



Environmental distribution of medicinal plants in Al-Baha region, Saudi Arabia

Abdulrahman Al Zandi¹, Abdul Wali Al-Khulaidi^{2,3} and Nageeb A. Al-Sagheer^{1,2}

¹Department of Biology, College of Science and Arts, Al-Baha University (BU), Qilwah Saudi Arabia

²Agricultural Research and Extension Authority (AREA), Yemen

³Department of Biology, College of Science and Arts, Al-Baha University (BU), Baljurashi, Saudi Arabia
a.alzandi2010@gmail.com

Abstract: Optimum Information on the medicinal plants is lacking in the Saudi Arabia including Al-Baha region. The information will be useful in sustainable use of these medicinal plants in future time and developing strategies for protecting, sustainable and proper uses of these plants. The study area is located South West of Saudi Arabia and characterized by intensive urbanization which affected dramatically the distribution of vegetation. Density per hectare and frequency of each medicinal plant species were calculated. 133 promising medicinal plant species belonging to 14 families and 28 genera were recorded in the study area. The most represented families were Apocynaceae with 18 plants, Euphorbiaceae with 14 plants, Asteraceae and Lamiaceae each with 11 plants. More intensive field work is needed to discover more medicinal plants.

[Abdulrahman Al Zandi, Abdul Wali Al-Khulaidi and Nageeb A. Al-Sagheer. **Environmental distribution of medicinal plants in Al-Baha region, Saudi Arabia.** *Life Sci J* 2019;16(9):95-102]. ISSN: 1097-8135 (Print) / ISSN: 2372-613X (Online). <http://www.lifesciencesite.com>. 12. doi:[10.7537/marslsj160919.12](https://doi.org/10.7537/marslsj160919.12).

Key words: Medicinal plants, frequency %, Al-Baha, Saudi Arabia.

1. Introduction

The study area is characterized by high plant diversity, recent studies recorded a significant plant species in Al-Baha region (Al-Aklabi, et al., 2016; Al-Khulaidi, et al., 2018;), a lot of them have a medicinal value. In fact, the last three decades, a significant growth in herbal product markets and exports have been seen across many countries in the world. According to the Secretariat of the Convention on Biological Diversity, in 2002, global value sales of medicinal plants products calculated to be 60 000 million US dollars (WHO, 2003). World trade volume of medicinal plants is more than 43 billion dollars and has been predicted to reach to 5 trillion dollars in 2050 (Mashayekhan, et al., 2016).

Saudi Arabia, is one of the developing country and medical plants are considered an important economic resource of natural biodiversity (Rahman et al., 2004). It is well known that Saudi Arabia and the Arabian Peninsula are rich in natural and cultivated plants. The flora of Saudi Arabia contains a total of 2250 plant species belong to 142 families (Collenette, 1999). Some of these plants were used and still by native people whom gain an accumulated experience in the uses of these plants in folk medicine to cure many different diseases. But Unfortunately, There is a gap in transferring the indigenous knowledge between old and new generation further to the lack and information scarcity on their uses, further to the difficulties that may found in identifying the wild

medicinal plants as well. However, the gap is still wider between traditional herbal medicine and modern medicine manufacturing.

However, few studies on medicinal and Ethnomedicinal plants have been done in Saudi Arabia including Al-Baha region among these, studies conducted by Al-Said, (1993) who described twenty plant species traditionally used as a medicine with their main chemical constituents. Further, an initial survey on the medicinal plant diversity in the flora of the Kingdom of Saudi Arabia has been made covering seven families. (Rahman et al., 2004). Yusuf, et al (2014) had found 15 angiosperm families are promising to be medicinal plants in the flora of Saudi Arabia. According to Abulafatih, (1987) the most common medicinal plants found in the Southwestern Saudi Arabia were belong to the Leguminosae, Labiatae, Compositae, and Euphorbiaceae. About 261 species were recorded, belonging to 55 families and 178 genera from At Taif region (Al-Sodany et al., 2013). Awadh, et al (2017) reported that 39 plant species from 28 plant families were investigated regarding the benefits of medicinal plants of Al-Baha region. The study aims to present the list of the medicinal plants of Al-Baha region and discuss their environmental distribution.

2. Materials and Methods

The study area, located in the south west of Saudi Arabia between 41/42 E and between 16/21 N (Fig. 1).

A field work covering different ecological zone within Al-Baha region has been conducted, 423 sample sites each 20 by 20 m. were investigated to determine the medicinal plants. The selected medicinal plants were according to information gathered from different studies on the medicinal plants of Saudi Arabia (Rahman, et al. 2004; Awadh, et al. 2017; Awadh, et al., 2019; Alyemeni, et al., 2010; and other similar environmental condition (Mesfin, et al., 2009; Giday, et al., 2003).

Principle coordinate analysis was applied for 18 dominant medicinal plant species using MVSP software Euclidean similarity option.

Frequency was calculated by dividing the number of plots in which a species occurs by the total number of plots sampled. (Al-Zandi, et al., 2018).



Figure 1. Location of the study area.

3. Results and discussion

The study area is characterized by different climatic zones starting from Arid to relatively humid which make it appropriate for various plant species that adapted to those different environmental conditions. The study revealed 133 promising medicinal plant species belonging to 14 families and 28 genera (Table 1). 15 were trees (11%), 16 were succulents (12%), 27 were shrubs (20%), 5 were climber (4%) and 70 were herb (53%). The most represented families were Apocynaceae with 18 plants, Euphorbiaceae with 14 plants, Asteraceae and Lamiaceae each with 11 plants (Fig. 2).

Frequency

Figure 4 shows the frequency for the most abundant medicinal plant species in the study area. Variations in abundance can also be observed among the medicinal plant species (Table 1).

The most dominant medicinal plant species in the study area were *Dodonaea viscosa*, *Solanum incanum*, *Olea europaea*, *Aerajavanica*, *Psiadiapunctulata*, *Blepharisedulis* and *Ziziphus spina-christi*. Figure 4 shows 18 dominant medicinal plant species with their frequency percentage, the frequency percentage and the density per hectare for the all medicinal plants were depicted in Table 1.

The former 18 dominant medicinal plant species were clustered to 4 groups using MVSP software Euclidean similarity option (Fig. 5).

Table (1). List of the medicinal plants with their **Frequency and density per hectare**

Plant name	Freq. %	dens./ha	Plant name	Freq. %	dens./ha
<i>Acacia etbaica</i>	12.8	1.8	<i>Fagoniabrugueri</i>	2.1	1.2
<i>Acalypha fruticosa</i>	7.1	1.2	<i>Fagonia indica</i>	15.6	5.9
<i>Achilleaiebersteini</i>	5.7	8.9	<i>Foeniculum vulgare</i>	0.2	0.2
<i>Achyranthes aspera</i>	6.6	7.1	<i>Geranium molle</i>	0.2	0.9
<i>Adeniavenenata</i>	0.7	0.1	<i>Gomphocarpus fruticosus</i>	6.1	0.4
<i>Adenium obesum</i>	12.3	2.5	<i>Hypoestes forskalii</i>	6.1	6.5
<i>Aerajavanica</i>	24.1	1.7	<i>Indigoferaspinosa</i>	19.4	4.7
<i>Aervalanata</i>	6.4	2.4	<i>Jasminum grandiflorum</i>	8.5	0.6
<i>Aizooncanariense</i>	4.5	11.8	<i>Jatropha glauca</i>	2.1	0.6
<i>Aloe castellorum</i>	0.9	5.3	<i>Jatropha pelargonifolia</i>	2.4	0.3
<i>Aloe pseudorubroviolacea</i>	1.7	0.7	<i>Kleinia odorata</i>	5.0	1.5
<i>Aloe sabaea</i>	0.5	4.1	<i>Lavanduladentata</i>	11.6	2.1
<i>Aloe shadensis</i>	0.9	1.2	<i>Lavandulapubescens</i>	17.7	3.0
<i>Amaranthus spinosus</i>	0.2	0.1	<i>Lawsonia inermis</i>	0.2	0.3

Plant name	Freq. %	dens./ha	Plant name	Freq. %	dens./ha
<i>Ammi majus</i>	3.1	1.8	<i>Malvaparviflora</i>	1.2	0.9
<i>Andrachneaspera</i>	0.9	0.2	<i>Marrubium vulgare</i>	4.3	7.1
<i>Anisotestrisulcus</i>	17.7	2.4	<i>Melhania ovata</i>	0.9	0.1
<i>Argemone mexicana</i>	0.7	1.2	<i>Melhaniavelutina</i>	0.2	0.1
<i>Argemoneochroleuca</i>	9.2	1.2	<i>Menthalongifolia</i>	1.2	1.5
<i>Aristolochiabracteolata</i>	0.5	0.1	<i>Meriandrabengalensis</i>	0.7	0.3
<i>Astragalus atropilosulus</i>	1.9	1.2	<i>Monollumaquadrangula</i>	2.8	0.2
<i>Astragalus fatmensis</i>	0.5	0.1	<i>Moringaperegrina</i>	0.5	0.3
<i>Astragalus pelecinus</i>	0.5	0.1	<i>Nepetadeflersiana</i>	7.8	3.5
<i>Astragalus sparsus</i>	0.2	0.1	<i>Ochnainermis</i>	1.7	0.2
<i>Astragalus vogelii</i>	0.2	0.2	<i>Olea europaea</i>	24.3	1.7
<i>Blepharis edulis</i>	21.7	4.4	<i>Otostegiafruticosa</i>	9.2	0.9
<i>Cadabafarinosa</i>	2.6	0.2	<i>Oxalis corniculata</i>	1.9	3.0
<i>Calotropisprocera</i>	11.6	3.3	<i>Pergulariadaemia</i>	0.7	0.1
<i>Capparisartilaginea</i>	2.4	0.1	<i>Pergulariatomentosa</i>	0.2	0.1
<i>Caralluma retrospiciens</i>	6.6	4.0	<i>Periplocaaphylla</i>	11.6	1.0
<i>Carallumasubulata</i>	0.2	2.1	<i>Periplocasomalensis</i>	7.3	0.6
<i>Carissa spinarum</i>	2.8	0.4	<i>Periplocasomalensis</i>	0.5	0.1
<i>Chenopodium album</i>	3.1	1.4	<i>Plantago ciliata</i>	0.2	1.2
<i>Chenopodiumambrosioides</i>	2.1	0.9	<i>Plantago cylindrica</i>	0.5	7.1
<i>Chenopodiumglaucum</i>	0.5	0.2	<i>Plantago lanceolata</i>	0.5	0.3
<i>Chenopodiummurale</i>	2.1	0.3	<i>Plantago ovata</i>	1.9	4.7
<i>Chenopodiumschraderianum</i>	1.2	9.3	<i>Plectranthusasirensis</i>	1.2	0.7
<i>Chrozophoraoblongifolia</i>	0.7	0.1	<i>Plucheadioscoridis</i>	5.2	7.1
<i>Cissusquadrangularis</i>	5.0	1.2	<i>Portulacaoleracea</i>	1.7	1.2
<i>Cissusrotundifolia</i>	6.6	1.8	<i>Psiadiapunctulata</i>	23.6	4.7
<i>Citrulluscolocynthis</i>	4.5	1.2	<i>Pulicariaundulata</i>	19.4	2.1
<i>Clematis hirsuta</i>	2.6	0.4	<i>Rhzyastricta</i>	0.7	0.7
<i>Cleome chrysantha</i>	0.2	0.4	<i>Ricinuscommunis</i>	6.6	0.6
<i>Cleome gynandra</i>	0.7	1.0	<i>Rumexnervosus</i>	4.7	2.4
<i>Clutia lanceolata</i>	8.7	0.2	<i>Rutachalepensis</i>	5.0	0.9
<i>Commiphoragileadensis</i>	1.9	0.7	<i>Salvadorapersica</i>	2.6	1.2
<i>Commiphorakataf</i>	2.1	0.3	<i>Salvia aegyptiaca</i>	6.4	4.7
<i>Commiphorakua</i>	2.1	0.2	<i>Sansevieriaehrenbergii</i>	1.4	5.9
<i>Commiphoramyrtha</i>	6.1	0.4	<i>Sansevieriaforskaliana</i>	1.9	3.0
<i>Conyzaincana</i>	0.9	1.8	<i>Sarcostemma viminale</i>	4.5	2.1
<i>Conyzapyrrhopappa</i>	0.5	0.1	<i>Senna alexandrina</i>	2.6	1.8
<i>Datura innoxia</i>	1.9	1.2	<i>Senna italica</i>	3.5	0.9
<i>Datura stramonium</i>	0.2	0.1	<i>Solanum incanum</i>	25.1	1.9
<i>Desmidorchispenicillata</i>	3.5	0.1	<i>Sonchusoleraceus</i>	1.2	0.3
<i>Diplo taxisharra</i>	0.2	0.2	<i>Tagetesminuta</i>	1.4	0.5
<i>Dodonaeaviscosa</i>	26.7	2.4	<i>Talinumportulacifolium</i>	0.9	0.2
<i>Dracaena serrulata</i>	0.2	0.1	<i>Tamarixaphylla</i>	0.9	1.2
<i>Duvaliavelutina</i>	0.2	5.9	<i>Tamarixnilotica</i>	1.9	1.2
<i>Euphorbia aff. Granulata</i>	1.2	1.2	<i>Teucriumyemense</i>	8.3	1.8
<i>Euphorbia cuneata</i>	0.5	0.1	<i>Tribulusparvispinus</i>	0.5	0.4
<i>Euphorbia falcata</i>	0.2	0.2	<i>Tribulusterrestris</i>	5.4	5.9
<i>Euphorbia helioscopia</i>	0.2	0.2	<i>Urticaurens</i>	0.5	17.7
<i>Euphorbia hirta</i>	0.2	0.3	<i>Withaniasomnifera</i>	10.2	0.5
<i>Euphorbia inarticulata</i>	1.4	2.1	<i>Xanthium spinosum</i>	1.9	1.5
<i>Euphorbia parcimilosa</i>	0.2	0.7	<i>Xanthium strumarium</i>	1.4	3.3
<i>Euphorbia schimperiana</i>	2.8	3.3	<i>Ziziphus spina-christi</i>	20.1	1.0
<i>Euphorbia serpens</i>	1.4	0.5			

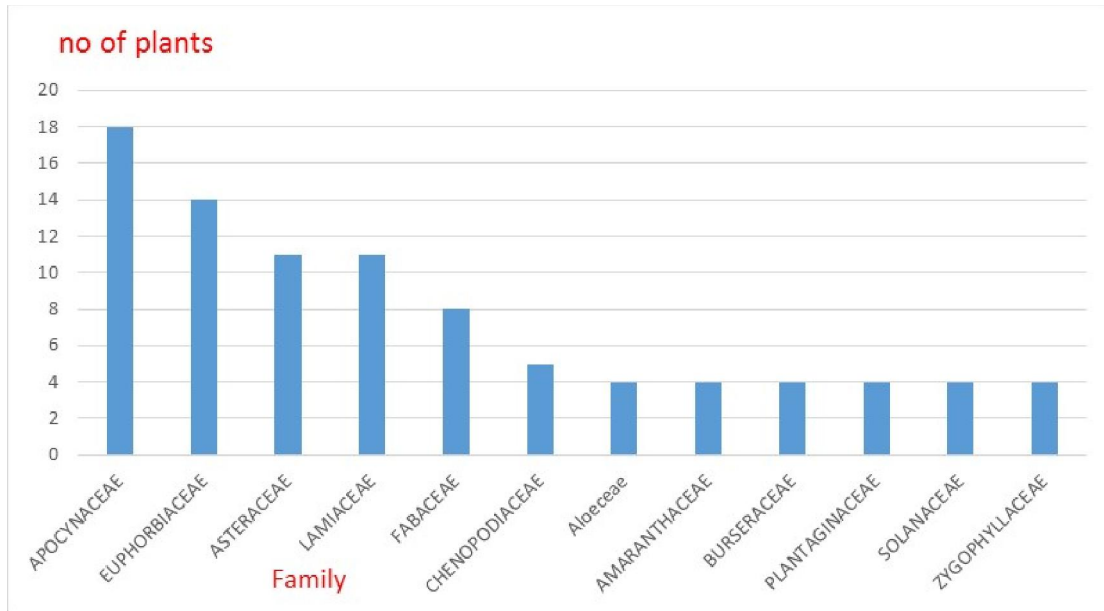


Figure 2. The most dominant families that contain medicinal plants.

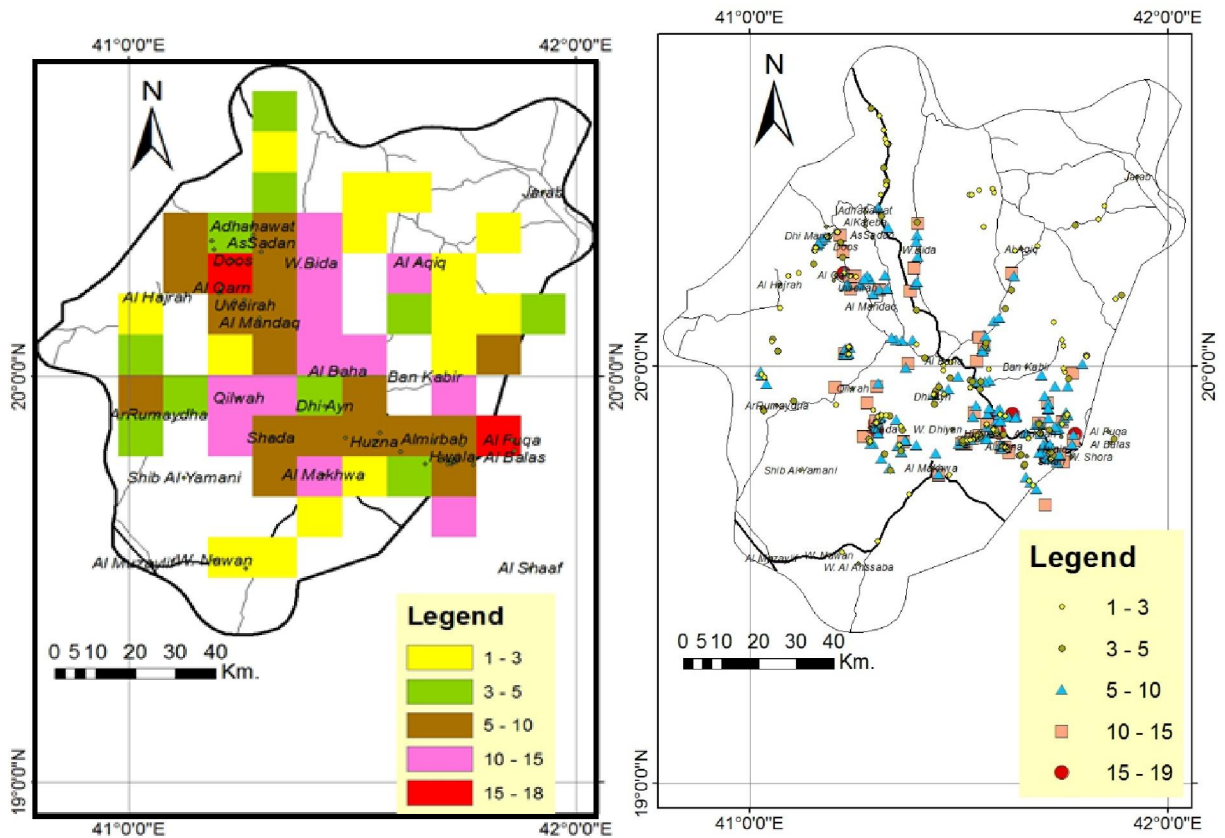


Figure 3. Map showing the number of medicinal plant species per 10 square kilometre left and per sample site (WP) right.

Plant name	Fre. %
<i>Dodonaea viscosa</i>	26.7
<i>Solanum incanum</i>	25.1
<i>Olea europaea</i>	24.3
<i>Aerva javanica</i>	24.1
<i>Psidium punctulata</i>	23.6
<i>Blepharis edulis</i>	21.7
<i>Ziziphus spina-christi</i>	20.1
<i>Indigofera spinosa</i>	19.4
<i>Pulicaria undulata</i>	19.4
<i>Anisotes trisulcus</i>	17.7
<i>Lavandula pubescens</i>	17.7
<i>Fagonia indica</i>	15.6
<i>Acacia etbaica</i>	12.8
<i>Adenium obesum</i>	12.3
<i>Calotropis procera</i>	11.6
<i>Lavandula dentata</i>	11.6
<i>Periploca aphylla</i>	11.6
<i>Withania somnifera</i>	10.2

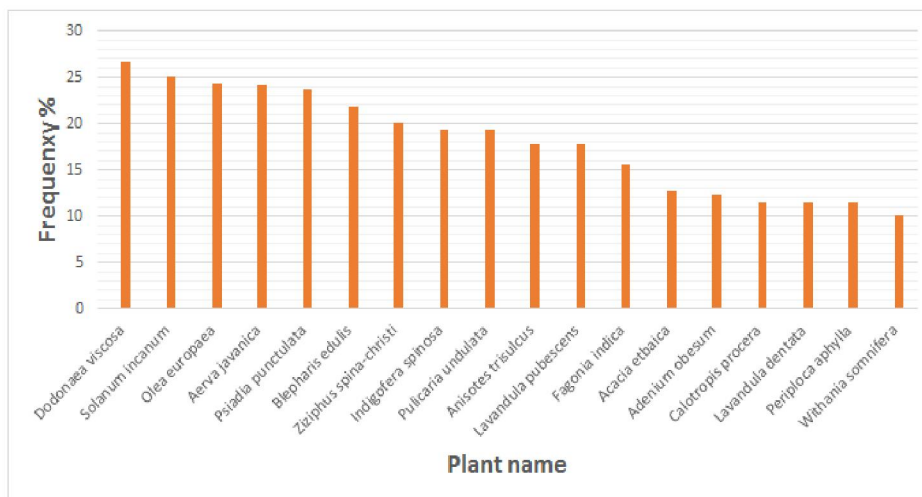


Figure 4. The most dominant medicinal plant species in the study area.

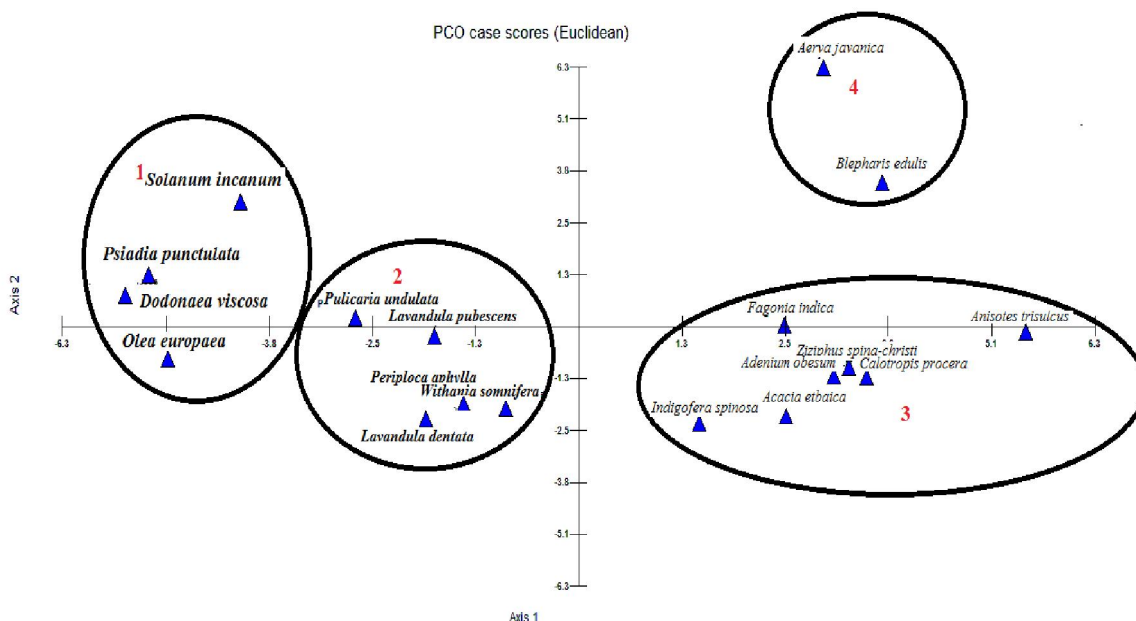


Figure 5. Principle coordinate analysis for 18 dominant medicinal plant species.

The Principle coordinate was arranged the 18 medicinal plants according to their similarities, group 1 was confined to high and moderate altitude with dry habitat areas, group 2 was confined to high altitude with wet and humid areas mainly between Al-Baha and Baljurashi, group 3 was confined to moderate altitude with relatively wet areas mainly on the Tihama foothills, group 4 was widespread plants found in different ecological areas. The finding is in accordance with the finding of Al-Aklabi et al., (2006)

Concerning the number of medicinal plants (Figures 6, 7,8, and 9), we outlines the following:

In the moderate altitude areas, South West and West (Figure 4), most of the medicinal plants are concentrated in Jabal Shada and surround areas between 1300 and 1480 ma.s.l., with medicinal plants range between 16 to 19 species, the most abundant species here are *Adeniumobesum*, *Blepharis edulis*, *Acalyphafruticosa*, *Aervajavanica*, *Indigoferaspinosa*, *Sarcostemmaviminale*, *Sansevieriaforskaliana* and *Aervalanata*, with individuals range from 10 to 43.

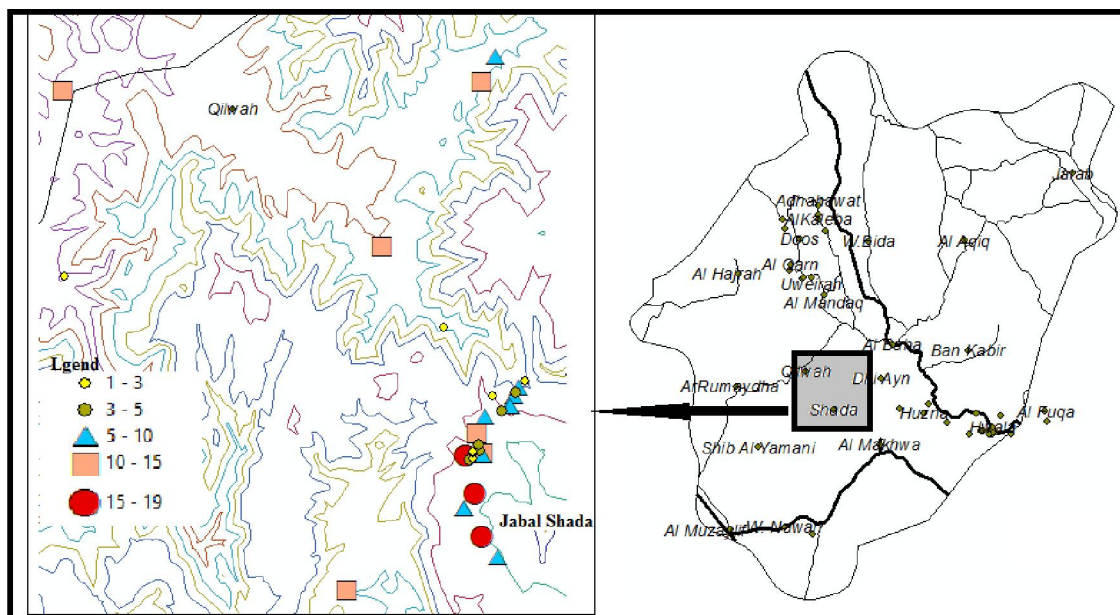


Figure 6. The number of medicinal plants in the moderate altitude areas.

North East Al-Baha region, around Boss and Al Mandaq, (Fig. 5) between 1286 and 2036 m a.s.l., mostly on terraces and wadi beds, 14 to 18 plant species are found here, the most abundant are *Achyranthesaspera*, *Aizooncanariense*, *Aloe sabaea*, *Anisotestrisulcus*, *Blepharis edulis*, *Dodonaeaviscosa*,

Hypoestesforskaolii, *Lavandula dentate*, *Malvaparviflora*, *Ocimumforskolei*, *Olea europaea*, *Pulicaria undulate*, *Rumexnervosus*, *Teucriumyemense* and *Tribulusterrestris* with individuals range between 10 to 70.

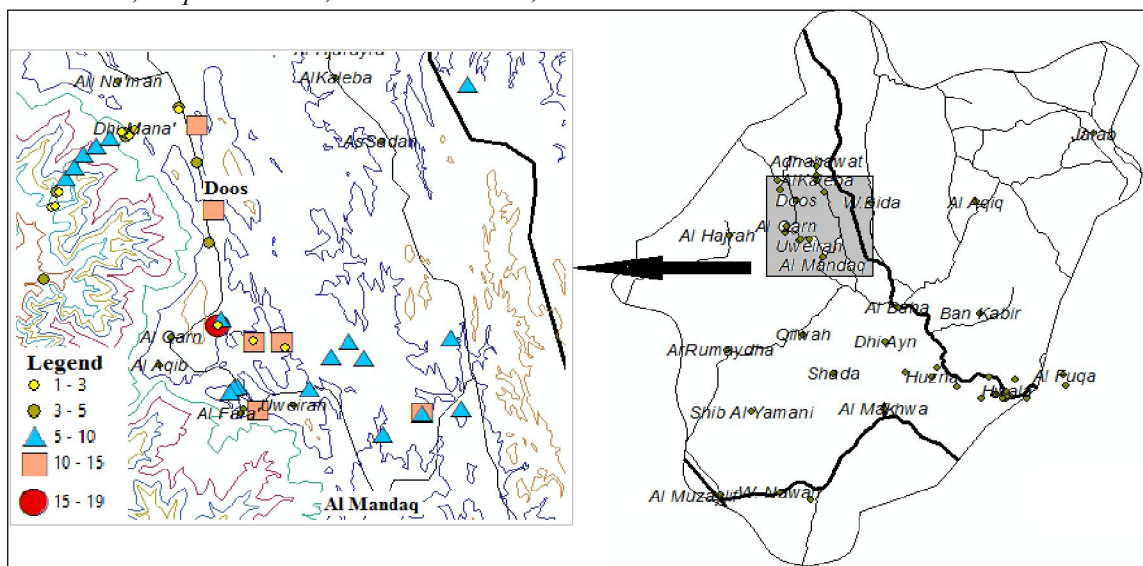


Figure 7. The number of medicinal plants in North East Al-Baha region (around Boss and Al Mandaq).

South East Al-Baha region, around Hawala, Jabal Uthrub and Qathana (Fig.8) between 1800 and 1960 m a.s.l., mostly on steep rocky slope, foot slope and wadi beds, 12 to 17 medicinal plant are found here, the most abundant are *Achilleabiebersteinii*, *Aervajavanica*, *Aloe castellorum*, *Blepharis edulis*,

Hypoestesforskaolii, *Hypoestesforskaolii*, *Lavandula dentate*, *Nepetadeflersiana*, *Olea europaea*, *Periplocaaphylla*, *Plectranthusasirensis*, *Psiadiapunctulata* and *Salvia aegyptiacaw* with individuals range between 10 and 80.

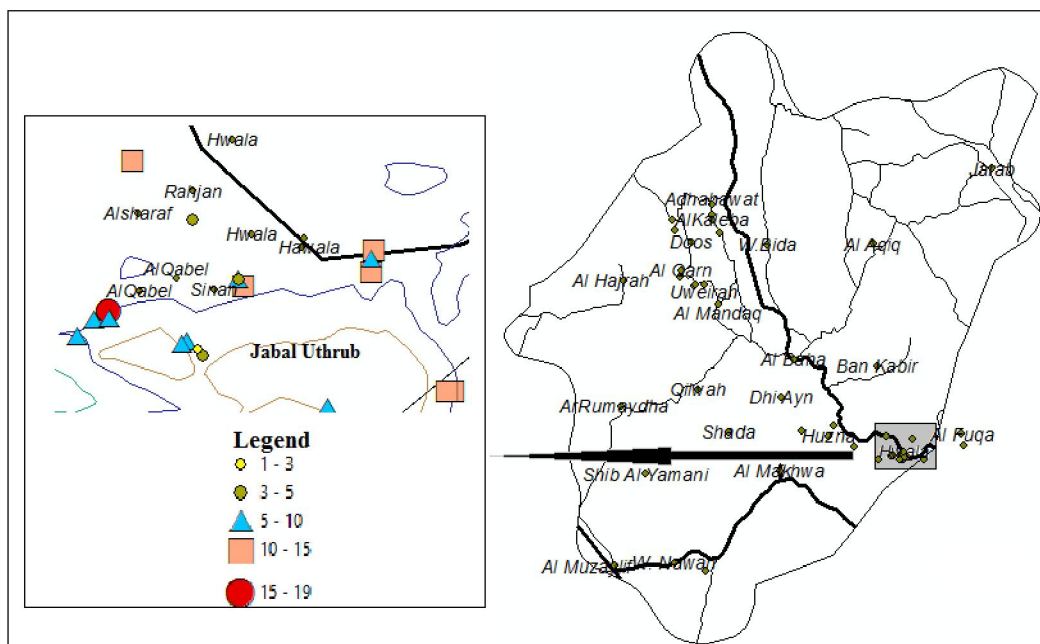


Figure 8. The number of medicinal plants in South East Al-Baha region (around Hawala, Jabal Uthrub and Qathana).

Baljurashi city and surrounding areas, between 2030 and 2050 ma.s.l. (Fig.9) Mainly rocky slopes, plateau and old terraces, 12 to 16 medicinal plants are found here most of them are annual, the most abundant are *Achilleabiebersteinii*, *Achyranthesaspera*, *Aizoocanariense*, *Aloe*

castellorum, *Ammi majus*, *Caralluma retrospiciens*, *Chenopodium album*, *Geranium molle*, *Nepetadeflersiana*, *Rumexnervosus*, *Salvia aegyptiaca*, *Solanum incanum*, and *Xanthium spinosum* with individuals range between 10 and 150.

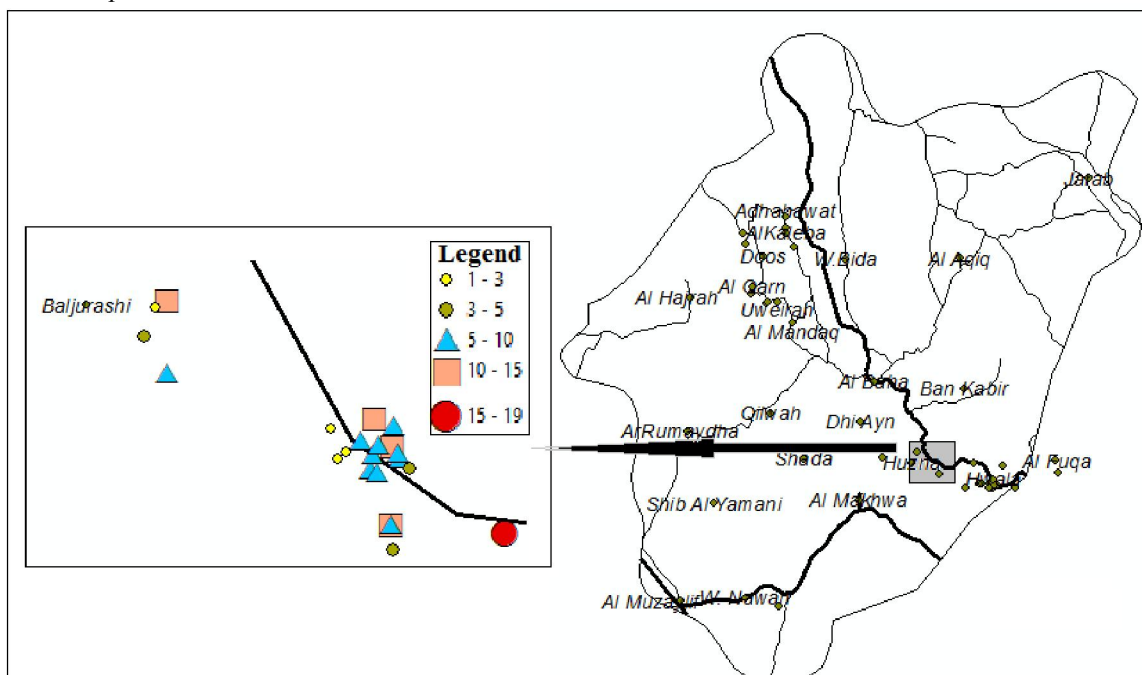


Figure 9. The number of medicinal plants in Baljurashi city and surrounding areas.

Acknowledgment

The authors appreciate the constant help and work financial support provided by Al-Baha University.

References

1. Al-Aklabi, A., A. Al-Khulaidi., H. Hussain and N. Al-Sagheer (2016). Main vegetation types and Plant Species Diversity along an Altitudinal Gradient of Al-Baha region, Saudi Arabia. *Saudi J. Biol. Sci.*, 23, 687–697 (2016).
2. Al-Khulaidi, A., Al-Sagheer, N.A., Al-Turki, T. and Filimban, F. (20118). Inventory of Most Rare and Endangered plant species in Al-Baha Region, Saudi Arabia. *IJBPAS*, 7(4): 443-460.
3. Abulafatih, H.A. (1987). Medicinal plants in Southwestern Saudi Arabia. *Viewing Economic Botany*. Vol. 41, No. 3 (Jul. - Sep., 1987), pp. 354-360.
4. Al-Said MS. Traditional medicinal plants of Saudi Arabia. *Am J Chin Med*. 1993;21(3-4):291-298.
5. Al-Sodany, Y.M., S, A. Bazaid and H. A. Mosallam (2013). Medicinal Plants in Saudi Arabia: I. Sarrwat Mountains at Taif, KSA. *Academic Journal of Plant Sciences* 6 (4): 134-145, 2013.
6. Al-Zandi, A., Al-Khulaidi, A. and Al-Sagheer, N., (2018). Preliminary analysing of plant diversity of high altitude area of Al-Baha region, Saudi Arabia. *Int. J. Adv. Res.* 6(2), 412-426 (2018).
7. Alyemeni, M.N., H. Sher, and L. Wijaya (2010). Some observations on Saudi medicinal plants of veterinary importance *Journal of Medicinal Plants Research* Vol. 4(21), pp. 2298-2304, 4 November, 2010.
8. Awadh Ali NA, Al Sokari SS, Gushash A, Anwar S, Al-Karani K, Al-Khulaidi A. (2017) Ethnopharmacological survey of medicinal plants in Al-Baha Region, Saudi Arabia. *Phcog Res*;9:401-407.
9. Awadh A.N. I Mansi, N. Ahmed, S. Alghamdi, R. Abu Alhalawah. Al-Khulaidi, A. Sirajudheen (2019). Ultra-High Performance Liquid Chromatography-Electrospray Ionization-Mass Spectroscopy Quantification, Xanthine Oxidase Inhibitory, and Antioxidant Activity Profile of some Medicinal Plants from Al-Baha Region. *Pharmacognosy Research*, Volume 15 | Issue 62 | April-June 2019 (Supplement 1).
10. Collenette S. (1999) *Wild Flowers of Saudi Arabia*. National Commission for Wildlife Conservation and Development (NCWCD), Riyadh. 799 pages.
11. Giday M, Asfaw Z, Elmquist T, Woldu Z. (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *J Ethnopharmacol*. 2003 Mar; 85(1):43-52.
12. Mashayekhan, A., Pourmajidian, M.R., Jalilvand, H., Gholami, M.R. and Teimouri, M.S. (2016). Economic importance and GIS mapping of medicinal plants in Iran: A Case study of Darkesh. *J. Appl. Sci. Environ. Manage.* 20: (3) 646-650.
13. Mesfin F, Demissew S, Teklehaymanot T (2009). An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. *J Ethnobiol Ethnomed*. 2009 Oct 12;5:28. doi: 10.1186/1746-4269-5-28.
14. Rahman MA, Mossa JS, Al-Said MS, Al-Yahya MA. (2004). Medicinal plant diversity in the flora of Saudi Arabia 1: a report on seven plant families. *Fitoterapia*. 2004 Mar;75(2):149-161.
15. WHO. 2003. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants, p. 1. Geneva.
16. Yusuf M, Al-Oqail MM, Al-Sheddr ES, Al-Rehaily AJ, Rahman MA. Diversity of medicinal plants in the flora of Saudi Arabia 3: An inventory of 15 plant families and their conservation management. *International Journal of Environment*. 2014;3(3):312–320.

9/25/2019