

# Habitat Variation and its Effect on the Morphological Characters of Three Wild Plant Species in El-Riyadh City

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تغير البيئات وتأثيرها على صفات الشكل الخارجي لثلاث أنواع نباتية منتشرة في مدينة الرياض

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الخلاصة: هذه الدراسة تتناول مدى تأثير الظروف البيئية المحيطة على الصفات التصنيفية للنباتات. ولذا فقد تم إختيار ثلاث أنواع نباتية منتشرة بمدينة الرياض وهم *Francoeuria crispa*, *Rumex vesicarius*, *Zilla spinosa*. وجمعهم من ثلاث بيئات مختلفة. وقد روعي جمع 25 عينة نباتية من كل نوع وكل موقع. ومن النتائج المتحصل عليها وجدنا أن الحالة العامة للنبات تتأثر بالبيئة النالمية بها وكذلك طولها ولون سيقانها ومرحلة التزهير والأثمار. ومن التحليل المرتبط التبادلي للبيئات وجدنا أن صفات الأوراق لا تتأثر بصورة معنوية تبعاً للتغير في البيئات. ولذا فأنا نوصي بالإعتماد عليها في التصنيف وعمل العلاقات بين النباتات.

ABSTRACT: Fourteen taxonomic characters have been studied in three wild plant species in El-Riyadh city; *Francoeuria crispa*, *Zilla spinosa* and *Rumex vesicarius*; collected from three different habitats. The results of this study revealed that the habitats have insignificant effect on the leaf characters in spite of the slight effect on the general status, fruiting stage and color of the plants. Cross correspondence analysis between the habitats revealed that the variations were within the confidence limits. It is concluded that leaf characters can be used as an effective selection criterion for classification.

Keywords:

## Introduction

Morphological changes in response to environmental disorders are known as phenotypic plasticity, whereas internal changes are considered adaptation. Taxonomists have to be accurate in deciding whether the studied characters are according to environment or specified to that plant. Radford (1986) 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 leaf, 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 between unrelated species, but even so Davis and Heywood (1973) deplored the neglect of morphological characters as one of the

most serious errors which delay the achievement of a natural system. Schlichting and Levin (1984), Schlichting (1986), Sultan (1987), Pianka (1988) and Grime (1994) have indicated the response of plants to environmental changes which may be under genetic control or may evolve under selection. In the last case, new traits evolved which allowed species to adjust to new environments (Mazer and Gorchoy, 1996). Dunn and Sharitz (1991) and Mazer and Wolfe (1992) have found differences in plant biomass, shoot length and even reproductive growth in *Murdannia keisak* grown in different populations. Taxonomists need to be precise in choosing the characters they rely on it.

This work deals mainly, with the study of fourteen phenotypic characters in three wild species; *Francoeuria crispa*, *Zilla spinosa* and *Rumex vesicarius*. These species are widely distributed in

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El-Riyadh City, Saudi Arabia. The aim of this work was to investigate the most stable characters which can be of use in taxonomy. Meanwhile, we have to know the limits of morphological alteration according to environmental changes.

## Materials and Methods

The materials were collected from three different habitats in El-Riyadh city; 1 - El-Nargis district, north El-Riyadh, in which the soil is dry, hard, with high salt contents and covered with rocks, 2 - The beginning of El-Riyadh El- Kharj road, south east El-Riyadh, in which the soil is calcareous, loamy and affected by the nearby factories and 3 - Wadi Hanifa, south El-Riyadh, in which the soil is sandy with a high water content. These habitats are completely different in their soil characteristics (Taia and El-Ghanem, 2001). At least 20 specimens from each species per location were used. All the specimens were collected during the middle of February 2002. The first three

characters were measured in the field, while the rest were studied in the laboratory at El-Riyadh. For plant moisture contents 100 grams of the shoot system was dried at 95 °C overnight. The data obtained from each species/location were summarized using a CHANDAT computer programme. Then a cross correspondence analysis for the summarized data was carried out to evaluate the effect of the habitats on the studied characters.

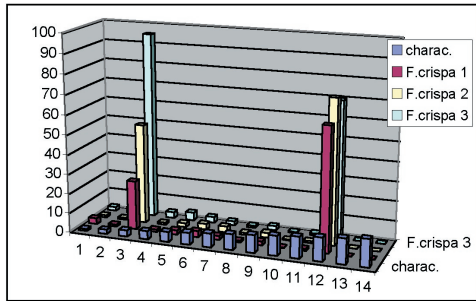
## Results

Table 1 summarizes the studied characters and their status in the different species gathered from the three habitats. *F. crispera* in the first location (El-Nargis district) is more widely distributed than in the other two locations. But, in spite of its abundance it was dry, short, the colour of the plant was whitish green and it was sparsely branched. In the second location (El-Riyadh- El-Kharj road) the density of the plant was low but it was flourishing and was taller, although it

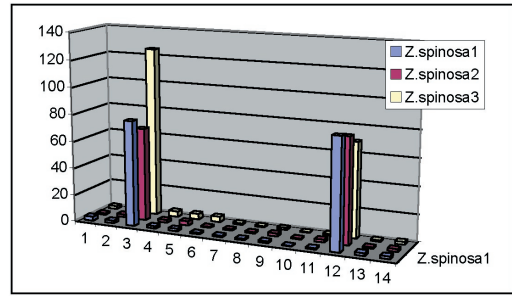
**Table 1.** Characters studied and their status in three habitats.

Sp. Char.	Location/Habitat								
	El-Nargis district			El-Riyadh- El-Kharj			Wadi Hanifa		
	F.crispa	Z.spin.	R.vesi.	F.crispa	Z.spni.	R.vesi.	F.crispa	Z.spin.	R.vesi.
Density	3	3	3	1	1	2	2	2	1
Appearance	1	2	3	1	2	2	3	3	1
Sh.Syst.L.	20-30	70-85	10-22	40-62	65-72	10-15	80-110	95-150	6-10
Color	1	2	2	1	2	2	3	4	4
Branches	2	2	2	2	3	2	4	4	1
Leaf color	3	1	3	3	1	3	3	4	2
Leaf marg.	2	1	1	3	1	1	2	1	1
Leaf apex	1	1	1	1	1	1	1	1	2
Leaf length	1.7-2.2	1.1-1.5	4.5-5.2	2.2-2.5	1.6-2.3	3.0-4.0	2.0-2.2	1.5-1.8	2.5-4.0
	2.05	1.4	4.97	2.38	2.05	3.2	2.14	1.61	3.2
Leaf width	0.3-0.4	0.2-0.3	2.5-2.9	0.3-0.5	0.3-1.0	2.0-3.5	0.4-0.5	0.4-0.5	2.0-3.2
	0.38	0.27	2.75	0.42	0.6	2.8	0.45	0.41	2.8
Leaf shape	1	1	3	1	2	4	1	1	4
Moisture	62.5	60.6	85.62	73.1	76.8	88.62	69.5	69.6	87.18
Fruit	0	2	2	0	1	1	0	1	0
Fruit shape	0	2	1	0	2	1	0	2	0

Characters: Density 1 = low, 2 = moderate, 3 = dense; Appearance 1 = dry, 2 = slightly flourished, 3 = flourished; Shoot system length in cm.; Colour of the shoot system 1 = whitish green, 2 = green, 3 = bright green 4 = olive green; Density of branches 1 = unbranched, 2 = branched, 3 = densely branched, 4 = very densely branched; Leaf colour 1 = pale green, 2 = green, 3 = olive green, 4 = dark green; Leaf margin 1 = entire, 2 = undulated, 3 = sinuated; Leaf apex 1 = acute, 2 = rounded; Leaf length in cm.; Leaf width in cm.; Leaf shape 1 = lanceolate, 2 = ovate-lanceolate, 3 = obovate, 4 = broadly-obovate; Plant moisture content (percentage); Fruit 0 = absent, 1 = present, 3 = dense; Fruit shape 0 = absent, 1 = flat, 2 = globular. Figures in parenthesis are mean values.



**Figure 1.** Variation in *F. crispa* growing in the three habitats.



**Figure 2.** Variation in *Z. spinosa* growing in the three habitats.

was still whitish green and the branches were few. In Wadi Hanifa *F. crispa* was moderately abundant and the plants were flourishing, being tall, bright green and with many branches. In the three habitats there were neither fruits nor flowers.

*Zilla spinosa* is widely distributed in the first location, and its status was very good. It was flourishing, being tall and green in color but the branches were few. The distribution 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 indicated 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 location.

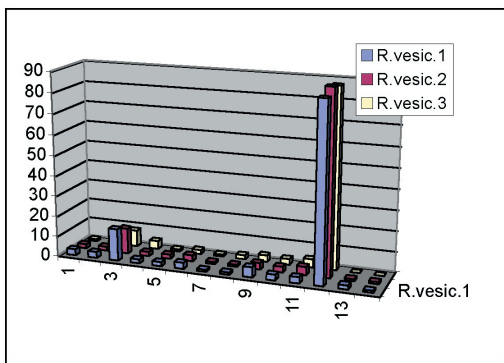
in Wadi Hanifa were dry, short, olive green, not branched and without any fruits, whereas in the first two locations it was dense and flourishing, slightly taller, green in color, with few branches and in the fruiting stage.

Leaf characters for the three species were more fixed, whereas the moisture contents of the plants differed slightly according to the location. These results are demonstrated in Figures 1, 2, and 3. The cross correspondence analysis between each pair of habitats shows that the differences between the habitats were within the confidence limits. Accordingly the effect of the habitats on the studied characters were insignificant.

The data obtained for *R. vesicarius* were completely different from that of the previous two species. Its presence in Wadi Hanifa was less than in the other two habitats. At the same time, plants found

### Discussion

The effect of habitat type on vegetation has recently been discussed (El-Demerdash *et al.*, 1995; Taia and El-Ghanem, 2001). 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 (1984) have noticed the effect of environmental conditions on the morphology of annual Phlox. Dunn and Sharitz (1991) found that the water available to the plant, besides the light intensity and temperature, altogether can have a direct effect on the phenotypic characters of *M. keisak*, especially the shoot length. This corresponds with our data, as the three chosen habitats have different soil types, water contents and chemical constituents (Taia and El-Ghanem, 2002). Even so, the changes in the morphological characters in the studied species were insignificant. The observable changes were only in the color of the



**Figure 3.** Variation in *R. vesicarius* growing in the three habitats.

plant, its status, degree of branching and fruiting stage. These characters can be due to the water available to the plants, which differ according to the habitats and the soil salt contents. Mahmoud *et al.* (1985) pointed to the effect of environmental conditions, especially soil salinity, on the structure of the vegetation and degree of speciation. Meanwhile, they neglected the effects of environmental changes on morphology. Our results show that the main factor affecting the plant is water availability and this may be due to the studied species allocated under the same climatic factors. Alawi and Abulfatih (1996) have found that the taxonomic characters in *Calotropis procera* grown in two altitudinal ranges were uniform and this is what we found in the results obtained. Our data reveal that the change in habitats which completely differ in their soil structure and constituents (Taia and El-Ghanem, 2002) has little effect on the phenotypic characters of the plants. The cross correspondence analysis between habitats revealed that the habitats have insignificant effect on the morphological characters and accordingly we can rely on these in taxonomic works.

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