http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (8): 1399-1403, 2004
ISSN 1028-8880

Effect of Habitats on Both the Phenotypic Characters and Mineral Contents of Five Wild Species in El-Riyadh City

W.K. Taia and [1]W.M. El-Ghanem
Department of Botany, Faculty of Science, Alexandria University, Alexandria, Egypt
[1]Girl's of Education College, El-Riyadh, KSA

Abstract: Fourteen taxonomic characters have been studied in five wild species in El-Riyadh city, *Salsola baryosma, Zygophyllum migahidii, Francoeuria crispa, Zilla spinosa* and *Rumex vesicarius,* collected from three different habitats throughout three seasons. In the same time mineral contents (P, K, Na, Fe, Cu, Mn and Zn) in these species have been measured during the periods of study. The results of this study revealed that the habitats have insignificant effect on the leaf characters in spite of the slightly effect on the general status, fruiting stage and colour of the plants. Whereas the mineral contents have great variations within the three habitats as well as within the same habitat throughout the different seasons. Analysis of the data revealed that the variations were within the confidence limits. From this study it can be concluded that leaf characters can be used as an effective taxonomic ones, while the chemical composition of the species are greatly affected by both habitats and seasonal variations.

Key words: Phenotypic characters, habitats, chemical constituents, season variations

INTRODUCTION

The morphological changes according to environmental disorders is known as phenotypic plasticity, whereas the internal changes called adaptation. Taxonomists have to be accurate in deciding whether the studied characters are according to environment or specified to that plant.

Radford[1] stated that evidence from plant morphology provided the basic language for plant characterization, identification, classification and relationships. Thus, vegetative morphological characters, especially that of the leaves, have been employed as a basis for classification since the early days of taxonomy. In fact, vegetative characters can be unreliable because of the similarity happened between unrelated species, but even so Davis and Heywood[2] deplored the neglect of morphological characters as one of the most serious errors which delay the achievement of a natural system. The response of plants to environmental changes which may be under genetic control[3-7] or may evolve under selction[8]. In the last case, new traits were evolved which allow species to adjust to the new environments. Differences in plant biomass, shoot length and even reproductive effort in Murdannia keisak grown in different populations[9,10]. Meanwhile Shaltout *et al.*[11] have been found great variations among *Thymelaea hirsute* populations in Egypt within four major habitats. These variations were mainly in the leaf characters. On the other hand Sharaf El-Din *et al.*[12] have measured the nutritive value of fifty species collected from three raudhas around the Riyadh city and found that Ca have high content, Na have moderate content and N, P and K have relatively low contents. They interpreted these variations as a result of environmental and/or genetical variations among the same species.

This work deals mainly with the study of fourteen phenotypic characters in five wild species; *Salsola baryosma, Zygophyllum migahidii, Francoeuria crispa, Zilla spinosa* and *Rumex vesicarius.* Meanwhile, eight minerals (P, N, K, Na, Fe, Cu, Mn and Zn) have been measured during three seasons of study (autumn, winter and spring, 2002). These species are widely distributed in El-Riyadh City, Saudi Arabia. The aim of this study was to search about the most stable characters which can be of use in taxonomy. Meanwhile, its is necessary to know how much the mineral contents affected by both habitats and environmental factors. As well as to evaluate the limits of morphological alteration according to environmental changes.

MATERIALS AND METHODS

The materials were gathered from three different habitats in El-Riyadh City (El-Nargis District, North El-Riyadh; The beginning of El-Riyadh El-Kharj Road, South

Corresponding Author: W.K. Taia, Department of Botany, Faculty of Sciences, Alexandria University, Alexandria, Egypt

East El-Riyadh and Wadi Hanif, South El-Rayadh). These habitats are completely different in their soil characteristics[13]. At least 20 specimens from each species per location were collected for this study. All the specimens collected during the mid of October, mid of December, 2001 and mid of February 2002. The first three characters measured in the field, while the rest were studied in the laboratory of the Girls College in El-Riyadh. For plant moisture contents 100 g of the shoot system were dryed in an oven 95°C over night. Plant specimens are gathered randomly from the different habitats through the three periods of study, dried and digested[14]. Then the different minerals have been measured[15]. Means of the data obtained are calculated for evaluating the effect of both habitats and seasonal variations.

RESULTS

Table 1 and 2 summarize the studied characters and their status in the different species gathered from the three habitats. It can be noticed that *S. baryosma, Z. Migahidii* and *F. crispa* in the first location (El-Nargis district) are widely distributed than in the other two locations (Fig. 1). But, in spite of its abundance it was dry, short, the colour of the plant was whitish green and sparsely branched. In the second location (El-Riyadh El-Kharj Road) the density of the plants were low but they were flourished and taller, except *Z. migahidii,* although

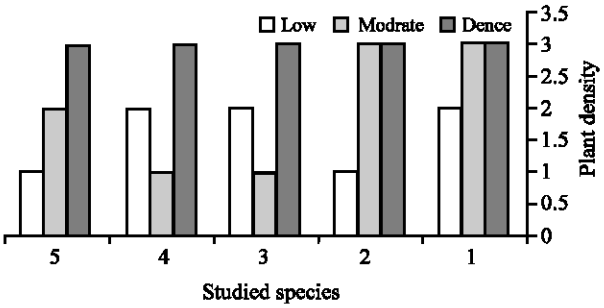

Fig. 1: Variation in plant density of five species studied in the three habitats

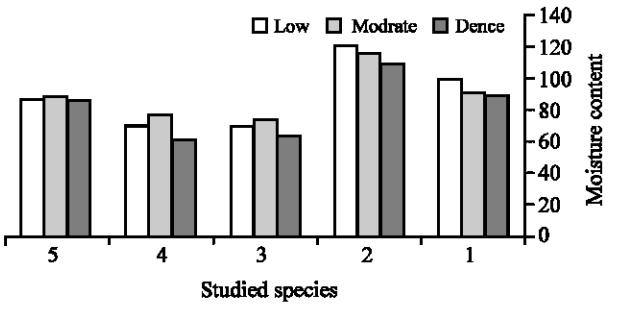

Fig. 2: Variation in moisture contents of five species studied in the three habitat

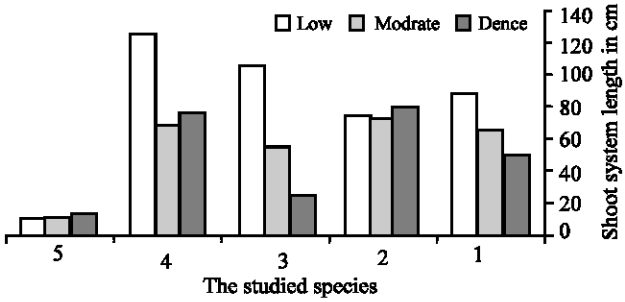

Fig. 3: Variation in shoot system length of five species studied in the three habitats

it still whitish green and the branches were few (Fig. 3). In Wadi Hanifa *S. baryosma, Z. migahidii* and *F. crispa* was moderately abundant and the plants were flourished, tall, bright green and with many branches. In the three habitats there were no fruits nor flowers. *Zilla spinosa* is widely distributed in the first location and its status was very good. It was flourished, tall and green in colour but the branches were few. The presence of *Z. spinosa* in the second location was sparse, but even so its status was very good as in the first location. This species was moderately abundant in wadi Hanifa and still keeping its good status with many branches. The plants were in the fruiting stage in the three locations, but the density of the fruits was higher in the first one.

The data obtained for *R. vesicarius* were completely different than the previous two species. Its presence in wadi Hanifa was lesser than the other two habitats. In the same time, plants founded in wadi Hanifa were dry, short, olive green, unbranched and without any fruits. Whereas in the first two locations it was dense, flourished, slightly taller, green in colour, with few branches and in the fruiting stage.

Leaf characters for the three species were more fixed, whereas the moisture contents of the plants slightly differ according to the locations. These results are well demonstrated (Fig. 1-3) which revealed the variations in the density of the plants and shoot system length within the different habitats in the studied species and the difference in moisture contents as well. The result of the characters showed insignificant variations within the three habitats.

S. baryosma show considerable variations in the contents of K and Fe in the three habitats within three seasons while *Z. migahidii* showed these variations in the contents of K, Na, Fe and Zn in the first habitat; Fe and Mn in the second habitat and K, Na and Fe in the third habitat (Table 2). These variations are less obvious in the other species studied, where the variations in the mineral contents restricted to K, Mn and Zn in both *F. cripa* and

Table 1: Characters studied and their status in the three habitats

Habitats	Char./Sp.	*S. baryosma*	*Z. migahidii*	*F. crispa*	*Z. spinosa*	*R. nervosus*
1	1	3	3	3	3	3
	2	1	1	1	2	3
	3	45-60	70-85	20-30	70-85	10-22
	4	1	2	1	2	2
	5	2	2	2	2	2
	6	3	2	3	1	3
	7	1	1	2	1	1
	8	2	2	1	1	1
	9	0.6-1.0	1.2-1.9	1.7-2.2	1.1-1.5	4.5-5.2
		0.8	1.6	2.05	1.4	4.97
	10	0.6-0.8	0.5-0.7	0.3-0.47	0.2-0.3	2.5-2.9
		0.76	0.57	0.38	0.27	2.75
	11	4	2	1	1	3
	12	87.9	107.6	62.5	60.6	85.62
	13	0	0	0	2	2
	14	0	0	0	2	1
2	1	3	3	1	1	2
	2	1	1	1	2	2
	3	55-75	65-72	40-62	65-72	10-15
	4	4	2	1	2	2
	5	3	3	2	3	2
	6	3	2	3	1	3
	7	1	1	3	1	1
	8	2	2	1	1	1
	9	0.5-0.66	1.3-1.6	2.2-2.5	1.6-2.3	3.0-4.0
		0.57	1.43	2.38	2.05	3.2
	10	0.4-0.58	0.6-0.9	0.3-0.5	0.3-1.0	2.0-3.5
		0.53	0.72	0.42	0.60	2.80
	11	4	2	1	2	4
	12	89.7	114.2	73.1	76.8	88.62
	13	0	0	0	1	1
	14	0	0	0	2	1
3	1	2	1	2	2	1
	2	3	3	3	3	1
	3	66-90	68-89	80-110	95-150	6-10
	4	3	3	3	4	4
	5	2	2	4	4	1
	6	3	2	3	4	2
	7	1	1	2	1	1
	8	2	2	1	1	2
	9	0.5-0.7	1.6-2.1	2.0-2.2	1.5-1.8	2.5-4.0
		0.62	1.8	2.14	1.61	3.2
	10	0.4-0.6	0.8-1.3	0.4-0.5	0.4-0.5	2.0-3.2
		0.45	1.0	0.45	0.41	2.8
	11	4	2	1	1	4
	12	98.3	119.2	69..5	69.6	87.18
	13	0	0	0	1	0
	14	0	0	0	2	0

Characters: 1-Density 1 = low, 2 = moderate, 3 = dence; 2 - Appearance 1 = dry, 2 = slightly flourished, 3 = flourished; 3 = Length of the shoot system in cm; 4-Colour of the shoot system 1 = whitish green, 2 = green, 3 = bright green 4 = olive green; 5-Density of branches 1 = unbranched, 2 = branched, 3 = densely branched, 4 = very densely branched; 6-Leaf colour 1 = pale green, 2 = green, 3 = olive green, 4 = dark green; 7-Leaf margin 1 = entire, 2 = undulated, 3 = sinuated; 8-Leaf apex 1 = lanceolate, 2 = ovate-lanceolate, 3 = obovate, 4 = broadly-obovate; 12-Plant moisture content (percentage); 13 = Fruit 0=absent, 1 = present, 3 = dense; 14-fruit shape 0 = absent, 1 = flat, 2 = globular

Z. spinosa throughout the three seasons in the different habitats. *R. nervosus* show small variation than the rest of the species especially in K, Mn and Zn.

DISCUSSION

The effect of habitats on the type of vegetation has recently been discussed[13,16,17]. But how much the variations in the soil characters and the surrounding environment affect the phenotypic characters of the same species has gained less attention. Schlichting and Levin[3] noticed the effect of the environmental conditions on the morphology of annual Phlox. Dunn and Sharitz[9] have found that the water available to the plant beside the light intensity and temperature, altogether can have direct effect on the phenotypic characters of *M. keisak* especially the shoot length. The same results have been obtained by Nicotra *et al.*[18] in their study on two piper species. This co-ordinate with the present data, as the three choosen habitats have different soil types, water

Table 2: Mineral contents in the studied species in the three habitats

Habitats	Char./Sp.	*S. baryosma*	*Z. migahidii*	*F. crispa*	*Z. spinosa*	*R. nervosus*
1	1 (P)	0.096-0.65-0.59	0.09-0.9-0.99	0.12-1.17-0.76	0.09-0.52-0.29	0.05-0.07-0.04
	2 (N)	1.63-1.22-1.35	1.3-1.38-1.4	0.9-1.24-1.02	1.12-1.23-1.02	1.02-1.35-0.9
	3 (K)	1.61-1.22-14.3*	0.5-3.29-9.97*	1.0-7.9-11.3*	0.34-5.3-5.6	0.23-1.3-3.6
	4 (Na)	9.08-5.7-7.2	1.1-5.28-5.68*	0.12-1.32-1.52	0.09-1.12-0.21	0.12-0.26-0.35
	5 (Fe)	696-975-146**	398-704-864*	356-378-532	331-342-289	164-253-275
	6 (Cu)	15.92.0-6.0	9.6-6-5	16-13-11	8.5-10-4	3.5-3-1.2
	7 (Mn)	52.5-48-63	98-47-41	38-70-65*	23-51-79*	11-6-3.6
	8 (Zn)	54.5-20-22	78-11-11**	95-35-29*	30-22-13*	22-17-8*
2	1 (P)	0.095-0.89-1.24	0.091-1.28-1.12	0.35-0.52-0.32	0.06-0.32-0.19	0.03-0.04-0.28
	2 (N)	1.9-1.4-1.31	1.5-1.36-1.37	0.76-0.97-0.83	1.06-1.12-1.02	0.82-0.91-0.62
	3 (K)	0.35-5.96-20.98**	0.62-1.36-3.65	0.9-6.3-10.6*	0.27-3.6-4.2	0.19-1.12-2.8
	4 (Na)	8.1-5.13-7.9	0.8-10.3-10.6**	0.1-1.42-1.46	0.1-1.22-0.21	0.21-0.35-0.52
	5 (Fe)	703-1235**-555	271-576-597**	321-345-437	128-231-142	119-153-201
	6 (Cu)	119-10-12	9.6-6-5	13-9-8	6.2-7.6-3.5	5.2-4.1-2.9
	7 (Mn)	90-71-45*	98-47-41*	33-54-56	18-47-65**	16-23-38*
	8 (Zn)	90-106-73	78-11-11	76-52-18*	32-28-15*	35-17-13*
3	1 (P)	1.02-0.75-1.22	0.06-0.85-0.9	0.11-0.17-0.74	0.09-0.51-0.28	0.03-0.07-0.05
	2 (N)	1.52-1.79-1.63	1.34-1.12-1.21	0.89-1.3-1.05	1.15-1.44-1.02	0.54-0.7-0.61
	3 (K)	0.55-3.49-14.3*	0.37-0.93-1.39*	1-7.8-11.2*	0.4-5.3-5.5**	0.21-0.97-1.6**
	4 (Na)	8.32-5.32-6.02	0.62-11.2-10.9*	0.1-1.7-1.7	0.12-1.3-0.67	0.08-1.75-1.6
	5 (Fe)	304-516-213	118-426-464*	356-378-532	177-307-189*	134-155-178
	6 (Cu)	7-6.4-6.9	5.2-3.9-4.7	16-13-12	8.3-10-14*	1.8-2.75-2.43
	7 (Mn)	63-52-23	83-37-34	38-70-65*	23-50-86**	9.2-11.6-22**
	8 (Zn)	72-84-32	58-18-17	107-40-28**	29-22-13	31-11-7.8

The readings are in order of autumn-winter-spring * = Significantly affected by seasons ** = Highly significantly affected by seasons

contents and chemical constituents. In spite of that, the changes in the morphological characters in the studied species were insignificant, but the mineral contents are greatly affected by these variations. The observable changes were only in the colour of the plants, its status, degree of branching and fruiting stage. These characters can be due to the water available to the plants which differs according to the habitats beside the soil salt contents. Mahmoud *et al.*[19] pointed to the effect of the environmental condition, especially soil salinity, on the structure of the vegetation and degree of specification. Meanwhile, they neglect the effect of the environmental changes on the morphology of the species. Alawi and Abulfatih[20] have found that the taxonomic characters in *Calotropis procera* grown in two altitutidinal ranges are uniform.

The results of the present study revealed that the change in habitats which completely differ in their soil structure and constituents has little effect on the phenotypic characters of the plants but has highly significant effect on the mineral contents of the taxa. The cross correspondence analysis between the habitats revealed that the habitats have insignificance effect on the studied morphological characters while it has either significant or highly significant effect on the accumulation of minerals inside the species. These may be due to the salinity and drought of the soil which cause the increase in some minerals especially K and Zn. Accordingly it can rely on these morphological characters, especially those of the leaves, in taxonomy.

REFERENCES

1. Radford, A.E., 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
2. Davis, P.H. and V.H. Heywood, 1973. Principles of Angiosperm Taxonomy. Robert E. Krieger Publ. Comp., Huntington, New York.
3. Schlichting, C.D. and D.A. Levin, 1984. Phenotypic plasticity of annual Phlox: test of some hypotheses. Am. J. Bot., 71: 252-260.
4. Schlichting, C.D., 1986. The evolution of phenotypic plasticity in plants. Ann. Rev. Ecol. Syst., 17: 667-693.
5. Sultan, S.E., 1995. The Role of Plasticity in a Exploiting Environmental Heterogeneity. In Cadwell, M.M. and R.W. Pearcy, Eds., Exploitation of Environmental Heterogeneity by Plants. Academic Press, New York, pp: 2-19.
6. Pianka, E.R., 1988. Evolutionary Ecology, 4th Ed., Harperad Row, New York.
7. Grime, J.P., 1994. The Role of Plasticity in Exploiting Environmental Heterogeneity. In Cadwell, M.M. and R.W. Pearcy, Eds., Exploitation of Environmental Heterogeneity by Plants. Academic Press, New York, pp: 2-19.
8. Mazer, S.J. and D.L. Gorchov, 1996. Parternal effects on progeny phenotype; Distinguishing genetic and environmental causes. Evolution, pp: 44-53.
9. Dunn, C.P. and R.R. Sharitz, 1991. Population and phenotypic plasticity in *Murdannia kiesak* (Commelinaceae). Am. J. Bot., 78: 1712-1723.

10. Mazer, S.J. and R.R. Sharitz, 1991. Density influence the expression of genetic variation in seed mass in wild radish (*Raphanus sativus* Brassicaceae) Population and phenotypic plasticity in Murdannia kiesak (Commelinaceae). Am. J. Bot., 79: 1185-1193.
11. Shaltout, K., N.Denelle, P. Jagquard and F. Romane, 1989. Variability among *Thymelaea hirsute* (L.) Endl. Populations in Egypt. Folia Geobot. Et. Phytotax, 24: 305-314.
12. Sharaf El-Din, A., H.F. El-Kady, K.H. Shaltout and M.I. Madi, 1998. Nutritive value of the Raudhas plants in central Saudi Arabia. Arab. Gulf J. Sci. Res., 16: 537-553.
13. Taia, W.K. and W.M. El-Ghanem, 2001. City vegetation analysis of three habitats at El-Riyadh. Bull. Pure Appl. Sci., 20B: 53-63.
14. Johnson, C.M. and A. Ultrich, 1959. Analytical methods for use in Plant Analysis. U.S. Dept. Agri., Calif. Univ. Agric., USA.
15. Chapman, H.D. and P.F. Pratt, 1961. Methods of analysis for soils, plants and water. Univ. Calif. Agri. Publ., Berkely, California, USA.
16. El-Demerdash, M.A., A.K. Hegazy and A.M. Zilay, 1995. Vegetation-soil relationships in *Tihamah coastal* plains of Jazan Regional, Saudi Arabia. J. Arid Environ., 30: 161-174.
17. Sultan, S.E., 1987. Evolutionary implications of phenotypic plasticity in plants. Evol. Biol., 21: 127-178.
18. Nicotra, A.B., R.L. Chazdon and C.D. Schlichting, 1997. Patterns of genotypic variation and phenotypic plasticity of light response in two tropical piper (Piperaceae) species. Am. J. Bot., 84: 1542-1553.
19. Mahmoud, A., A.M. El-Sheikh and F. Isawi, 1985. Ecology of the littoral salt marsh vegetation at Rabigh on the red sea coast of Saudi Arabia. J. Arid Environ., 5:35-42.
20. Alawi, H.M. and H.A. Abulfatih, 1996. Uniformity of morphological charact6eristics of Calotropis procera found in two altitudinal ranges in Saudi Arabia. Arab Gulf J. Sci. Res., 14: 169-176.