

Full Length Article

Floristic Composition of Eleven Wadis in Gebel Elba, Egypt

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ABSTRACT

A total of 377 species have been recorded in eleven surveyed wadis of Gebel Elba district; annuals (43.2%), perennials (56.2%). One-hundred fourteen species are confined and 57 species are recorded for the first time in this district. Taxa of Sahara regional subzone (SS₁), Arabian regional subzone (SS₂), Nubo-Sindian local centre of endemism (SS₃), Somalia-Masai regional centre of endemism (SM) and Sahel regional transition zone (Sa) are represented by higher numbers of plant species as compared with other floristic elements. Most of Gebel Elba species were pluri-regional (34.7%), followed by tri-regional (30.0%), bi-regional (25.7%) and mono-regional (9.5%). Fifty three species (14.1%) were cosmopolitan, pantropical or palaeotropical.

Key Words: Chronology; Plant-species composition; Gebel Elba

INTRODUCTION

Gebel Elba is considered as one of the distinct phytogeographical territories of Egypt (Friis, 1998; El-Hadidi, 2000). It lies between latitude 22°0' to 23°2' N, longitude 36°0' to 36° 55' E at south eastern corner of the Arabian desert of Egypt, covering approximately 10,000 km² and includes a group of six granite mountains, which are not far from the sea.

Gross geology and geomorphological features of Gebel Elba were adequately described by Ball (1912), Fahmy (1936), Said (1990) and Ayyad *et al.* (1993). It comprises a rugged mountainous country of high relief (up to 2117 m.a.s.l.) built upon basement rocks, in addition to small outcrops of low relief Miocene rocks and young sediments, exposed along the coastal plain. The basement is predominated by younger granites and meta-gabbros.

The main climatic characteristics of the Elba district seem to occupy an arid province (Ayyad & Ghabbour, 1986; El-Hadidi, 2000) with scanty rainfall during spring months (50-10 mm year⁻¹), mild air temperature in winter (18-22°C) and hot in summer months (28-33°C). The orographic condensation of cloud moisture forms an essential source of water for the plants in this district (Ayyad *et al.*, 1993).

El-Hadidi (2000) pointed out that the richness of the vegetation of Gebel Elba is notable, compared with other parts of the Eastern Desert. Some 427 species contribute to the flora of this district. Taxa of Sahelian regional transition zone and Nubo-Sindian local center endemism are well represented and are the main constituents of desert and mountain vegetation types. The vegetation types are recognized by Zahran and Willis (1992), Ayyad *et al.*

(1993), Zaki (2000) and Al-Gohary and Youssef (2002).

The present work is a follow up to earlier studies (Al-Gohary & Youssef, 2002) on the natural vegetation of Gebel Elba. This investigation was based on fieldworks throughout the region initiated in February 2000-2002 as well as study and revision of the collections of specimens kept in CAI, CAIM and CAIH (Abbreviations according to Holmgren *et al.*, 1990). The phytogeographical treatment of the present study is in accordance with White (1983) and the modifications phytochoria in North Africa and Southwest Asia by Léonard (1988 & 1989).

The studied wadis. The location of eleven wadis in Gebel Elba (W. Di-ib, W. Bashowia, W. Aideib, W. Yahamib, W. Acow, W. Kansisrob, W. Tetuila W. Sarimatai, W. Merikwan, W. Shellal & W. Hedriba) is represented in Fig. 1.

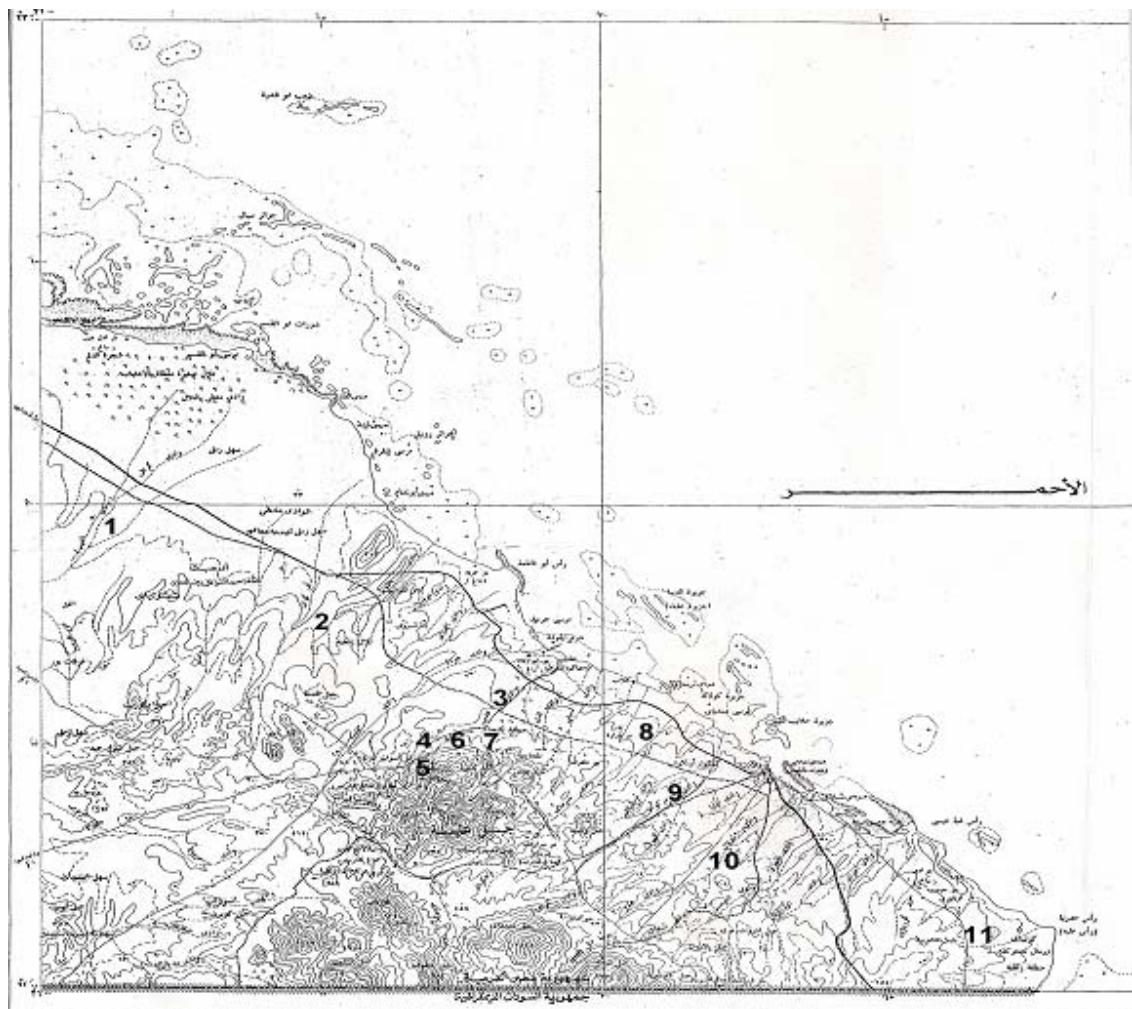
Wadi Di-ib rises far to the south, probably near the 20th parallel and flows generally northwards, so that its length must be well over 300 km. It enters Egypt a little west of the 36th meridian as a broad sandy drainage channel. Its floor in many places instead of being sandy, consists of mud similar to that of the Nile Valley (Ball, 1912). The Di-ib system ends into the sea 86 km south of Shalatin.

Wadi Bashowia (8 km) is the main drainaing Gebel Elba complex towards the east. It is the first one to the north draining the undulated gravelly piedmont, about 15 km to the north of Abu Ramad.

Wadi Aideib (20 km) is one of the important drainage lines running into the Red Sea. Its downstream part drains the north-east flanks for about 2 km south of Abu Ramad village.

Wadi Acow (5 km) and W. Kansisrob (3.5 km) drainage lines originated on the north-west flank of Gebel Elba where big boulders cover the steep slopping stony

Fig. 1. Studied areas of wadis in Gebel Elba district



- | | | |
|----------------|-----------------|----------------|
| 1. W. Di-ib | 5. W. Acow | 9. W. Merkwán |
| 2. W. Bashowia | 6. W. Kansisrob | 10. W. Shellal |
| 3. W. Aideib | 7. W. Tetuila | 11. W. Hedriba |
| 4. W. Yahamib | 8. W. Sarimatai | |

plains then pouring down in W. Yahamib (11 km). The latter Wadi is fed, just before it joins W. Aideib, with about (3.5 km) by the W. Acow and about (2.5 km) by W. Kansisrob. Wadi Tetuila (2.7 km) originates on the north-east flank of Gebel Elba and pouring down in W. Aideib south the joint of W. Yahamib with about (2.5 km).

Wadi Sarimatai is drainage line with its main head situated in the Sudan, near the great mountain of Asotriba (2217 m). It enters Egypt at longitude 36°22', coursing northward between Gebel Hanquf and Gebel Shendodai. The length of this Wadi in Egypt is 45 km. It lies 16 km to the south of Abu-Ramad village.

Wadi Merikwan (27 km) originates on the north-east flank of Gebel Shendodai (1446 m) and pouring down in the Red Sea for about 20 km south of Abu-Ramad.

Wadi Shellal (30 Km) runs between the high mountain masses of Gebel Shendodai and Shellal and courses north-

east for about four km south-east of Haliab. In its lower part, where it crosses the coastal plain, it is a broad shallow drainage channel full of scrub (Ball, 1912).

Wadi Hedriba (nine km) extends from south-east Elba mountains to Mersa Halaib (latitude 22°N) at the Sudano-Egyptian borders and drains north-east flanks for about 30 km south Halaib at Ras Hedriba.

Vegetation. Three main types of vegetation are distinguished in studied Wadis of Gebel Elba: littoral salt marshes, desert and mountain vegetation (Kassas & Zahran, 1971; Zahran & Willis, 1992; Ayyad *et al.*, 1993; Zaki, 2000; Al-Gohary & Youssef, 2002). Plant collections were mainly identified according to Täckholm (1974), updated by Boulus (1999-2005) and El-Hadidi (2000). Voucher specimens were deposited in the Herbarium of the Desert Research Centre (CAIH).

The vegetation of the littoral salt marshes is arranged

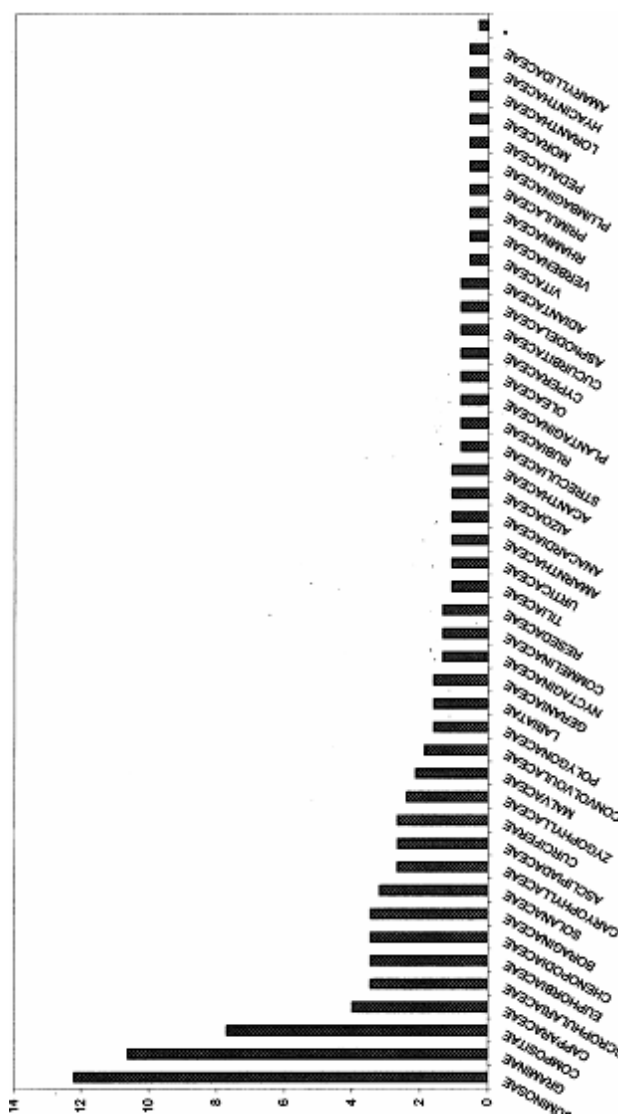
into zones running parallel to the shoreline. The common communities occupy the wet salt-marsh zones in most studied Wadis draining to the Red Sea are dominated by *Zygophyllum album* and in certain areas, *Arthrocnemum macrostachyum* and/or *Halopeplis perfoliata* (Table I). The following inland strip is dominated by *H. perfoliata* with *Salsola imbricata* subsp. *imbricata*. The dry salt marshes, which occupy the more elevated inland zones are dominated by *Limonium axillare*, *Suaeda monoica*, *H. perfoliata*, *Aeluropus littoralis*, *Atriplex farinosa* and *Anabasis articulata*. Zaki (2000) recorded community type dominated by *Z. album* and *H. perfoliata* with *S. imbricata* in the littoral salt marshes of Wadi Sarimatai and *A. macrostachyum* - *Z. album* community in W. Bashowia. Al-Gohary and Youssef (2002) stated that the vegetation of the littoral zone of W. Aiedeib is very poor except for some salt tolerant halophytes, *Z. album*, *A. littoralis*, *S. monoica*, *S. imbricata* and *Cyperus conglomeratus*.

Desert plains occupy midland belt between the littoral salt marshes and the ranges of hills and mountains. Several community types are recorded in the studied wadis including desert grassland, community dominated by *Panicum turgidum* in W. Di-ib, W. Bashowia and W. Merikwan and desert shrub communities dominated by *Acacia tortilis* subsp. *tortilis*, *Capparis decidua* and *Lycium shawii* with dense cover of *Zygophyllum simplex* dominating the ground layer in other Wadis. Common associate species are, *Cadaba farinosa*, *Maerua crassifolia*, *Acacia tortilis* subsp. *raddiana*, *Balanites aegyptiaca*, *Leptadenia pyrotechnica*, *Aerva javanica* var. *javanica* and *Tephrosia nubica* together with rare confined individuals of *Crotalaria senegalensis*, *C. impressa*, *Solanum forsskaolii*, *Ifloga spicata* subsp. *elbaensis*, *Ophioglossum polyphyllum* and *Zaleya decandra* etc. (Table I).

Kassas and Zahran (1971) stated that the inland side of delta W. Di-ib is choked with sand dunes covered and stabilized by *Suaeda monoica*, which forms what looks like a forest of green dunes, with plant cover reaching 70-80%. The coastal plain of W. Bashowia, its plant cover is a good example of the savanna vegetation type, in which shrubs of *Acacia tortilis* subsp. *tortilis* dominate and are associated with *Capparis decidua*, *Cadaba farinosa* and *Lycium shawii*, while *Panicum turgidum* dominates the ground layer. Al-Gohary and Youssef (2002) stated that, within the bounding hills and mountainous area of W. Aiedeib and W. Tetuila *A. tortilis* subsp. *tortilis* community abounds and formed open-like forests with common *Zygophyllum simplex*, which dominates the ground layer.

The vegetation of mountainous country is rich in species and the density of individuals is greater as compared to those inhabiting the exposed open coastal stretch. Kassas and Zahran (1971) and Zahran and Willis (1992) reported that the whole slopes of mountains face a northeast bend of the shore to an almost endless stretch of water. The vegetation on the north and northeast flanks is much richer than that on the south and southwest. Three altitudinal zones

Fig. 2. Histogram showing the percentage of the species in each of the 74 families recorded in the surveyed wadis of Gabel Elba * refers to 29 families represented by one species



of the vegetation are recognized on north and north-eastern slopes of Gebel Elba: a lower zone of *Acacia tortilis* subsp. *tortilis* with common species *Euphorbia consobrina*, *E. cuneata*, *Abutilon fruticosum*, *Trichodesma africanum*, *Ochradenus baccatus*, *Aerva javanica* var. *javanica* and rare confined species e.g., *Forsskaolea viridis*, *Kickxia hastata*, *Aerva lanata*, *Solanum nigrum* var. *elbaensis*, *S. forsskaolii*, *Scrophularia arguta* and *Hibiscus micranthus*; a middle zone of *A. tortilis* subsp. *tortilis*, *Ocimum forsskaolii*, *Withania obtusifolia*, *Grewia villosa*, *Helichrysum glumaceum*, *Leucasneuflyzeana* and *Commiphora gileadensis* and a higher zone of *Acacia etbaica*, *Dodonaea viscosa*, *Dracaena ombet*, *Euclea racemosa* subsp. *schimperii*, *Ficus cordata* subsp. *salicifolia*, *Pistacia khinjuk* var. *glabra* and *Rhus abyssinica* (Fig. 2). Within these higher altitudes ferns, mosses and liverworts abound (Table I).

Table I. A detailed chorological analysis of the flora of studied wadis in Gebel Elba district

No.	Species	Habit	Location											Chorology		
			1	2	3	4	5	6	7	8	9	10	11			
1.	<i>Abutilon fruticosum</i>	P			+	+	+	+	+	+						GC+SM+SS _{2,3} +D
2.	<i>A.longicuspe*</i>	P			+	+										E/Sa+SA
3.	<i>A. pannosum</i>	P		+	+	+	+							+	+	Su+SS _{2,3} +D
4.	<i>Acacia asak*</i>	P			+		+									E/Sa+SA +Eth.
5.	<i>A. ehrenbergiana</i>	P		+	+		+								+	Sd+SS _{1,2} +Eth.
6.	<i>A. etbaica</i>	P			+	+	+	+	+	+						SM+SS ₂
7.	<i>A. laeta</i>	P			+	+	+									GC+SM+E/Sa
8.	<i>A. mellifera</i>	P			+	+	+	+								SM+ KN +E/Sa + SA
9.	<i>A.nilotica</i> subsp. <i>Nilotica</i>	P				+										Sd
10.	<i>A.nilotica</i> subsp. <i>tomentosa</i>	P			+											SM+E/Sa
11.	<i>A.oerfota</i> var. <i>oerfota*</i>	P			+	+										SM+ E/Sa + SA
12.	<i>A. seyal</i>	P	+					+								SM+ E/Sa +SA
13.	<i>A. tortilis</i> subsp. <i>Radiana</i>	P		+			+	+	+	+	+	+	+	+	+	Su+SM+SS ₁
14.	<i>A. tortilis</i> subsp. <i>Tortilis</i>	P	+	+	+	+	+	+	+	+	+	+	+	+	+	SM+SS _{1,2} +S/Afr.
15.	<i>Actinoptery semiftabellata*</i>	P					+									SM+ E/Sa +SA+ Ma
16.	<i>Aerva javanica</i> var. <i>javanica</i>	P	+	+	+	+	+	+	+	+	+	+	+	+	+	KN+Sa+SS
17.	<i>A. lanata*</i>	P				+	+									KN+Sa+SS
18.	<i>Aeluropus lagopoides</i>	P				+								+	+	SS _{2,3} +Md+D+Cent. As.
19.	<i>A. littoralis</i>	P		+												Md+Cent.As.
20.	<i>Aizoon canariense</i>	A	+	+	+	+	+	+	+	+	+	+	+	+	+	GC+SM+SS
21.	<i>Amaranthus graecizans</i> subsp. <i>graecizans</i>	A	+		+	+	+									Pal
22.	<i>Anabasis setifera</i>	P		+	+											SS
23.	<i>Anagallis arvensis</i> var. <i>arvensis</i>	A			+	+	+		+	+	+					Cos
24.	<i>A. arvensis</i> var. <i>caerulea</i>	A				+	+									Cos
25.	<i>Anastatica hierochuntica</i>	A		+						+	+	+	+	+		SS
26.	<i>Andrachne aspera</i>	P			+		+							+	+	Su+SM+SS
27.	<i>Aneilemai aequinoctiale*</i>	P				+	+								+	GC+Z+Su+SM+KH
28.	<i>Anogramma leptophylla*</i>	P					+	+								Pan.
29.	<i>Anthemis melampodina</i> subsp. <i>deserti**</i>	A	+		+											Md+IT ₁
30.	<i>Anticharis Arabica</i>	A	+											+	+	Sd+SS ₂
31.	<i>A. glandulosa</i>	A	+		+											SM+Sa+SS _{2,3} +D
32.	<i>A. linearis</i>	A		+		+									+	SM+KN+E/Sa+SS _{2,3} +D
33.	<i>Argyrolobium arabicum</i>	A			+	+								+	+	Sd+A+SS ₂
34.	<i>Aristida adscensionis</i>	A	+	+	+	+	+	+	+	+	+	+	+	+	+	Pal
35.	<i>A. funiculata</i>	A			+	+	+	+	+							Su+SM+SS+D
36.	<i>A. mutabilis</i>	A			+		+							+	+	Sa+SS+D
37.	<i>Aristolochia bracteolata*</i>	P			+		+	+								GC+SM+SS _{2,3} +D
38.	<i>Arnebia hispidissima</i>	A	+	+	+	+	+	+	+	+	+	+	+	+	+	GC+Su+Sa+SS _{2,3}
39.	<i>Arthrocnemum macrostachyum</i>	A		+												SS ₁ +Md+IT ₂ +D
40.	<i>Asphodelus tenuifolius</i>	A	+	+	+	+	+	+	+	+	+	+	+	+	+	SM+SS+Md+IT ₂
41.	<i>A. viscidulus**</i>	A	+											+	+	SS ₂ +IT _{1,2}
42.	<i>Astragalus annularis**</i>	A	+													SS _{1,2} +IT _{1,2}
43.	<i>A. eremophilus</i>	A	+	+												SS
44.	<i>A. peregrinus**</i>	A														SS ₁ +IT ₁
45.	<i>A. vogelii</i> subsp. <i>Vogelii</i>	A		+											+	SS ₁ +Eth.
46.	<i>Balanites aegyptiaca</i>	P	+	+		+	+									GC+SM+SS ₂
47.	<i>Bassia muricata</i>	A	+			+										SS _{1,2} +Md+IT ₂
48.	<i>Bidens bipinnata*</i>	A				+	+	+								Pan
49.	<i>B.schimperi*</i>	A				+	+	+								Su+SM+Sa+S/Afr.
50.	<i>Blepharis edulis</i>	P	+			+	+									Sd+SM+SS ₂ +IT ₂
51.	<i>Boerhavia diffusa**</i>	P			+											Pan
52.	<i>B. elegans*</i>	P				+	+									SS+Eth.+D
53.	<i>B. repens</i> subsp. <i>repens**</i>	P				+										Pal
54.	<i>Boscia angustifolia*</i>	P					+									Su+E/Sa+SA +Eth.
55.	<i>B. senegalensis*</i>	P					+									Sa+Eth.
56.	<i>Bromus pectinatus**</i>	A		+	+		+	+	+	+						SM+E/Sa+SS ₂ +S/Afr.
57.	<i>Cadaba farinose</i>	P		+	+											GC+SM+Sa+SS _{2,3} +D
58.	<i>C. glandulosa</i>	P		+	+											Su+SM
59.	<i>C. rotundifolia</i>	P		+												SM+E/Sa+SS ₂
60.	<i>Calligonum polygonoides</i> subsp. <i>Comosum</i>	P				+								+	+	E/Sa+SS _{2,3}
61.	<i>Calotropis procera</i>	P	+	+		+										GC+Sd+SM+SS+D
62.	<i>Capparis deciduas</i>	P	+	+												SM+SS
63.	<i>C. sinaica</i>	P	+													SM+KN+E/Sa+SS _{2,3} +D
64.	<i>Caralluma acutangula*</i>	P														SM+Sa+SS _{2,3}
65.	<i>C.edulis*</i>	P		+												SM+Sa+SS _{2,3} +D
66.	<i>Carissa spinarum*</i>	P			+											Pal

Table I. Continued

Table I. Continue

		1	2	3	4	5	6	7	8	9	10	11	
67.	<i>Caylusea hexagyna</i>	A	+	+	+	+	+	+	+	+	+	+	SM+SS+IT ₂
68.	<i>Cayratia ibuensis*</i>	P			+	+		+					Pal
69.	<i>Cenchrus ciliaris</i>	P			+	+	+	+					GC+SM+SS+S/Afr.+D
70.	<i>C. pennisetiformis</i>	A	+	+	+	+			+		+		SM+E/Sa+SS _{2,3} +D+Au
71.	<i>C. setiger</i>	P			+	+	+	+	+		+	+	Pal
72.	<i>Centaurea aegyptiaca</i>	B				+				+	+		SS ₂ +IT ₁
73.	<i>C. pumilio**</i>	P							+				SS ₁ +IT ₁
74.	<i>Centropodia forsskaolii</i>	P	+	+		+			+	+	+		GC+SM+SS+Cent. As.
75.	<i>Cheilanthes coriacea*</i>	P				+							SM+E/Sa+SS _{2,3}
76.	<i>Chenopodium murale</i>	A	+		+	+	+	+	+	+	+	+	Cos
77.	<i>Chrozophora oblongifolia</i>	P	+	+	+	+	+	+	+	+	+	+	SM+SS
78.	<i>C. plicata**</i>	P	+	+					+	+	+		GC+SM+SS ₂
79.	<i>C. tinctoria</i>	A	+	+		+			+		+		SS ₁ + Md+IT+Cent. As.
80.	<i>Cissus quadrangularis*</i>	P			+	+		+					Pal
81.	<i>Cistanche tubulosa var. tubulosa</i>	P	+						+				SS ₁ +IT+Cent. As.
82.	<i>Citrullus colocynthis</i>	P	+	+	+	+	+		+	+	+	+	SM+SS
83.	<i>Cleom amblyocarpa</i>	A	+	+	+	+			+	+	+		SM+SS _{1,2} +IT ₂
84.	<i>C. chrysantha</i>	P		+					+	+			SS _{1,2} +IT ₂ +Eth.
85.	<i>C. droserifolia</i>	P		+					+		+		SS _{1,2} +IT ₁
86.	<i>C. paradoxa</i>	P		+					+				E/Sa+SS ₂ +Eth.
87.	<i>C.scaposa</i>	A				+	+	+		+			GC+SM+SS
88.	<i>Clitoria ternatea**</i>	P					+			+		+	Pan
89.	<i>Cocculus pendulus</i>	P			+		+		+			+	Pal
90.	<i>Coelachyrum brevifolium</i>	A	+		+	+	+	+	+	+	+		SM+SS _{1,2}
91.	<i>Cometes abyssinica</i>	A	+		+	+	+	+	+	+	+	+	SM+E/Sa+SS ₂
92.	<i>Commelina africana*</i>	P			+				+				GC+SM+SA+Au
93.	<i>C. benghalensis*</i>	P			+	+					+		Pal
94.	<i>C.forsskaolii</i>	A			+				+				Pal
95.	<i>C.latifolia*</i>	P				+			+		+		Su+SM
96.	<i>Commicarpus africanus*</i>	P			+		+		+	+	+		SM+SS ₂
97.	<i>C.helena</i>	P			+	+			+				GC+SM+SS ₂ +D
98.	<i>Commiphora gileadensis*</i>	P			+	+	+	+	+		+	+	E/Sa+SS ₂
99.	<i>Convolvulus hystrix</i>	A		+		+	+		+		+		Sd+SM+SS ₂
100.	<i>C. prostrates</i>	P				+	+	+		+	+	+	Sd+SS ₂
101.	<i>Corchorus depressus</i>	P			+	+	+	+		+	+		GC+SM+SS+D
102.	<i>Cordia sinensis</i>	P				+	+		+			+	GC+Su+SM+SS _{2,3} +D
103.	<i>Cornulaca monacantha**</i>	P	+			+				+			GC+SS
104.	<i>Cotula cinerea**</i>	A	+	+					+		+	+	SM+Sa+SS _{1,2} +Eth.
105.	<i>Crotalaria aegyptiaca</i>	A		+						+			SM+SS _{2,3}
106.	<i>C. impressa*</i>	A	+		+	+	+		+	+	+		SM+E/Sa
107.	<i>C. microphylla*</i>	A	+		+				+		+	+	SM+ Sa +SA
108.	<i>C. senegalensis*</i>	A				+							GC+SM+SA+S/Afr.
109.	<i>Cucumis prophetarum subsp. Prophetarum</i>	P			+	+	+	+	+	+	+	+	SM+Sa+SS
110.	<i>C. pustulatus*</i>	P			+		+	+					Su+SM+SS _{2,3}
111.	<i>Cuscuta chinensis*</i>	A				+	+				+		Pal
112.	<i>Cymbopogon schoenanthus subsp. proximus</i>	P				+	+			+	+	+	SM+Sa+SS ₁
113.	<i>Cynodon dactylon</i>	P			+	+	+	+	+	+	+	+	Pan
114.	<i>Cyperus conglomerates</i>	P	+	+	+				+	+	+	+	SM+Sa+SS+IT _{1,2}
115.	<i>C. esculentus</i>	P				+						+	Pan
116.	<i>C. laevigatus var.laevigatus</i>	P			+					+	+	+	Pan
117.	<i>Dactyloctenium aristatum*</i>	A				+	+		+	+	+	+	SM+SS
118.	<i>D. scindicum</i>	P			+	+	+	+	+	+	+	+	SM+SS
119.	<i>Delonix elata*</i>	P					+						GC+SM+E/Sa+SS ₂ +D
120.	<i>Desmostachya bipinnata</i>	P			+		+		+				Pal
121.	<i>Diceratella elliptica*</i>	A				+	+			+		+	SM+E/Sa
122.	<i>Dicoma schimperii</i>	P				+	+	+	+				SS+D
123.	<i>D. tomentosa*</i>	A							+				GC+SM+KN+SS
124.	<i>Digitaria ciliaris*</i>	A				+	+					+	Pal
125.	<i>D. nodosa*</i>	P				+		+					E/Sa+SS
126.	<i>D. velutina*</i>	A				+	+			+		+	Su+E/Sa+SA+S/Afr.
127.	<i>Dipcadi erythraeum</i>	P	+						+				SS ₂ +E/ Md
128.	<i>D. viride*</i>	P				+			+				Pal
129.	<i>Dipterygium glaucum</i>	P	+	+					+	+			SM+SS+IT ₂
130.	<i>Dodonaea viscosa*</i>	P				+							Pan
131.	<i>Dracaena ombet*</i>	P				+							SM+E/Sa
132.	<i>Echinochloa colona</i>	A				+	+		+	+	+	+	Pan
133.	<i>E. stagnina</i>	P				+	+			+	+	+	pal
134.	<i>Echinops hussonii</i>	P				+			+				E/Sa+SS ₂
135.	<i>E. spinosus**</i>	P				+			+		+		SS ₂ +Md
136.	<i>Echium horridum</i>	A									+		SS _{1,2}

Table I. Continued

Table I. Continue

		1	2	3	4	5	6	7	8	9	10	11	
137.	<i>E. longifolium</i> **	A									+		SS _{1,2}
138.	<i>Elionurus royleanus</i>	A	+		+	+	+	+		+			SS
139.	<i>Enicostema axillare</i> *	P			+		+	+					SM+E/Sa+SS ₂
140.	<i>Ephedra ciliata</i>	A	+		+	+			+		+		SS
141.	<i>Eragrostis aegyptiaca</i> subsp. <i>Aegyptiaca</i>	A			+					+	+	+	Sa+SS ₁
142.	<i>E. aspera</i>	A								+	+		pal
143.	<i>E. barrelieri</i>	A			+							+	SM+SS+Md
144.	<i>E. ciliansasis</i>	A	+	+	+	+		+	+	+	+		Pal
145.	<i>E. ciliaris</i>	A	+	+	+	+	+	+	+			+	Pan
146.	<i>E. lepida</i> *	A			+					+			SM+E/Sa+SS ₂
147.	<i>E. tremula</i> **	A			+						+	+	pal
148.	<i>Eremobium aegyptiacum</i> var. <i>aegyptiacum</i> **	P	+	+	+	+			+		+		SS _{2,3}
149.	<i>Erodium crassifolium</i>	P	+							+		+	SS _{2,3} +Md
150.	<i>E. laciniatum</i> subsp. <i>laciniatum</i>	A			+	+	+				+		SS _{2,3} +Md
151.	<i>E. neuradifolium</i>	A		+		+						+	Sd+SM+SS+Md
152.	<i>Euclea racemosa</i> subsp. <i>schimperi</i> *	A				+				+			GC+Z+SM+E/Sa+SS ₂
153.	<i>Euphorbia arabica</i> *	A	+		+	+	+	+	+	+	+		SM+E/Sa+SS ₂
154.	<i>E. consobrina</i>	P	+		+	+	+	+	+		+		SM+E/Sa+SS ₂
155.	<i>E. cuneata</i>	P	+			+	+	+	+		+		SM+ZI+E/Sa+SS ₂
156.	<i>E. forssikaolii</i>	A	+		+	+	+	+			+		SS _{1,2} +IT ₂ +Eth.
157.	<i>E. granulata</i> var. <i>granulate</i>	P	+	+	+	+	+	+	+		+	+	GC+SM+SS+IT ₁ +Cent. As.
158.	<i>E. scordifolia</i>	A	+						+				SM+SS ₂
159.	<i>Evolvulus alsinoides</i> *	P	+		+						+		pal
160.	<i>Fagonia cretica</i> **	P	+			+			+		+	+	SS ₁ +Md
161.	<i>F. indica</i> var. <i>indica</i>	P	+	+	+	+	+	+	+		+		SM+Sa+SS+D
162.	<i>F. paulayana</i>	P	+	+						+	+	+	SM+E/Sa+SS ₂
163.	<i>Faidherbia albida</i> **	P								+			pal
164.	<i>Farsetia aegyptia</i> subsp. <i>aegyptia</i> **	P	+	+						+	+		SS+Md
165.	<i>F. longisiliqua</i>	P	+		+	+	+	+	+	+	+		Sd+SM+SS ₂
166.	<i>Ficus cordata</i> subsp. <i>salicifolia</i>	P			+	+	+	+				+	GC+SM+SA+E/Sa+S/Afr.
167.	<i>F. Palmata</i>	P				+			+				Sd+SM+SS _{2,3} +E/Md
168.	<i>Filago desertorum</i> **	A								+			SS+E/Md
169.	<i>Forsskaolea tenacissima</i>	P		+	+	+	+	+	+	+		+	SM+SS+Md
170.	<i>F. viridis</i> *	P				+	+	+	+		+		SM+E/Sa+SS
171.	<i>Galium mollugo</i> *	P			+	+	+	+					E/Sa+Md+W/As.+Eu.
172.	<i>Galium setaceum</i> **	A			+	+							SS _{2,3} +Md+D
173.	<i>Geigeria alata</i> *	A	+						+		+		Z+Su+SM+Sa+SS _{1,2}
174.	<i>Geranium molle</i> **	A				+	+						SS ₁ +W/As.+Eu
175.	<i>G. trilophum</i> *	A				+	+					+	SM+E/Sa+SS ₂
176.	<i>Gisekia pharmacoides</i> var. <i>pharmacoides</i>	A	+	+		+			+	+	+		SM+SS _{2,3} +Ma+D
177.	<i>Globularia arabica</i> **	P								+	+		Sd+SM+SS _{1,2} +IT ₁
178.	<i>Glossonema boveanum</i> subsp. <i>Nubicum</i>	P		+								+	SM+SS _{1,2}
179.	<i>Grewia tenax</i>	P			+	+		+					GC+SM+SS+D
180.	<i>G. villosa</i> *	P			+		+	+					GC+SM+E/Sa+SS+D
181.	<i>Gymnarrhena micrantha</i> **	A			+								SS+IT ₁
182.	<i>Gymnocarpus decandrus</i> **	P	+						+				SS
183.	<i>Halopeplis perfoliata</i> **	A	+	+					+	+		+	SS
184.	<i>Haplophyllum tuberculatum</i>	P	+			+				+			SS+E/Md
185.	<i>Helichrysum glumaceum</i> *	P				+	+						GC+SM+E/Sa
186.	<i>Heliotropium arbainense</i> **	P			+	+	+	+		+		+	Sd+SS ₂ +Ma
187.	<i>H. bacciferum</i> subsp. <i>bacciferum</i>	P	+	+	+	+	+	+		+	+	+	Sd+SS+E/Md
188.	<i>H. pterocarpum</i>	A	+			+	+	+					Sd+SM+SS ₂
189.	<i>H. supinum</i> **	A	+							+	+		GC+SM+SS+Md+IT ₁
190.	<i>H. zeylanicum</i> *	P				+	+	+		+			GC+SM+E/Sa+SS ₂ +D
191.	<i>Hibiscus vitifolius</i> *	A				+	+						pal
192.	<i>Hyoscyamus boveanus</i> *	P	+										End.
193.	<i>H. muticus</i>	P			+					+	+		SS+D
194.	<i>Hyparrhenia hirta</i>	P								+			SS+Md+S/Afr.
195.	<i>Ifloga spicata</i> subsp. <i>elbaensis</i> *	P			+	+	+	+	+	+	+		End.
196.	<i>Indigofera articulata</i>	P		+		+		+				+	Sd+SM+SS ₂
197.	<i>I. hochstetteri</i>	A								+	+		GC+SM+SS+D
198.	<i>I. oblongifolia</i>	P										+	Su+SM+SS ₂
199.	<i>I. spinosa</i>	P				+	+			+	+		SM+SS ₂
200.	<i>I. trita</i> subsp. <i>subulata</i> var. <i>nubica</i> *	P	+	+						+	+		SM+E/Sa
201.	<i>Iphiaon mucronata</i> **	P			+	+	+		+			+	SS ₂
202.	<i>I. scabra</i>	P	+			+				+	+	+	Sd+SS _{2,3} +Eth.
203.	<i>Ipomoea obscura</i> *	P				+	+						pal
204.	<i>I. sinensis</i> subsp. <i>blepharosepala</i>	A				+	+				+		Z+SM+KH+SS ₂
205.	<i>Jasminum fluminense</i> subsp. <i>gratissimum</i> *	P				+							E/Sa+SS ₂ +Eth.

Table I. Continued

Table I. Continue

		1	2	3	4	5	6	7	8	9	10	11	
206.	<i>J. grandiflorum</i> subsp. <i>floribundum</i> *	P			+								SM+E/Sa+SS ₂
207.	<i>Justicia heterocarpa</i> subsp. <i>heterocarpa</i> *	A	+		+				+				SM+E/Sa+SS ₂
208.	<i>J.ladanoides</i> *	A				+			+				Su+SM+Sa
209.	<i>Kickxia acerbiana</i>	A	+							+			SS _{1,2} +E/Md
210.	<i>K. aegyptiaca</i> subsp. <i>aegyptiaca</i> **	P							+				SS _{1,2} +E/Md
211.	<i>K. hastate</i> *	A			+	+	+		+	+			E/Sa+SS ₂ +Eth.
212.	<i>K. heterophylla</i>	P	+			+			+		+		Sa+SS ₁
213.	<i>K. scoparia</i> *	P				+	+		+	+	+	+	Sd+SS ₂
214.	<i>Lantana viburnoides</i> *	P				+		+					Z+Sd+SM+ZI+SS ₂
215.	<i>Launea amal-aminea</i> **	P				+			+	+			SS _{1,2}
216.	<i>L. capitata</i>	A	+	+	+	+	+	+	+	+	+	+	Sa+SS
217.	<i>L. massauensis</i>	A			+	+	+	+	+	+			Sd+SM+SS _{2,3}
218.	<i>L. nudicaulis</i>	P	+	+	+	+	+	+	+	+	+	+	SS+Md+IT ₁
219.	<i>L. procumbens</i> **	P							+			+	SS _{2,3} +Md+D+W/As.
220.	<i>Lavandula coronopifolia</i>	P				+	+	+	+		+		SS _{1,2}
221.	<i>Leptadenia pyrotechnica</i>	P	+	+		+			+		+		SM+SS+D
222.	<i>Leucas neuflyzeana</i> *	A				+	+						SM+E/Sa+SS ₂
223.	<i>Limonium axillare</i>	P		+						+		+	SM+E/Sa+SS ₂
224.	<i>Lindenbergia indica</i>	P	+			+	+		+		+		SM+SS ₂ +D
225.	<i>Lotononis platycarpa</i>	A	+						+				SS
226.	<i>Lotus glaber</i> **	A		+					+				Md+Cent. As.+IT+Eu
227.	<i>L. glinoides</i>	A	+						+				SS
228.	<i>L. hebranicus</i>	A	+	+					+		+		SM
229.	<i>L. nubicus</i>	A			+	+	+			+		+	E/Sa
230.	<i>Lupinus angustifolius</i> **	A				+							Md
231.	<i>Lycium shawii</i>	P	+	+	+	+	+	+	+	+	+	+	Sd+SS ₂
232.	<i>Maerua crassifolia</i>	P		+	+	+	+		+	+	+	+	GC+SM+SS
233.	<i>M. oblongifolia</i> *	P		+	+	+	+	+	+	+	+	+	GC+SM+SA
234.	<i>Malva parviflora</i>	A	+		+	+	+	+	+	+	+	+	SS1+IT+Eu
235.	<i>Matthiola longipetala</i> subsp. <i>longipetala</i> **	A		+									SS2+Md+IT ₂
236.	<i>Maytenus senegalensis</i> *	P				+	+	+					GC+SS+D
237.	<i>Melanocentris abyssinica</i>	A	+					+					SM+E/Sa+SS _{2,3} +D
238.	<i>Melhania denhamii</i> *	P		+	+	+		+		+			SM+SS+D
239.	<i>Micromeria imbricata</i> *	p				+		+	+				SS _{2,3} +Cent. As.
240.	<i>Misopates orontium</i>	A				+							SS ₁ +Cent. As.+Eu
241.	<i>Monsonia nivea</i>	P	+	+		+			+			+	E/Sa+SS
242.	<i>Morettia philaeana</i>	P		+								+	Sd+SM+SS _{1,2}
243.	<i>Moringa peregrine</i>	P				+			+				Sd+SM+SS _{2,3}
244.	<i>Neurada procumbens</i>	A	+	+					+		+		Sd+SS+E/Md+Eth.
245.	<i>Nitraria retusa</i>	P	+										SS+IT ₁
246.	<i>Noaea mucronata</i> **	A							+				SS+Cent. As.
247.	<i>Notoceras bicorne</i>	A							+				SS+Md
248.	<i>Ochradenus baccatus</i>	P	+	+	+	+	+	+				+	SM+SS
249.	<i>Ocimum forsskaolii</i>	P				+	+						SM+E/Sa+SS ₂
250.	<i>Olea europaea</i> subsp. <i>cuspidata</i>	P				+							GC+SM+E/Sa+SS _{2,3} +Cent. As.
251.	<i>Oligomeris linifolia</i> **	A			+								Pan
252.	<i>Onychium divaricatum</i> *	P				+	+						SS+D
253.	<i>Ophioglossum polyphyllum</i> *	P				+	+	+	+				SS
254.	<i>Osteospermum vaillantii</i>	P				+					+		SM+E/Sa+SS ₂
255.	<i>Otostegia fruticosa</i> subsp. <i>Fruticosa</i>	P				+	+		+		+		SM+E/Sa+SS ₂
256.	<i>Oxalis anthelmintica</i> *	P				+				+			GC+SM+E/Sa
257.	<i>Oxygonum atriplicifolium</i> *	A				+	+						SM+Ma
258.	<i>O. sinuatum</i> *	A				+		+	+				GC+SM
259.	<i>Pancratium sickenbergeri</i> **	P	+	+	+	+	+	+	+	+	+	+	SS ₂
260.	<i>P. tortuosum</i>	P			+			+	+				E/Sa+SS ₂
261.	<i>Panicum turgidum</i>	P	+	+	+	+	+	+	+	+	+	+	SM+SS
262.	<i>Parietaria alsinifolia</i>	A				+			+	+			SS+Cent. As.
263.	<i>P. debilis</i>	A				+	+					+	Pan
264.	<i>Paronychia arabica</i> subsp. <i>arabica</i> **	A			+	+	+	+		+		+	SS
265.	<i>P. argentea</i> **	A			+	+	+			+			Md
266.	<i>Pavonia kotschyii</i> *	P			+						+		E/Sa+SS ₂
267.	<i>P. triloba</i> *	P							+		+		Su+SS _{2,3}
268.	<i>Pedaliium murex</i> *	A			+								SM+E/Sa+SS ₂ +Ma+D
269.	<i>Pennisetum glaucum</i>	A	+	+		+		+		+		+	Sa
270.	<i>P.violaceum</i> **	A				+							GC+Su
271.	<i>Pentatropis nivalis</i>	P		+					+		+		SM+SS+D
272.	<i>Pergularia daemia</i>	A				+	+	+	+	+	+		pal
273.	<i>P. tomentosa</i>	A				+	+	+					SS
274.	<i>Periploca aphylla</i> subsp. <i>laxiflora</i> *	P				+							SS

Table I. Continued

Table I. Continue

		1	2	3	4	5	6	7	8	9	10	11	
275.	<i>Peristrophe paniculata</i>	P		+								+	SM+Sa+SS ₂
276.	<i>Phagnalon schweinfurthii</i> *	P			+	+	+			+			E/Sa+SS ₂
277.	<i>Phalaris minor</i> **	A	+	+					+		+		Md
278.	<i>Phyllanthus maderaspatensis</i> *	P				+	+				+		Pan
279.	<i>P. reticulatus</i> var. <i>reticulatus</i> *	P	+			+							Pal
280.	<i>P. rotundifolius</i>	P	+		+	+	+		+		+		SS+D
281.	<i>Pimpinella etbaica</i> *	A				+			+				E/Sa
282.	<i>Pistacia khinjuk</i> var. <i>glabra</i>	P			+	+							SS ₂ +IT ₁
283.	<i>Plantago afra</i>	A			+	+	+		+	+	+		Sd+SS _{2,3} +Md
284.	<i>P. amplexicaulis</i> subsp. <i>bauphuld</i> **	A			+	+			+			+	SS
285.	<i>P. ciliata</i>	A			+				+	+			SS
286.	<i>Plicosepalus acaciae</i>	P			+	+	+						E/Sa+SS ₂ +Eth.
287.	<i>P. curviflorus</i> *	P			+	+	+	+					GC+SM+SS _{2,3}
288.	<i>Plumbage zeylanica</i> *	P			+	+	+			+		+	Pan
289.	<i>Polycarpha corymbosa</i> *	A			+	+			+				Pan
290.	<i>P. repens</i>	P	+				+		+				SS
291.	<i>P. spicata</i>	A	+						+				Sd+SM+SS _{2,3} +Au
292.	<i>Polygala eriopetra</i>	A			+		+		+				GC+Sd+SM+SS _{2,3}
293.	<i>Portulaca oleraceae</i> subsp. <i>Oleraceae</i> *	A				+	+			+		+	Cos
294.	<i>Priva adhaerens</i> *	P				+	+	+					SM+E/Sa+SS ₂
295.	<i>Pulicaria incisa</i> subsp. <i>incisa</i>	P	+	+					+			+	GC+SM+Sa
296.	<i>P. petiolaris</i> *	P				+	+	+	+				SM+SA+E/Sa
297.	<i>P. undulata</i>	P	+	+	+	+		+	+	+	+		GC+SM+SS+D
298.	<i>Pupalia lappaceae</i> var. <i>velutina</i> *	P	+		+	+	+		+			+	Pal
299.	<i>Reichardia tingitana</i>	A	+		+	+	+	+	+	+	+		SM+SS _{2,3} +Md+Au
300.	<i>Reseda pruinosa</i>	A	+	+					+			+	SS _{1,2} +Eth.
301.	<i>Rhus abyssinica</i> *	P				+	+	+					SM+E/Sa+SS ₂
302.	<i>R. flexicaulis</i> *	P					+		+			+	E/Sa+SS ₂
303.	<i>R. tripartite</i>	P				+	+						Sd+SS
304.	<i>Rhynchosia minima</i> var. <i>memnonia</i>	P							+			+	Sd+SS ₂
305.	<i>R. malacophylla</i> *	p			+	+							SM+SA+E/Sa
306.	<i>R. pulverulenta</i> *	P			+								SM+SA+E/Sa
307.	<i>Rogeria adenophylla</i> *	P			+				+				GC+E/Sa
308.	<i>Ruellia patula</i> *	P				+				+	+		GC+SM+E/Sa+SS ₂ +S/Afr.+D
309.	<i>Rumex cyprius</i>	A							+	+	+		SS+E/Md
310.	<i>R. simpliciflorus</i>	A				+	+	+			+	+	SS ₁
311.	<i>R. vesicarius</i>	A			+	+	+	+	+		+	+	SS+E/Md
312.	<i>Salsola imbricata</i> subsp. <i>gaetula</i>	A	+		+				+				Su+Sa+SS ₁
313.	<i>S. imbricate</i> subsp. <i>imbricata</i>	A		+		+						+	Sd+SM+SS+IT ₁ +D
314.	<i>S. tetrandra</i>	A		+								+	SS ₁ +E/Md
315.	<i>Salvadora persica</i> var. <i>persica</i>	P					+		+				Z+KN+Sd+SM+SS+D
316.	<i>Salvia aegyptiaca</i>	P				+	+	+	+	+		+	Sd+SS+Eth.+D
317.	<i>Schismus barbatus</i>	A	+	+	+	+	+	+	+	+		+	SS+Md+S/Afr.
318.	<i>Schweinfurthia pedicellata</i> *	A	+						+				SM+E/Sa+SS _{1,2}
319.	<i>Sclerocephalus arabicus</i>	A			+	+	+	+	+			+	SS+IT ₂
320.	<i>Scrophularia arguta</i> *	A			+		+		+	+	+		SM+E/Sa+SS _{1,2}
321.	<i>Seddera latifolia</i>	A							+			+	Sd+SM+SS+D
322.	<i>Senecio flavus</i>	A				+	+	+		+			SS+IT _{1,2}
323.	<i>Senna holosericea</i>	P	+	+								+	Sd+SM+SS
324.	<i>S. italica</i>	P			+	+	+	+	+	+			Su+SM+SS+D
325.	<i>Setaria pumila</i>	A					+			+	+		pal
326.	<i>S. verticillata</i>	A		+						+		+	Cos
327.	<i>Sida ovata</i> *	A							+				GC+SM+E/Sa+SS+D
328.	<i>Sisymbrium erysimoides</i>	A			+	+	+	+	+	+	+		SS+Md
329.	<i>Solanum coagulans</i>	A							+			+	SM+SA+E/Sa
330.	<i>S. forsskaolii</i> *	A		+			+		+				Su+SM+E/Sa+D
331.	<i>S. incanum</i>	P		+	+	+	+	+				+	Su+Sa+SS
332.	<i>S. nigrum</i> var. <i>elbaenis</i> *	A				+	+	+	+	+		+	End.
333.	<i>S. nigrum</i> var. <i>nigrum</i>	A				+							Cos
334.	<i>S. schimperianum</i> *	A					+	+					E/Sa+SA
335.	<i>S. villosum</i> subsp. <i>villosum</i> *	A				+	+		+				SM+E/Sa+SS ₁
336.	<i>Solenostemma arghel</i> **	P		+		+	+						SS _{1,2}
337.	<i>Spergula fallax</i>	A	+		+	+	+	+	+	+	+		SS+D
338.	<i>Spergularia diandra</i>	A			+	+	+	+	+			+	SS+Md+Cent. As.
339.	<i>Sporobolus spicatus</i>	P			+	+	+	+	+			+	KN+ZI+SS+D
340.	<i>Sterculia africana</i> *	P				+		+					GC+SM+E/Sa+S/Afr.
341.	<i>Stipa capensis</i> **	A			+	+	+	+	+				SS+Md+S/Afr.
342.	<i>Stipagrostis plumose</i>	P	+	+	+	+	+	+	+	+		+	SS+IT ₁
343.	<i>Suaeda monoica</i>	A	+	+	+							+	ZI+Sa+SS

Table I. Continued

Table I. Continue

			1	2	3	4	5	6	7	8	9	10	11	
344.	<i>S. vera</i> **	A		+									+	Md
345.	<i>S. vermiculata</i>	A	+							+	+	+	+	SM+Sa+SS
346.	<i>Tamarix nilotica</i>	P	+	+									+	SS _{1,2} +E/Md
347.	<i>Tephrosia nubica</i>	P				+	+		+	+	+			SM+Sa
348.	<i>T. purpurea</i> subsp. <i>apollinea</i>	A		+	+	+	+	+	+	+		+		Sd+SS _{2,3}
349.	<i>T. quartiniana</i>	P								+			+	SM+Sa+SS _{1,2}
350.	<i>T. uniflora</i> subsp. <i>Petrosa</i>	P					+							SM+E/Sa+SS
351.	<i>T. villosa</i> subsp. <i>ehrenbergiana</i> **	A				+	+							GC+Z+SM+SA+Ma
352.	<i>Trianthena portulacastrum</i> *	A	+											Pan
353.	<i>T. triquetra</i>	A	+											Pan
354.	<i>Tribulus pentandrus</i>	A			+	+	+	+				+	+	SM+SS+D
355.	<i>T. terrestris</i>	A		+		+	+			+	+	+	+	Pan
356.	<i>Trichodesma africanum</i> var. <i>abyssinicum</i> *	P			+	+	+	+	+	+	+			SM+E/Sa
357.	<i>T. africanum</i> var. <i>africanum</i>	A			+					+	+			SS+D
358.	<i>T. ehrenbergii</i>	A	+	+		+	+	+		+		+		Sd+SS ₂
359.	<i>Tricholaena teneriffae</i>	P			+	+	+	+	+		+		+	SM+SS+Md
360.	<i>Triumfetta flavescens</i> *	P			+	+	+	+		+		+		SM+E/Sa+SS ₂
361.	<i>Umbilicus botryoides</i> *	P					+							GC+Z+Su+E/Sa
362.	<i>Urginea maritima</i> **	P								+			s	SS ₂ +Md
363.	<i>Valantia hispida</i>	A								+				SS ₂ +Md
364.	<i>Verbesina encelioides</i> **	A								+				Pan
365.	<i>Veronica anagallia-aquatica</i> **	P				+				+				Cos
366.	<i>Vigna membranacea</i> *	A				+	+							SM+E/Sa
367.	<i>Viola cinerea</i> *	A				+	+	+						SM+Sa+SS
368.	<i>Waltheria indica</i> *	P			+					+				Pal
369.	<i>Withania obtusifolia</i>	P				+	+	+						E/Md+IT ₁
370.	<i>W. somniferae</i>	P	+					+		+				Su+SS+Md+D+Au
371.	<i>Zaleya decandra</i> *	A			+	+					+		+	Pal
372.	<i>Zilla spinosa</i> subsp. <i>spinosa</i>	P		+	+						+			SS
373.	<i>Ziziphus lotus</i> **	P			+	+								SS+E/Md
374.	<i>Z. spina-christi</i>	P										+		SM+Sa+SS
375.	<i>Zygophyllum album</i> **	A	+		+					+	+		+	SM+SS+E/Md
376.	<i>Z. coccineum</i> **	A	+											SS
377.	<i>Z. simplex</i>	B	+	+	+	+	+	+	+	+	+	+	+	Su+Sa+SS+D
Total			114	94	122	192	207	128	88	200	132	139	116	

Keys

Key to Location	Key to Chorology		
1. Wadi Di-ib	End.	Endemic	SS ₃ Nubo- sindian local center of endemism
2. Wadi Bashowia	Cos.	Cosmopolitan	SA South Arabian
3. Wadi Aidieb	Pan.	Pantropical	Md Mediterranean – Sahara regional transitional zone
4. Wadi Yhamib	Pal.	Palaeotropical	Ma Malagasy regional center of endemism
5. Wadi Acow	GC.	Guineo-Congolian regional centre of endomism	IT Irano- Turanian regional centre of endemism
6. Wadi Kansirob			IT ₁ Western Irano –Turanian regional subcenter
7. Wadi Tetuila	Z.	Zambeziian regional centre of endemism	IT ₂ Southern Irano- Turanian Regional subcentre
8. Wadi Sarimatai	Su	Sudanian regional centre of endemism	D Deccan region
9. Wadi Merkwani	Sd	Sudanian domain	Au Australian region
10. Wadi Shellal	SM	Somalia-Masai Regional centre of endemism	Eu European region
11. Wadi Hedriba	KN	Karoo- Namib regional centre of endemism	Cent.As Central Asia region (meridional zone)
	A	Afromontane archipelago-like regional centre of endemism	Prefix E / Eastern
	Eth.	Ethiopian montane	Prefix W / Western
	ZI	Zanzibar – Inhambane regional mosaic	Prefix S / Southern
	KH	Kalahari- Highveld regional transition zone	P Perennial
	Sa	Sahel regional transition zone	A Annual
	SS	Sahara- Sindian regional zone	B Biennial
	SS ₁	Sahara regional subzone	* Confined to Gebal Elba district
	SS ₂	Arabian regional subzone	** New record to Gebal Elba district

Zaki (2000) and Al-Gohary and Youssef (2002) stated that some individuals of species that occupies the high latitudes were recorded in the lower or middle zone including *Dracaena ombet*, *Rhus abyssinica*, *Ficus cordata* subsp. *salicifolia*, *Helichrysum glumaceum*, *Scrophularia arguta*, *Oxalis anthelmintica* and *Commiphora gileadensis*.

The southern limits are notably drier and plant growth is confined mostly to the runnels of the drainage system,

where *Commiphora gileadensis* dominates. At higher altitudes, individuals of *Acacia etbaica* and *Moringa peregrina* may be found (Kassas & Zahran, 1971). The vegetation of the north-eastern slopes of Gebel Shindodai (Gebel Elba group) comprises four main zones from base to top: a zone dominated by *Caralluma acutangula*; a zone dominated by *Delonix elata*; a zone of *M. peregrina* and a zone with bushes of *Dodonaea viscosa*, *Euclea racemosa*

subsp. *schimperii* and *Pistacia khinjuk* var. *glabra* (El-Hadidi, 1993).

Taxonomic patterns. A total of 377 species were recorded in the surveyed wadis of Gebel Elba representing 226 genera and 74 families (Table I). The largest families Leguminosae (12.2%), Graminae (10.6%), Compositae (7.7%) and Capparaceae (4.0%) (Fig. 2). The number of genera indicates a high generic index of 1.7 (377/226). Zohary (1973) stated that a striking feature in Egypt's flora is the large number of genera in proportion to that of the species, amounting to 2.14 species per genus. The generic index i.e., the number of genera per 100 species is 45 in Egypt. The low value in Egypt can be attributed to a lack of accumulation and differentiation centre (Zohary, 1973).

From Table I, it may be noticed that 163 species are annuals and 212 are perennials, 2 species are biennial and 114 species are confined to Elba district. Fifty seven species are recorded for the first time in this territory. Three endemic species, *Hyoscyamus boveanus*, *Ifloga spicata* subsp. *elbaensis* and *Solanum nigrum* var. *elbaensis* are recorded from Elba, similar number of endemic species was reported by El-Hadidi (2000).

Phytogeography. Table I gives the chorology of 377 species recorded in the investigated wadis of Elba territory. Taxa of Sahara regional sub-zone (SS₁), Arabian regional sub-zone (SS₂), Nubo-Sindian local centre of endemism (SS₃), Somalia-Masai regional centre of endemism (SM) and Sahelian regional transition zone (Sa) are represented by higher numbers of species as compared with other floristic elements. The species of each of these five phytochoria were mono-, bi-, tri- and pluri-regional. Table I shows that SS₂ species are represented by a higher number (245 or 25.7%), followed by SS₃ species (166 or 17.4%), SM species (164 or 17.2%), SS₁ species (155 or 16.2%) and Sa species (115 or 12.0%).

El-Hadidi (2000) reported that the species recorded in this district are of Sa and SS₃ distribution. It will also be noticed from obtained results of phytogeography of the recorded species that Arabian regional sub-zone (SS₂), Somalian-Masai species (SM) and Sahara regional subzone (SS₁) are well represented.

Thus, the present work shows that the species of SS₁, SS₂, SM with Sa and SS₃ are the main constituent species, which contribute to the flora of this district. The other floristic elements such as Cosmopolitan, Pantropical, Palaeotropical, Mediterranean, Sudanian, Ethiopian, South African and Irano-Turanian elements are represented by varying low numbers of species, reflecting their differential capability to penetrate the area (Wickens, 1977a & b).

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