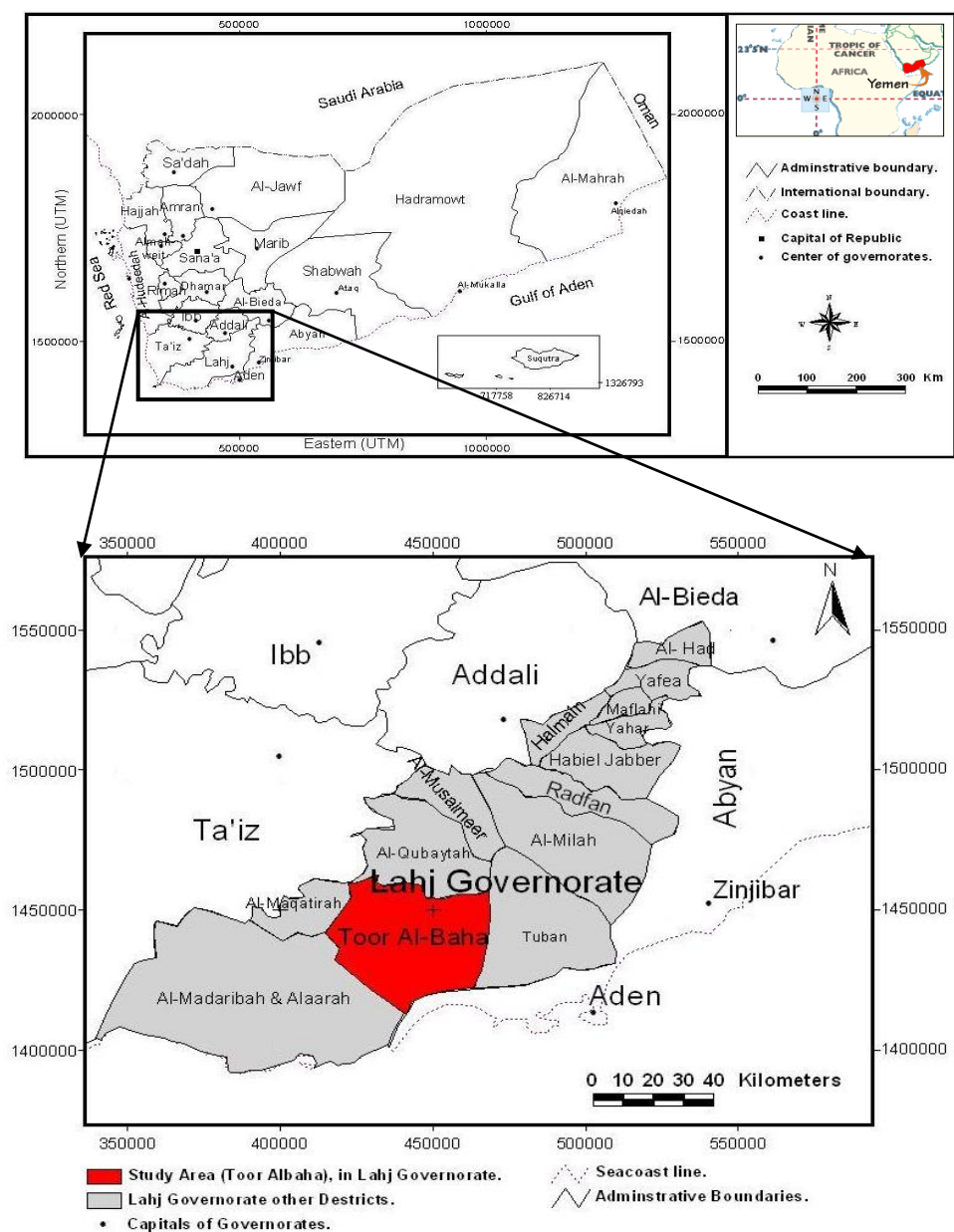


Fig. 1: Map of Yemen (modified after [http://www.worldatlas.com/web image/ country/s/ asia/ye.htm](http://www.worldatlas.com/web_image/country/s/asia/ye.htm)), showing political map of Lahej governorate with browsing the location of study area -Toor Al-Baha (modified after Ministry of the Local administration)

The present study aims to carry out a comprehensive survey of the natural flora of the selected area, to analysis the floral composition of the studied area and to give an annotated

checklist of the flora of the studied area as a step towards understanding the flora of Yemen as a whole.

MATERIALS AND METHODS:

The field studies were carried out through several trips during the different seasons between 2008 and 2011. About 4-8 (-10), trips per month were conducted. One hundred sites and 280 quadrates were selected to cover all the different habitats and floral composition of the studied area. For each taxon at least three duplicates of representative plant specimens were collected, with respect to their coordinates (latitude, longitude and altitude using GPS system).

The collected specimens (un-diseased, and not seriously damaged by insects or other agencies) including flowers and or fruits as well as leaves and stems (Plants of small or moderate size, herbs and small shrubs), were dug up carefully and collected as a whole, including the underground parts (roots, rhizomes, tubers and bulbs).

The plant specimens were pressed in the field and transported to be continued in the laboratory. When the specimens were completely dried, each individual specimen was mounted on a herbarium sheet. For each taxon collected at least three dried specimen were mounted on herbarium sheet and labeled.

Arrangement of the families in the present work was followed the system proposed by Cronquist, 1981, while the genera and species within each family were arranged alphabetically. Voucher specimens for each taxon reported are kept in each of: Herbarium of Biology Department, Faculty of Science, Sanaa University, Herbarium of Biology

Departement, Faculty of Education, Aden University (Yemen) and the Herbarium of Assiut Universty, Egypt (ASTU).

RESULTS AND DISCUSSION:

A total number of the vascular plant which has been recorded from the studied area is 560 taxa related to 288 genera and 89 families (Fig.2). These numbers are very high comparing with those have been recorded from other regions or governorates of Yemen, even their climates are humid arid. If we have a look at the previous results of the floristic composition in other governorates of Yemen, we can note that, the flora of the studied district is very rich and diverse.

Based on the data from the literature, Gabali and Al Gifri (1990), recorded only 467 taxa from the whole southern governorates of Yemen. Also Boulos in 1988 visited the southern governorates (Abyan, Aden, Hadhramout, Lahej and Shabwah) with other Yemenis botanists and they recorded 378 taxa of all these governorates. On the other governorates even the climate is humid arid, wetter, (high rainfall and low temperate) as in Ibb, Al-Mahweet, Hadhramout and Hauf district (Al-Mahrah) the number of the collected taxa was less than that collected from Toor Al-Baha. Aqlan in 2008 reported that about 416 taxa from Ibb governorate. Ibrahim (2006) recorded about 385 taxa from Al-Mahweet governorate. While, from Hadhramout governorate, Al Khulaidi (2010) recorded about 469 taxa of the whole governorate. After different studies on the

vegetation of Hauf district, Hussein (2006) recorded 236 taxa only.

As we usually state that the flora of Toor Al-Baha district is very rich floristically, since it comprises about 560 taxa. This number represents about 22% of the whole flora of Yemen (2559 species) (Al-Khulaidi, 2000). Also the present results proved that the flora of Toor Al-Baha is rich in the genera since its genera represent about 29% of the total genera in the whole flora of Yemen (288/1006). The number of the families in the flora of Toor Al-Baha is constituted about 51% of the families in the flora of Yemen as a whole (89/173). This means that the flora of Toor Al-Baha is relatively the richest part of Yemen in its floristic composition till now. Thus, it may be owing to the biotic, climatic and topographic factors.

In the flora of Yemen the number of genera in proportion to that of species are 2.54, according to (Al-Khulaidi, 2000). This is very low figure comparing with the global average proportion, which are about 13.6. The present studies indicate that the flora of Toor Al-Baha goes below the average level of the Yemenis flora where the number of species per genus is 1.94. This means that the flora of Toor Al-Baha district is more diverse floristically than that of Yemenis flora, as the region that has a certain numbers of species each of which belongs to a different genus is relatively more diverse than that a region with the same number of species

but belong to a few number of genera (Hawksworth, 1995; Khedr *et al.*, 2002).

From the recorded 89 families in the present investigation, there are only three families of Pteridophyta which represent 3.37% of the recorded families, while only one family of the Gymnospermae was recorded, which represent 1.12% of the total number of the recorded families, thus indicates that the flora of this region is poor in the vascular non flowering plants (Pteridophyta and Gymnospermae). The above results are natural and agree with the global floral composition (Cronquist, 1981). The remaining families are 85 are belonging to the Angiospermae which divided into two main groups: Dicots (71 families) and Monocots (14 families). The number of dicots families represents 79.78%, while the number of the monocots represents 15.73% of the total number of the recorded families (Fig. 2).

At the generic level the Pteridophyta comprise six genera (2.08%), while Angiospermae comprise 281 genera (97.57%). Of these the dicots comprise about 237genera (82.29%), while the monocots are represented by 44 genera (15.28%). At the specific level, the Pteridophyta comprise eight species (1.43%), while the rest 551 species (98.39%) belong to Angiospermae. Of these the dicots are represented by 470 species (83.93%), and the monocots comprise 81species (14.46%) (Fig. 2).

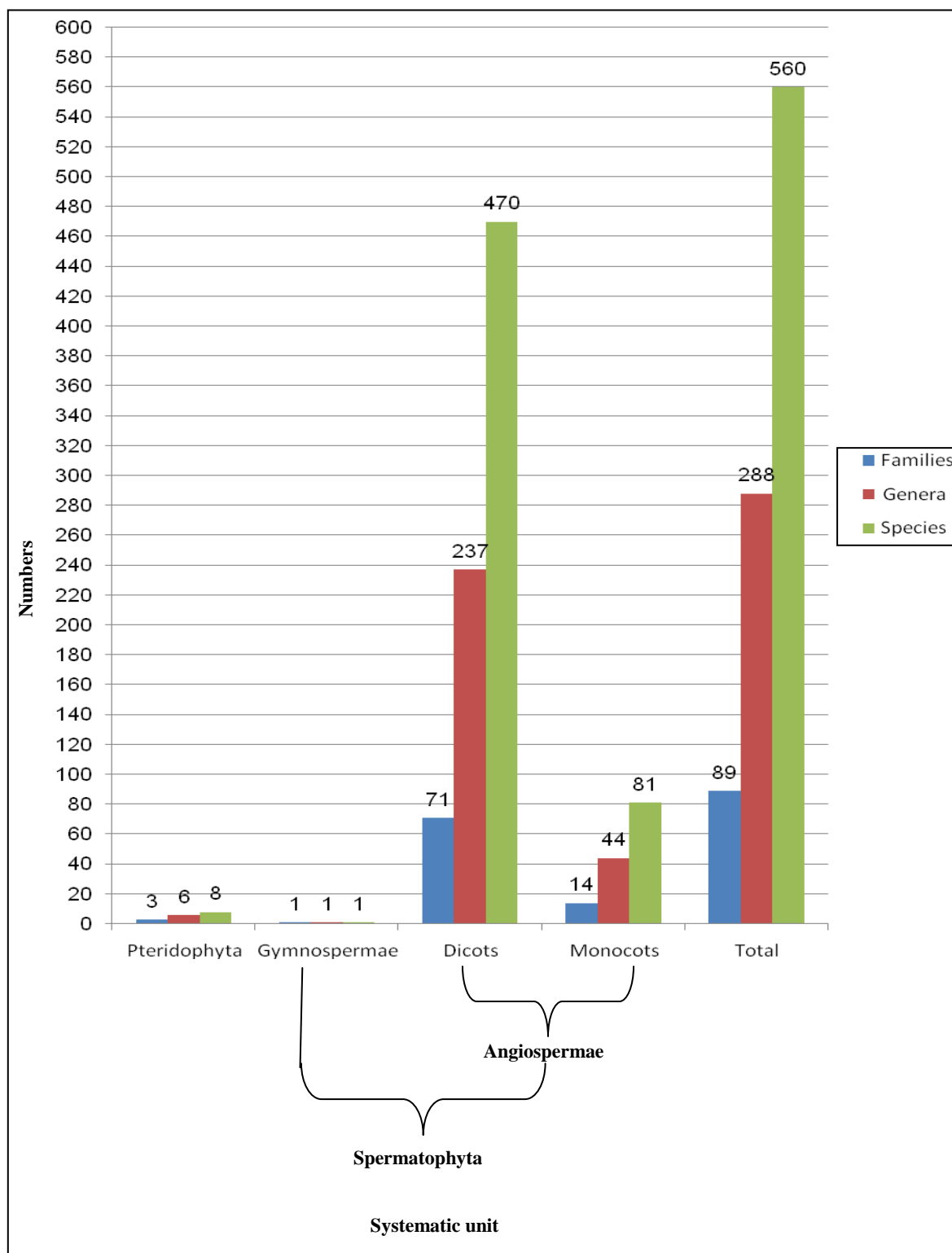


Fig. 2: Numbers of families, genera and species in the flora of Toor Al-Baha by major plant groups (Species including infraspecific taxa), (The numbers are inserted above the columns)

On the other hand from the present results of the flora of Toor Al-Baha, the largest families of the dicots are: Asteraceae (39 sp., 26 g.), Asclepiadaceae (34 sp., 21 g.), Euphorbiaceae (34 sp., 9 g.), Fabaceae (30 sp., 10 g.), Acanthaceae (28 sp., 13 g.), Capparaceae (19 sp., 6 g.), Lamiaceae (18 sp., 9 g.), Boraginaceae (18 sp., 6g.), Malvaceae (17 sp., 7 g.), Solanaceae (15 sp., 6 g.), Mimosaceae (14 sp., 2 g.), Tiliaceae (13 sp., 2 g.), Amaranthaceae (12 sp., 8 g.), Cucurbitaceae (12 sp., 7 g.), Convolvulaceae (12 sp., 5 g.) and Scrophulariaceae (11sp., 6 g.) while, the largest family of the monocots is Poaceae (49 species and 27 genera) (Figs. 3 & 4). Regarding the number of taxa belong the families the present results are in agreement with those of Ghazanfar, 1992 and Al Khulaidi, 2000. These families represent a high percentage (about 66%) of the total genera and species of the studied area.

The present results revealed that, the largest genera are: *Euphorbia* (19 species), followed by *Acacia* (12 species), *Grewia*, *Heliotropium* and *Indigofera* (10 species for each), *Barleria* and *Eragrostis* (8 species for each), *Aloe*, *Hibiscus*, *Solanum* and *Tephrosia* (7 species for each), *Cadaba*, *Crenulluma*, *Ficus*, *Justicia*, and *Senna* (6 species for each) (Fig. 5). The analysis of the present data proved that, there are sixteen genera have number of species represent about 24.11% of the total species recorded in the studied area, about 181 genera in Toor Al-Baha are represented by only one species, 46 genera have only two species and 22 genera represented by 3 species. It was also noted that the generic

index 560/288 was 1.94. From the present results we can emphasis the high diversity of the flora of the selected area. The present results agree with those of Ghazanfar, 1992.

The succulent plants are of a great ecological significance, particularly in arid and semi-arid parts of Yemen or the Arabian Peninsula. They store water in their stems, leaves or roots, a characteristic feature adopted by several plants to withstand high temperature and low precipitation. In Yemen, the succulents are usually seen in shallow depressions and dry places with low altitudes and along the Aden Gulf and the Red Sea coasts. In the study area, approximately, 68 species belonging to 18 families are generally recognized as succulent. Some of the families, which are rich in succulent species, are Aizoaceae, Aloaceae, Asclepiadaceae, Crassulaceae, Euphorbiaceae, and Vitaceae. These results are in agreement with those of (McCoy, 2003). The succulent habit of the plants may be reflect the dominant climatic factors in this region since the plants modify their parts leaves, stems and inflorescences to storage the available water in the wet rainy seasons to survive in the dry seasons.

There are three species viz.: *Cucumis dipsaceus* Ehrenb. ex Spach (Cucurbitaceae), *Dactyloctenium robecchii* (Chiov.) Chiov. (Poaceae) and *Helichrysum glumaceum* DC. (Asteraceae) are recorded here, for the first time in Toor Al-Baha. Previously, these three species were reported, that they are found in Socotra Island only (Al-Khulaidi, 2000).

One of the most distinct features of the flora of Yemen is the high percentage of the endemic plants among its components (Al-Hubaishi & Muller-Hohenstein, 1984; Wood, 1997; Al-Khulaidi, 2000).

The present results revealed that there are about 28 species belong to 22 genera and 14 families are endemic to the flora of Yemen. In addition to the endemic species to the flora of Yemen there are also about 34 species belong to 27 genera and 20 families are near endemic to Yemen (endemic to Saudi Arabia Oman and Yemen) Appendix (1).

The present results of the flora of Toor Al-Baha has revealed the importance of this region in terms of plant biodiversity, and particularly of endemic and near-endemic species, which urgently require further management and conservation activities.

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Appendix (1): List of plant species recorded in the study area with their families

(* = Endemic to Yemen ; ** = Near endemic)

Actiniopteridaceae (2):

Actiniopteris radiata (Swartz) Link.
Actiniopteris semiflabellata Pic.-Ser.

Adiantaceae (5):

Adiantum capillus-veneris L.
Adiantum incisum Forssk.
Cheilanthes coriacea Decne.
Negripteris scioana (Chiov.) Pic.-Ser.
Onychium divaricatum (Poir.) Alston.

Selaginellaceae (1):

Selaginella imbricata (Forssk.) Spreng.

Cupressaceae (1):

Juniperus procera Hochst. ex Endl.

Aristolochiaceae (1):

Aristolochia bracteolata Lam.

Menispermaceae (1):

Cocculus pendulus (J. R. & G. Forst.) Diels

Papaveraceae (2):

Argemone mexicana L.
Argemone ochroleuca Sweet.

Ulmaceae (1):

Celtis africana Burm. f.

Moraceae (8):

Dorstenia barnimiana Schweinf.
Dorstenia foetida (Forssk.) Schweinf. subsp. *foetida*.
Ficus cordata Thunb. subsp. *salicifolia* (Vahl) C. C. Berg.
Ficus glumosa Delile.
Ficus ingens (Miq.) Miq.
Ficus palmata Forssk. subsp. *palmate*.
Ficus sycomorus L. subsp. *sycomorus*.
Ficus vasta Forssk.

Urticaceae (2):

Forsskaolea tenacissima L.
Forsskaolea viridis Webb.

Nyctaginaceae (7):

Boerhavia diffusa L.
Boerhavia elegans Choisy subsp. *stenophylla* (Boiss.) A. G. Miller.
Boerhavia erecta L.
Commicarpus grandiflorus (A. Rich.) Standl.
Commicarpus helenae (J. A. Schultes) Meikle.
Commicarpus mistus Thulin.
Commicarpus plumbagineus (Cav.) Standl.

Aizoaceae (4):

Aizoon canariense L.
Trianthema crystallina (Forssk.) Vahl.
Trianthema triquetra Willd.
Zaleya pentandra (L.) C. Jeffrey.

Gisekiaceae (1):

Gisekia pharmaceoides L. var. *alata* M. Gilbert.

Cactaceae (2):

Opuntia dillenii (Ker-Gawl.) Haw.
Opuntia ficus-indica (L.) Miller.

Chenopodiaceae (5):

Chenopodium murale L.
Chenopodium schraderianum Schultes.
Halothamnus bottae Jaub. & Spach subsp. *niger* Kothe-Heinrich.*
Salsola spinescens Moq.
Suaeda aegyptiaca (Hasselq.) Zohary.

Amaranthaceae (12):

Achyranthes aspera L.
Aerva javanica (Burm. f.) Juss. ex Schult. var. *javanica*.
Aerva lanata (L.) Juss. ex Schult.
Alternanthera pungens Kunth.
Amaranthus graecizans L. subsp. *graecizans*.
Amaranthus lividus L.
Amaranthus sparganiocephalus Thell.
Amaranthus spinosus L.
Digera muricata (L.) Mart. subsp. *muricata*.
Psilotrichum gnaphalobryum (Hochst.) Schinz.
Pupalia lappacea (L.) A. Juss. var. *velutina* (Moq.) Hook. f.
Saltia papposa (Forssk.) Moq*.

Portulacaceae (2):

Portulaca oleracea L. subsp. *oleracea*.
Portulaca quadrifida L.

Molluginaceae (4):

Corbichonia decumbens (Forssk.) Exell.
Glinus lotoides L.
Limnium obovatum Vicary.
Mollugo cerviana (L.) Ser.

Caryophyllaceae (4):

Cometes abyssinica R. Br.
Herniaria hirsuta L.
Minuartia filifolia (Forssk.) Mattf.
Polycarpaea repens (Forssk.) Aschers & Schweinf.

Polygonaceae (1):

Rumex vesicarius L.

Tiliaceae (13):

Corchorus depressus (L.) Stocks.
Corchorus tridens L.
Corchorus trilocularis L.
Grewia arborea (Forssk.) Lam.
Grewia erythraea Schweinf.
Grewia schweinfurthii Burret
Grewia tembensis Fresen.
Grewia tenax (Forssk.) Fiori.
Grewia trichocarpa Hochst. ex A. Rich.
Grewia velutina (Forssk.) Vahl.
Grewia sp. A.
Grewia sp. B.
Grewia sp. C.

Sterculiaceae (3):

Melhanian denhamii R. Br.
Melhanian stipulosa J. R. I. Wood.
Sterculia africana (Lour.) Fiori.

Malvaceae (17):

Abutilon bidentatum A. Rich.
Abutilon figarianum Webb.
Abutilon fruticosum Guill. & Perr.
Cienfuegosia welshii (T. Anders.) Garcke.
Gossypium arboreum L.
Hibiscus aristaevalvis Garcke.
Hibiscus cannabinus L.
Hibiscus micranthus L. f.
Hibiscus palmatus Forssk.
Hibiscus purpureus Forssk.
Hibiscus trionum L.
Hibiscus vitifolius L.
Pavonia arabica Hochst. & Steud. ex Boiss.
Pavonia flavoferruginea (Forssk.) Hepper & J. R. I. Wood.
Senra incana Cav.
Sida alba L.
Sida ovata Forssk.

Cistaceae (1):

Helianthemum stipulatum (Forssk.) C. Chr.

Tamaricaceae (1):

Tamarix aphylla (L.) Karst.

Passifloraceae (1):

Adenia venenata Forssk.

Cucurbitaceae (12):

Citrullus colocynthis (L.) Schrad.
Coccinia grandis (L.) Voigt.
Corallocarpus glomeruliflorus (Defl.) Cogn.
Corallocarpus schimperii (Naud.) Hook. f.
Cucumis dipsaceus Ehrenb. ex Spach
Cucumis melo L. subsp. *agrestis* (Naud.) Grebensc.
Cucumis prophetarum L. subsp. *dissectus* (Naud.) C. Jeffrey.
Cucumis prophetarum L. subsp. *Prophetarum*.
Cucumis pustulatus Naud. ex Hook. F.
Kedrostis foetidissima (Jacq.) Cogn.
Momordica balsamina L.
Zehneria anomala C. Jeffrey.

Capparaceae (19):

Boscia arabica Pestalozzi**.
Cadaba baccarinii Chiov.
Cadaba farinosa Forssk. subsp. *Farinosa*.
Cadaba glandulosa Forssk.
Cadaba heterotricha Stocks.
Cadaba longifolia DC.
Cadaba rotundifolia Forssk.
Capparis cartilaginea Decne.
Cleome brachycarpa Vahl ex DC.
Cleome gynandra L.
Cleome paradoxa R. Br. ex DC.
Cleome scaposa DC.
Cleome viscosa L.
Dipterygium glaucum Decne.
Maerua angolensis DC.
Maerua crassifolia Forssk.

Maerua macrantha Gilg.

Maerua oblongifolia (Forssk.) A. Rich.

Maerua sp.

Brassicaceae (Cruciferae) (6):

Diplotaxis harra (Forssk.) Boiss.
Farsetia linearis Decne. ex Boiss**.
Farsetia longisiliqua Decne.
Farsetia stylosa R. Br.
Farsetia sp.
Schouwia purpurea (Forssk.) Schweinf.

Moringaceae (1):

Moringa peregrina (Forssk.) Fiori.

Resedaceae (2):

Ochradenus baccatus Delile.
Reseda sphenocleoides Defl**.

Sapotaceae (2):

Mimusops laurifolia (Forssk.) Friis.
Sideroxylon mascatense (A. DC.) Pennington.

Primulaceae (2):

Anagallis arvensis L. subsp. *Arvensis* var. *coerulea* Gouan.
Anagallis arvensis L. subsp. *foemina* (Mill.) Schinz & Thell.

Crassulaceae (4):

Kalanchoe alternans (Vahl) Pers**.
Kalanchoe bentii Hook. f. subsp. *bentii**.
Kalanchoe deficiens (Forssk.) Asch. & Schweinf. var. *glabra* Raadts**.
Kalanchoe yemensis (Defl.) Schweinf*.

Mimosaceae (14):

Acacia asak (Forssk.) Willd.
Acacia edgeworthii T. Anders.
Acacia ehrenbergiana Hayne
Acacia etbaica Schweinf. subsp. *uncinata* Brenan
Acacia hamulosa Benth.
Acacia hunteri Oliv*.
Acacia johnwoodii Boulous**.
Acacia laeta R. Br. ex Benth.
Acacia mellifera (Vahl) Benth.
Acacia nilotica (L.) Willd. ex Delile subsp. *indica* (Benth.) Brenan.
Acacia oerfota (Forssk.) Schweinf.
Acacia tortilis (Forssk.) Hayne subsp. *Tortilis*.
Prosopis cineraria (L.) Druce.
Prosopis juliflora (Sw.) DC.

Caesalpinaceae (9):

Delonix elata (L.) Gamble.
Parkinsonia aculeata L.
Senna alexandrina Mill.
Senna holosericea (Fresen.) Greuter.
Senna italica Mill.
Senna obtusifolia (L.) Irwin & Barneby.
Senna occidentalis (L.) Link.
Senna sophera (L.) Roxb.
Tamarindus indica L.

Fabaceae (30):

Astragalus sp.
Cadia purpurea (Picc.) Ait.
Crotalaria emarginella Vatke.
Crotalaria incana L.
Crotalaria pycnostachya Benth. subsp. *Pycnostachya*.
Crotalaria senegalensis (Pers.) DC.
Indigofera arabica Jaub. & Spach.
Indigofera argentea Burm. f.
Indigofera coerulea Roxb. var. *coerulea*.
Indigofera coerulea Roxb. var. *occidentalis* Gillett & Ali.
Indigofera colutea (Burm. f.) Merr.
Indigofera hochstetteri Bak.
Indigofera oblongifolia Forssk.
Indigofera semitrijuga Forssk.
Indigofera spiniflora Boiss.
Indigofera spinosa Forssk.
Microcharis tritoides (Bak.) Schrire subsp. *Tritoides*.
Ormocarpum yemenense Gillett**.
Rhynchosia minima (L.) DC. var. *prostrata* (Harv.) Meikle.
Rhynchosia pulverulenta Stocks.
Rhynchosia schimperi Hochst. ex Boiss.
Sesbania leptocarpa DC.
Tephrosia purpurea (L.) Pers. subsp. *apollinea* (Delile) Hosni & El- Karemy.
Tephrosia heterophylla Vatke.
Tephrosia quartiniiana Cuf. ex Greuter & Burdet.
Tephrosia subtriflora Hochst. ex Bak.
Tephrosia uniflora Pers.
Tephrosia sp. A.
Tephrosia sp. B.
Vigna aconitifolia (Jacq.) Maréchal.

Lythraceae (1):

Lawsonia inermis L.

Thymelaeaceae (1):

Gnidia somalensis (Franch.) Gilg.

Combretaceae (2):

Combretum molle R. Br. ex G. Don.
Terminalia brownii Fresen.

Loranthaceae (4):

Oncocalyx doberae (Schweinf.) A. G. Miller & J. A. Nyberg*.
Phragmanthera austroarabica A. G. Miller & J. A. Nyberg**.
Plicosepalus acaciae (Zucc.) Wiens & Polh.
Plicosepalus curviflorus (Benth. ex Oliv.) Tieghem.

Viscaceae (1):

Viscum cruciatum Sieb. ex Boiss.

Celastraceae (2):

Maytenus parviflora (Vahl) Sebsebe.
Maytenus senegalensis (Lam.) Exell.

Salvadoraceae (2):

Dobera glabra (Forssk.) Poir.
Salvadora persica L.

Euphorbiaceae (34):

Acalypha ciliata Forssk.
Acalypha fruticosa Forssk. var. *fruticosa*.
Acalypha indica L.
Chrozophora oblongifolia (Delile) A. Juss. ex Spreng.
Croton lobatus L.
Euphorbia balsamifera Ait. subsp. *adenensis* (Defl.) Bally.
Euphorbia cuneata Vahl subsp. *Cuneata*.
Euphorbia fractiflexa S. Carter & J. R. I. Wood**.
Euphorbia fruticosa Forssk*.
Euphorbia granulata Forssk. var. *glabrata* (Gay) Boiss.
Euphorbia granulata Forssk. var. *granulate*.
Euphorbia greuteri N. Kilian, Kürschner & P. Hein*.
Euphorbia heterophylla L.
Euphorbia hirta L.
Euphorbia inarticulata Schweinf**.
Euphorbia indica Lam.
Euphorbia longituberculosa Boiss.
Euphorbia prostrata Ait.
Euphorbia qarad Defl*.
Euphorbia schimperi Presl.
Euphorbia schimperiana Scheele.
Euphorbia serpens Kunth.
Euphorbia triaculeata Forssk.
Euphorbia uzumuk S. Carter & J. R. I. Wood*.
Flueggea virosa (Roxb. ex Willd.) Voigt.
Jatropha curcas L.
Jatropha pelargonifolia Courb. var. *pelargonifolia*.
Jatropha spinosa Vahl.
Micrococca mercurialis (L.) Benth.
Phyllanthus amarus Schum. & Thonn.
Phyllanthus fraternus Webster
Phyllanthus maderaspatensis L.
Phyllanthus rotundifolius Willd.
Ricinus communis L.

Rhamnaceae (3):

Ziziphus mucronata Willd.
Ziziphus spina-christi (L.) Desf.
Ziziphus sp.

Vitaceae (4):

Cissus quadrangularis L.
Cissus rotundifolia (Forssk.) Vahl.
Cyphostemma digitatum (Forssk.) Descouings.
Cyphostemma ternatum (J. F. Gmel.) Descouings.

Balanitaceae (1):

Balanites aegyptiaca (L.) Delile var. *aegyptiaca*.

Linaceae (1):

Linum volkensii Engl.

Polygalaceae (4):

Polygala abyssinica R. Br. ex Fresen.
Polygala erioptera DC.
Polygala irregularis Boiss.
Polygala senensis Klotzsch.

Sapindaceae (2):

Allophylus rubifolius (Hochst. ex A. Rich.) Engl. var. *rubifolius*.
Pappea capensis Eckl. & Zeyh.

Burseraceae (5):

Commiphora gileadensis (L.) C. Chr.
Commiphora kataf (Forssk.) Engl.
Commiphora kua (Royle) Vollesen
Commiphora myrrha (Nees) Engl.
Commiphora schimperi (O. Berg) Engl.

Anacardiaceae (2):

Pistacia falcata Becc. ex Mart.
Rhus flexicaulis Bak.

Meliaceae (2):

Azadirachta indica A. Juss.
Turraea parvifolia Defl.

Zygophyllaceae (7):

Fagonia indica Burm. f. var. *indica*.
Fagonia indica Burm. f. var. *schweinfurthii* Hadidi.
Fagonia paulayana Wagner & Vierh.
Tribulus macropterus Boiss. var. *arabicus* (Hosni)
 Al-Hemaid & J. Thomas**.
Tribulus pentandrus Forssk.
Tribulus terrestris L.
Zygophyllum simplex L.

Oxalidaceae (1):

Oxalis corniculata L.

Geraniaceae (1):

Geranium biuncinatum Kokwaro.

Apiaceae (Umbelliferae) (2):

Conium maculatum L.
Oreoschimperella arabiae-felicis (C. C. Townsend) C. C.
 Townsend var. *laevis* C. C. Townsend**.

Gentianaceae (1):

Centaurium pulchellum (Sw.) Druce.

Apocynaceae (2):

Acokanthera schimperi (DC.) Schweinf.
Adenium obesum (Forssk.) Roem. & Schult.

Asclepiadaceae (34):

Angolluma chrysostephana (Defl.) Plowes*.
Angolluma deflersiana (Lavranos) Plowes**.
Blyttia spiralis (Forssk.) D. Field & J. R. I. Wood.
Calotropis procera (Ait.) Ait. f.
Caralluma subulata (Forssk.) Decne**.
Crenulluma cf. arabica (N. E. Br.) Plowes*.
Crenulluma awdeliana (Defl.) Plowes*.
Crenulluma sp. A.
Crenulluma sp. B.
Crenulluma sp. C.
Crenulluma sp. D.
Cynanchum viminale (L.) L. subsp. *stipitaceum* (Forssk.)
 Meve & Liede.
Desmidorchis penicillata (Defl.) Plowes.
Duvalia sulcata N. E. Br. subsp. *seminuda* (Lavranos)
 Meve**.
Duvalia sulcata N. E. Br. subsp. *Sulcata***.
Echidnopsis scutellata (Defl.) A. Berger subsp. *Scutellata**.
*Edithcolea sp. nov.**.
Glossonema boveanum (Decne.) Decne.
Glossonema varians (Stocks) Benth. ex Hook. f.
Huernia rubra Plowes*.
Leptadenia arborea (Forssk.) Schweinf.
Leptadenia pyrotechnica (Forssk.) Decne.
Marsdenia schimperi Decne.
Monolluma quadrangula (Forssk.) Plowes**.
Odontanthera radians (Forssk.) D. V. Field.

Pentatropis nivalis (J. F. Gmel.) D. V. Field & J. R. J. Wood.
Pergularia daemia (Forssk.) Chiov.
Pergularia tomentosa L.
Periploca aphylla Decne.
Periploca visciformis (Vatke) K. Schum.
Rhytidocaulon splendidum T. A. McCoy*.
Sulcolluma hexagona (Lavranos) Plowes**.
Sulcolluma shadhvana (Lavranos) Plowes**.
Sulcolluma shadhvana (Lavranos) Plowes var. *barhana*
 (Lavranos & L. E. Newton) Plowes**.

Solanaceae (15):

Datura innoxia Miller.
Datura metel L.
Datura stramonium L.
Lycium shawii Roem. & Schult.
Nicotiana glauca R. C. Graham.
Physalis angulata L.
Solanum coagulans Forssk.
Solanum cordatum Forssk.
Solanum forsskaolii Dunal.
Solanum glabratum Dunal.
Solanum incanum L.
Solanum nigrum L.
Solanum villosum Miller subsp. *miniatum* (Bernh. ex Willd.)
 Edmonds.
Withania somnifera (L.) Dunal.
Withania sp.

Convolvulaceae (12):

Convolvulus arvensis L.
Convolvulus hystrix Vahl
Evolvulus alsinoides (L.) L.
Hildebrandtia africana Vatke subsp. *arabica* Sebsebe**.
Ipomoea dichroa Choisy.
Ipomoea eriocarpa R. Br.
Ipomoea nil (L.) Roth.
Ipomoea obscura (L.) Ker-Gawl.
Seddera arabica (Forssk.) Choisy.
Seddera latifolia Hochst. & Steud.
Seddera virgata Hochst. & Steud.
Seddera sp.

Boraginaceae (18):

Arnebia hispidissima (Lehm.) DC.
Cordia monoica Roxb.
Cordia nevillei Alston.
Cordia sinensis Lam.
Echium rauwolfii Delile.
Ehretia abyssinica R. Br. ex Fresen.
Ehretia obtusifolia Hochst. ex A. DC.
Heliotropium aegyptiacum Lehm.
Heliotropium bottae Defl*.
Heliotropium longiflorum (A. DC.) Jaub. & Spach var.
longiflorum.
Heliotropium ovalifolium Forssk.
Heliotropium pterocarpum (DC.) Hochst. & Steud. ex
 Bunge.
Heliotropium rariflorum Stocks.
Heliotropium strigosum Willd. var. *bicolor* (Hochst. &
 Steud.) Schwartz.
Heliotropium strigosum Willd. var. *cordofanum* (Hochst.)
 Schweinf.
Heliotropium zeylanicum (Burm. f.) Lam.
Heliotropium sp.
Trichodesma trichodesmoides (Bunge) Gürke.

Verbenaceae (5):

Chascanum marrubifolium Fenzl ex Walp.
Lantana camara L.
Lantana viburnoides (Forssk.) Vahl.
Phyla nodiflora (L.) Greene.
Priva adhaerens (Forssk.) Chiov.

Lamiaceae (Labiatae) (18):

Ballota sp.
Endostemon tenuiflorus (Benth.) M. Ashby.
Lavandula dhofarensis A. G. Miller**.
Lavandula pubescens Decne.
Lavandula setifera T. Anders.
Leucas alba (Forssk.) Sebald**.
Leucas glabrata (Vahl) R. Br. var. *glabrata*.
Leucas inflata Benth.
Leucas urticifolia (Vahl) Sm. var. *urticifolia*.
Micromeria imbricata (Forssk.) C. Chr.
Ocimum filamentosum Forssk.
Ocimum forsskaolii Benth.
Ocimum spicatum Defl.
Ocimum tenuiflorum L.
Otostegia fruticosa (Forssk.) Schweinf. ex Penz. subsp. *fruticosa*.
Plectranthus hyemalis J. R. I. Wood*.
Plectranthus montanus Benth.
Teucrium yemensense Defl**.

Plantaginaceae (1):

Plantago lanceolata L.

Oleaceae (2):

Jasminum grandiflorum L. subsp. *floribundum* (R. Br. ex Fresen.) P. S. Green.
Olea europaea L. subsp. *cuspidata* (Wall. Ex G. Don) Ciferri.

Scrophulariaceae (11):

Anticharis arabica Endl.
Anticharis glandulosa Aschers.
Anticharis senegalensis (Walp.) Bhandari
Campylanthus junceus Edgew.
Campylanthus yemenensis A. G. Miller*.
Kickxia scalarum Schweinf. ex D. A. Sutton**.
Kickxia woodii D. A. Sutton.
Schweinfurthia pedicellata (T. Anders.) Balf. f.
Schweinfurthia pterosperma (A. Rich.) A. Braun
Scrophularia arguta Sol.
Striga angustifolia (D. Don.) C. J. Saldanha.

Orobanchaceae (2):

Cistanche phelypaea (L.) Cout.
**Cistanche rosea* Bak.

Acanthaceae (28):

Acanthus arboreus Forssk*.
Anisotes trisulcus (Forssk.) Nees
Asystasia guttata (Forssk.) Brummitt.
Barleria acanthoides Vahl.
Barleria hildebrandtii S. Moore.
Barleria hochstetteri Nees.
Barleria parviflora R. Br. ex T. Anders.
Barleria prionitis L. subsp. *appressa* (Forssk.) Brummitt & J. R. I. Wood**.
Barleria proxima Lindau.
Barleria trispinosa (Forssk.) Vahl.
Barleria sp.

Blepharis ciliaris (L.) B. L. Burtt.
Crossandra johanninae Fiori.
Dyschoriste radicans Nees.
Ecbolium gymnostachyum (Nees) Milne-Redh.
Ecbolium viride (Forssk.) Alston.
Justicia calyculata Defl.
Justicia debilis (Forssk.) Vahl.
Justicia flava (Vahl) Vahl.
Justicia heterocarpa T. Anders. subsp. *heterocarpa*.
Justicia ladanoides Lam.
Justicia odora (Forssk.) Lam.
Lepidagathis calycina Hochst. ex Nees.
Megalochlamys violacea (Vahl) Vollesen.
Peristrophe paniculata (Forssk.) Brummitt.
Ruellia discifolia Oliv.
Ruellia patula Jacq.
Ruellia sp.

Pedaliaceae (1):

Pedaliium murex L.

Bignoniaceae (1):

Rhigozum somalense Hall. f.

Rubiaceae (4):

Kohautia aspera (Heyne ex Roth) Bremek.
Kohautia caespitosa Schnizl.
Pavetta longiflora Vahl subsp. *longiflora***.
Wendlandia arabica Defl. subsp. *arabica*.

Asteraceae (Compositae) (39):

Acanthospermum hispidum DC.
Bidens biternata (Lour.) Merr. & Sherff.
Blepharispermum yemensense Defl.
Blumea bovei (DC.) Vatke.
Echinops erinaceus Kit Tan**.
Eclipta prostrata (L.) L.
Erigeron bonariensis L.
Flaveria trinervia (Spreng.) C. Mohr.
Helichrysum glumaceum DC.
Iphiona mucronata (Forssk.) Asch. & Schweinf.
Iphiona scabra DC.
Kleinia odora (Forssk.) DC.
Kleinia pendula (Forssk.) DC.
Laggera decurrens (Vahl) F. N. Hepper & J.R. I. Wood.
Launaea intybacea (Jacq.) Beauverd.
Launaea massauensis (Fresen.) Sch. Bip. ex Kuntze.
Launaea petitiata (A. Rich.) N. Kilian.
Osteospermum vaillantii (Decne.) Norl.
Pegolettia senegalensis Cass.
Pluchea indica (L.) Less. subsp. *indica*.
Pluchea indica (L.) Less. subsp. *yemenensis* King-Jones*.
Pluchea ovalis (Pers.) DC.
Pseudoconyza viscosa (Mill.) D'Arcy.
Psiadia punctulata (DC.) Vatke.
Pulicaria jaubertii Gamal-Eldin.
Pulicaria petiolaris Jaub. & Spach.
Pulicaria schimperii DC.
Pulicaria somalensis O. Hoffm. subsp. *schweinfurthii* Gamal-Eldin**.
Reichardia tingitana (L.) Roth.
Sonchus oleraceus L.

Cont. Asteraceae (Compositae):

Tagetes minuta L.
Tridax procumbens L.
Vernonia arabica F. G. Davies.
Vernonia cinerascens Sch. Bib.
Vernonia cinerea (L.) Less.
Vernonia spatulata (Forssk.) Sch. Bip. ex Asch.
Volutaria albicaulis (Defl.) J. R. I. Wood**.
Xanthium spinosum L.
Xanthium strumarium L.

Arecaceae (Palmae) (2):

Hyphaene thebaica (L.) Mart.
Phoenix dactylifera L.

Commelinaceae (6):

Aneilema forskalei Kunth.
Commelina albescens Hassk.
Commelina benghalensis L.
Commelina erecta L.
Commelina forsskaolii Vahl.
Commelina imberbis Ehrenb. ex Hassk.

Cyperaceae (3):

Cyperus falcatus Nees.
Cyperus rotundus L.
Cyperus sp.

Poaceae (Gramineae) (49):

Aristida abnormis Chiov.
Aristida adscensionis L.
Aristida ferrilateris S. M. Phillips
Aristida mutabilis Trin. & Rupr.
Arundo donax L.
Brachiaria lata (Schumach.) C. E. Hubb.
Brachiaria leersioides (Hochst.) Stapf.
Brachiaria ovalis Stapf.
Cenchrus ciliaris L.
Cenchrus pennisetiformis Hochst. & Steud.
Chloris barbata Swartz.
Chrysopogon plumulosus Hochst.
Cymbopogon schoenanthus (L.) Spreng.
Dactyloctenium aegyptium (L.) Willd.
Dactyloctenium aristatum Link.
Dactyloctenium robecchii (Chiov.) Chiov.
Dactyloctenium scindicum Boiss.
Dichanthium foveolatum (Delile) Roberty.
Digitaria abyssinica (Hochst. Ex A. Rich.) Stapf.
Digitaria ciliaris (Retz.) Koeler.
Digitaria pennata (Hochst.) T. Cooke.
Echinochloa colona (L.) Link.
Echinochloa pyramidalis (Lam.) Hitchc. & Chase.
Enneapogon persicus Boiss.
Eragrostis aspera (Jacq.) Nees.
Eragrostis barrelieri Daveau.
Eragrostis cilianensis (All.) Vignolo ex Janch.
Eragrostis ciliaris (L.) R. Br.
Eragrostis lepida (A. Rich.) Hochst. Ex Steud.
Eragrostis minor Host.

Eragrostis papposa (Roem. & Schult.) Steud.
Eragrostis tremula (Lam.) Hochst. Ex Steud.
Hyparrhenia hirta (L.) Stapf.
Lasiurus scindicus Henrard.
Leptothrium senegalense (Kunth) Clayton.
Melinis repens (Willd.) Zizka.
Ochthochloa compressa (Forssk.) Hilu.
Odyssea mucronata (Forssk.) Stapf.
Panicum turgidum Forssk.
Paspalum dilatatum Poir.
Pennisetum setaceum (Forssk.) Chiov.
Setaria verticillata (L.) P. Beauv.
Sporobolus angustifolius A. Rich.
Stipagrostis lumose (Desf.) De Winter.
Stipagrostis lumose (L.) Munro ex T. Anders.
Tetrapogon cenchriformis (A. Rich.) Clayton.
Tetrapogon tenellus (K. D. Koenig ex Roxb.) Chiov.
Tetrapogon villosus Desf.
Tragus berteronianus Schult.

Agavaceae (1):

Agave sisalana Perrine.

Alliaceae (1):

Allium subhirsutum L.

Amaryllidaceae (1):

Crinum album (Forssk.) Herb**.

Asparagaceae (1):

Asparagus africanus Lam.

Aloaceae (7):

**Aloe inermis* Forssk*.
**Aloe irafensis* Lavranos, McCoy & Gifri*.
***Aloe niebuhriana* Lavranos**.
***Aloe officinalis* Forssk**.
Aloe rivierei Lavranos & L. E. Newton**.
Tetrapogon cenchriformis (A. Rich.) Clayton.
Aloe sabaea Schweinf**.
Aloe sp.

Dracaenaceae (3):

Dracaena ombet Kotschy & Peyr.
Sansevieria ehrenbergii Schweinf. Ex Bak.
Sansevieria forskaoliana (Schult. F.) Hepper & J. R. I. Wood.

Hyacinthaceae (4):

Albica abyssinica Jacq.
Dipcadi filifolium Bak.
Dipcadi serotinum (L.) Medic.
Dipcadi viride (L.) Moench.

Velloziaceae (1):

Xerophyta arabica (Bak.) N. Menezes**.

Colchicaceae (1):

Littonia revoliu Franch.

Orchidaceae (1):

Eulophia petersii (Reichb. F.) Reichb. F..

دراسات على فلورة اليمن : ٢ - محافظة لحج- اليمن

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تناولت الدراسة الحالية فلورة مديرية طور الباحة (محافظة لحج، الجمهورية اليمنية) بالتفصيل والتحليل حيث تقع منطقة الدراسة بين خطي عرض ١٢'٥٨ - ١٣'٢٠ شمالاً، وخطي طول ١١'٤٤ - ١٣'٤٤ شرقاً، بمساحة تقدر ١٨٨٣ كم مربع.

أجريت هذه الدراسة خلال الفترة ما بين ٢٠٠٨-٢٠١١م من خلال رحلة استكشافية تم فيها تحديد مائة موقع مختلف من أرجاء المديرية تمثلت فيها جميع الموائل المتوفرة في المديرية، وكذلك مناطق تواجد النباتات بكثافة عالية حيث نظمت رحلات دورية لمنطقة الدراسة كانت بمعدل ٤-٦ رحلات خلال الشهر الواحد، وازدادت هذه الرحلات في مواسم الأمطار، وكذا مواسم إزهار النباتات. فشملت الدراسة كلاً من المسطحات والكثبان الرملية، والوديان، والمرتفعات التلالية والجبلية بمختلف ارتفاعاتها عن سطح البحر.

وأسفرت الدراسة عن تسجيل ٥٦٠ وحدة تصنيفية تنتمي لـ ٢٨٨ جنساً في ٨٩ فصيلة نباتية. سجلت ثمانية أنواع تنتمي للنباتات السرخسية في حين سُجِّلَ نوعٌ واحدٌ في ضمن نباتات معراة البذور. بينما الباقي كان ضمن كل من نباتات ذوات الفلقتين (٤٧٠ نوعاً) ونباتات ذوات الفلقة الواحدة (٨١ نوعاً).

وأثبتت النتائج أن أكثر الفصائل النباتية تنوعاً وتمثيلاً كلٌّ من: الفصيلة النجيلية، المركبة، اللبينية (السوسبية)، الفراشية، الأكانثاسية، الكبارية، الشفوية، البوراجينية، الخبازية، الباذنجانية، الطحلية، الزيزافونية (التيلية)، الأمرانتية (عرف الديك)، القرعية، العليقية وفصيلة حنك السبع. وبيّنت النتائج أن أكثر من ٢٩ فصيلة نباتية تمثلت بنوع واحد فقط. واتضح أن أكثر الأجناس تنوعاً في ضمن فلورة طور الباحة هي:

Euphorbia, Acacia, Grewia, Heliotropium Indigofera, Barleria, Eragrostis, Aloe, Hibiscus, Solanum, Tephrosia, Cadaba, Crenulluma, Ficus, Justicia and Senna .

وتبين أن ١٨١ جنساً تمثلت في نوع واحد فقط. وأسفرت النتائج عن تسجيل ٦٨ نوعاً نباتياً تنتمي لمجموعة النباتات الغضة التي تقع في ١٨ عائلة نباتية، سجلت منها ٦ عائلات نباتية كانت الأكثر والأوفر بالأنواع النباتية الغضة، وهي: العائلة العشارية، اللبينية، الصبارية، الغاسولية، الكراسيوليسية والعنبية.

أما بخصوص الأنواع المستوطنة فقد أسفرت النتائج عن تسجيل ٢٨ نوعاً نباتياً من منطقة الدراسة مستوطناً في اليمن و ٣٤ نوعاً نباتياً آخر مستوطناً في اليمن والسعودية وعمان. ووجد من ضمن الأنواع المستوطنة في اليمن نوعاً ينتمي للعائلة العشارية (*Rhytidocaulon splendidum* T.A. AcCoy) متوطن في طورالباحة فقط.

ومن خلال النتائج المتوصل إليها تبين أن مديرية طور الباحة غنية جداً بالأنواع، وهي الأكثر تنوعاً وتبايناً، وتحتاج إلى اهتمام كبير وعناية خاصة لجعلها منطقة محمية، للحفاظ على التنوع النباتي فيها.