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Family Boraginaceae in Saudi Arabia

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Abstract: Sixty nine Boraginaceous species have been recorded in Saudi Arabia. Twenty nine of them not listed in the Flora of Saudi Arabia. These newly recorded species are mostly inhabit the mountains and the wadies as well as in the areas characterized by the great variations in temperature. The appearance of these species may be due to the rapid change in the ecological factors which leeds to the movement of the vegetation, or due to the uncomplete, previous survey of the flora. This study was pointed the need of more ecological studies to know the reasons of the change in the flora and to study how much the ecological stress may affect the speciation.

Key words: Distribution, flora of Saudi Arabia, not recorded species vegetation dynamic, speciation

INTRODUCTION

Saudi Arabia is a very big country, with great variations in both topographic, edaphic and climatic factors beside the variations in water resources. These wide variations have greatly affected the wild life in the kingdom. Abd-El-Rehman and Baleg[1], Chapman[2] had divided the lands of the country into two main divisions; the first contributes the lowlands with El-Hegaz area and Thomamah plane, while the second has the high lands with Najd plateau with the surrounding plateaux and mountains beside the south part of the kingdom. The floristic works in the area have identified 1500 species by Eig[3], while Ozenda[4], said that the species never exceed 1200 in the kingdom. Collenette[5] and Migahid[6] recorded about 1500 and even reach 1800 species in the different habitats of the kingdom. Inspite of that, new records are still unidentified till now and not mentioned in the flora of the area by Migahid[6].

Family Boraginaceae Juss, is one of the widely distributed families in Saudi Arabia. The plants have great variations in shape and life forms. They are either trees, shrubs or even herbs without essential oils, annuals or perennials but usually covered by hairs with different shapes and densities. Leaves minute to medium in size, alternate or opposite, petiolate or sessile; with entire, narrow exstipulate lamina and entire, crenate or even dentate margins. Boraginaceous plants hermaphrodite, monoecious; sometimes unisexual and dioecious in *Heliotropium* or even gynodioecious in *Echium*. Flowers aggregated in helicoids or scorpoid inflorescences, bracteate, with regular or irregular flowers, pentamerous with sympetalous corolla and epipetalous stamens with either cohering or separate anthers. Gynaecium 2 or 4-5, with four-celled pistils (two becomes four via false septa), syncarpous or synstylovarious to eu-syncarpous[7]. According to the last character of the gynaecium, the family has been divided into four subfamilies:Ehretioideae, Heliotropioideae, Cordioideae and Boraginoideae in which the ovary is syncarpous, slightly lobed, moderately lobed or deeply lobed, respectively[7]. Migahid[6] in the flora of Saudi Arabia has listed thirty six species distributed over twelve genera. Here in this study new unlisted species have been found in the kingdom which reach 29 new species. This record is supplementary to the flora of Saudi Arabia by Migahid[6].

Taxonomy of the Boraginaceae of Saudi Arabia: Members of the Boraginaceae is divided into two families; Ehretiaceae with the genera *Ehretia* and *Cordia*, with syncarpous gynaecium and Boraginaceae with the rest of the genera with slightly, moderately or deeply lobed gynaecium. This division of the genera has been proposed by Zohray[8] and followed by Migahid[6]. Here it deal with the two families as one entity.

MATERIALS AND METHODS

Field trips to different parts of the kingdom throughout the whole year around have been done during the last five years (1998-2003). Boraginaceous species have been collected, dried and preserved as herbarium sheets. These sheets are allocated in the college of education for girls in El-Riyadh city. Meanwhile a survey

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Table 1 : Species of the Boraginaceae and their distribution in Saudi Arabia

Taxa	Distribution
Alkana orientalis (L.) Boiss.	Abha, Sawdah mountain, Lauz mountain, Saraa.
Anchusa aegyptiaca (L.)DC.	Jeddah, Konfoudah, Tabuk.
Anchusa milleri Willd	Wadi Um Rimth, Tabuk, Buraydah, Medina, Yanbu, Hail.
Anchusa undulata L.*	Wadi Arar
Anchusa hispida Forssk.	Tabuk, Buraydah, Al-Goof
Arnebia asperrima L.*	Al-Taif
Arnebia decumbens (Vent.) Coss and Karl	Al-Harra, Al-Goof, Rumaih, Wadi Maarik, Hail, Skaka, Riyadh, Wadi Arar, Doumah El-Jondol.
Arnebia hispidissima (Lehm.)DC.	Abha, Al-Kara,Riyadh, Al-Taif, Al-Lith,,Unaiza, Al-Harik.
Arnebia linearifolia DC.	Al-Harra, Hail, Khurais, Sakaka.
Arnebia tetrastigma Forssk.	Al-Taif, Dahnaa desert, AL-Harra, Al-Goof.
Brandella erythraea L.*	Sawdah mountain.
Buglossoides arvensis (L.) I.M.Johson *	Warjan mountain, Medinah.
Buglossoides tenuiflora L.*	Wadi Baesha.
Cordia abyssinica R.Br.	Gizan, Arar.
Cordia africana L.*	Gizan.
Cordia myxa L.	Riyadh.
Cordia ovalis L.*	Abha.
Cordia gharaf Forssk. Ehrln.ex Asch.*	Wadi Baesha, Tabuk, Yanboa.
Echiochilon propersicum Burm.F.*	Nagran, Sakaka.
Echiochilon kotschyi Bunge.*	Al-Kharj-Sulayil road.
Echium angustifolium Mill.*	Sawdah mountain, Abha, Khamees Moushait.
Echium horridum Batt.	Gizan.
Echium longifolium Del.	Medinah, Shamanseel mountain, El-Dammam.
Echium plantagineum Del.*	Wadi Baesha
Echium sericeum L.*	Sakaka, Hail, Unayza.
Echium rauwolfii Del.	El-Dammam, Rumaih, Kaisumah.
Ehretia obtusifolia Hochst.*	Abha, Sawdah mountain.
Ehretia abyssinica R.Br.*	Gizan, Hail.
Gastrocotyle hispida (Forssk.) Bunge	Hail, Sakaka, Al-Kharj.
Heliotropium arbainense Fres.	Abha, Gizan, Jeddah.
Heliotropium bacciferum Forssk.	Al-Badeia, Taif, Al-Riyadh, Unaiza,Hail, Al-Hofuf.
Heliotropium calcareum Forssk.*	Wadi Baesha.
Heliotropium cinerascens Steud.	Nagran, Sakaka.
Heliotropium crispum L.*	Al-Kharj, Al-Riyadh,Taif, Hail, Hofuf, Unayza.
Heliotropium curassavicum Steud.*	Medinah, Jeddah.
Heliotropium digynum (Forssk.) Asch.	Jeddah, Konfudah, El-Dammam, Rumaih, Unaiza.
Heliotropium europaeum L.	Al-Kharj, Al-Riyadh, Sakaka, Gizan.
Heliotropium hirsutissimum Grauer	Gizan, Arar.
Heliotropium kassasi Tackh.et Boulos	Jeddah, Konfudah.
Heliotropium kotschyi (Bunge) Gurke**	El-Zahran.
Heliotropium lasiocarpum L.*	Abha.
Heliotropium lignosum Schweinf.ex Bunge	El-Dammam, El-Zahran, Rumah.
Heliotropium longiflorum (A.DC.) Steud et Hochst.	Taif-Jeddah road, Nagran.
Heliotropium pallens Del.	Hail, Jeddah, Komfudah.
Heliotropium pterocarpum Hochst.	Gizan,Badr-Medinah road.
Heliotropium ramosissimum (Lehm.) Siebu ex DC.**	El-Riyadh.
Heliotropium ramiflorum Del.*	Said mountain near El-Medinah, Abha, Nagran.
Heliotropium strigosum Willd.	Abha,Yanbua, Gizan.
Heliotropium supinum L.	Al-Kharj, Al-Riyadh.
Heterocaryum subsessile Varke*	Al-Harra, Hail.
Hormuzakia aggregata (Lehm.) Gusul.	Al-Riyadh.
Lappula spinocarpos (Forssk.) Asch.ex Ktze.	Al-Hara, Hail, Skaka.
Lappula sinaica (DC) Aschirs Schweif.*	Warjan mountain in El-Medina, Radwa mountain north Yanbua.
Microparacaryum intermedium Boiss.*	Radwa mountain Yanbua.
Moltkiopsis ciliata (Forssk.) Johnst.	Dammam, Nifud desert, Rumaih, Buraida, Kaisumah.
Ogastemma pusillum Boiss.*	Thumamah, Rumah, Rowdat Al-Khuraim.
Paracaryum boissieri Schweinf.	Radwa mountain north Yanbua.
Paracaryum intermedium (Forssk.) Lipsky.	Tabuk, Shar mountain.
Paracaryum regulosum L.*	Al-Harra, Hail.
Paraenoglossum bottae DC.*	Sawda, north Abha.
Trichodesma africanum (L.) R.Br.	Agga mountain, Hail, Jeddah.
Trichodesma ehrenbergii Schweinf.	Medina, Shamanseel mountain near El-Medina.
Trichodesma pauciflorum Bak.	Gizan, Arar.
Trichodesma trichodesmioides Boiss.*	Gizan, Fayfa mountain, El-Hadda, Taif road.
Trichodesma zeylanicum (Burm F.) R.Br.	Gizan. Arar, Asir mountain.

*species not recorded in the flora of Saudi Arabia[6]

**Species not recorded in the flora of Saudi Arabia[6] but recorded by Zohray[8]

through the herbarium specimens present at the Ministry of Agriculture and Water Resources in El-Riyadh has been carried out. The locations of each new recorded species have been pointed out carefully to know the limit of distribution of each taxa as illustrated in Table 1.

RESULTS AND DISCUSSION

From the species collected we found sixty five species, twenty nine of them not listed in the Flora of Saudi Arabia by Migahid[6], while Zohary[8] has recorded ten Boragenaceous species in Saudi Arabia, two from them not listed by Migahid[6]. This means that either the flora of Saudi Arabia in rapid dynamic changes, in which new species have introduced into the country or the survey of the species within the city flora was not complete. These new records are mostly grown in the wadies , on the mountains, or in places with wide range of variations in temperature. These means that both climate and topography affecting the growth of the species. This conclusion has been achieved by Abulfatih[9] who pointed to the effect of the different ecological factors beside the topography in delimiting the species in three elevated regions in Saudi Arabia. Meanwhile Abulfatih[10] in his study on the flora of Abha region found that the topography is the only limited factor in speciation. On the other hand Mahmoud *et al*.[11] found that the salinity of

the soil beside the other edaphic factors were the limited ones in delimiting species in the red sea coastal regions. While, Abulfatih[12] mentioned that the climate is the most important factor responsible for species diversity. On the other hand. El-Kady *et al.*[13] Shaltout and Mady[14], Shaltout *et al.*[15] have illustrated that, species diversity within the studied areas was relayed to the effect of human activities which in turn affected the soil characters especially the salinity. Thus, from all these opinions we can say that the topography of the area and the climatic factors are greatly affected the species grown in that area. In the same time these two factors affecting the degree of salinity of the soil which has a secondary effect on the species. On other words, it can be said that all the ecological factors affecting speciation, but the most important ones are topography and climate.

From this foristic study it may be concluded that the relay on the present flora of Saudi Arabia Migahid[6], in floristic works is not enough. For that, the area still in need to more floristic works to fulfill the changes happen in the types of species present. In the same time it was indicated that, Saudi Arabia is under severe ecological changes which lead to rapid change in the type of the vegetation, these ecological changes are in need to more studies.

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