

Uniformity of Morphological Characteristics of *Calotropis procera* found at Two Altitudinal Ranges, in Saudi Arabia

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ABSTRACT. Nine morphological characteristics namely: plant height, leaf length, leaf width, leaf dry weight, fruit diameter, seed number per fruit, seed weight per fruit, corolla length and corona length were used to test the influence of environmental conditions on the performance of *Calotropis procera* plants. The comparison was made on the plant materials collected from low altitude (0-300 m) and from high altitude (1700-2000 m). The comparison showed no significant differences between these two groups of plants, indicating that *Calotropis procera* can endure a wide range of environmental conditions, without showing any obvious morphological differences.

Calotropis procera (Ait.) Ait. f. shrubs are widely distributed in Asia and Africa and can survive over a broad range of altitudes. The species is commonly found in the sandy warm parts of Saudi Arabia, especially in the western lowlands (Migahid 1978, Zahran, *et al.* 1985 and Abulfatih 1984 and 1992). The seeds of *Calotropis procera* do not go through a dormant period, and can germinate fast if proper water and temperature are available (Mahmoud *et al.* 1983 and Abulfatih 1985). The proper temperature for germination ranges between 30 and 36°C. (Abulfatih and Bazzaz 1985). The seeds do not germinate in saline water, and accordingly the plant is commonly found in non-saline soils (Mahmoud *et al.* 1984). *Calotropis procera* is common in the southwestern lowland, which is locally called Tihama (0-300 m), and in the rainshadow plateau to the east of the Asir mountains (1700-2000 m). The plant (called Ushar in Arabic) is not important commercially, and not used as forage because of its milky poisonous sap, but it is used in folk medicine for the treatment

of various human ailments (Watt and Breyer-Brandwijk 1962 and Osborn 1968) such as the relife of rheumatic pain and swelling (Abdulfatih 1987).

It has been known from the literature that species commonly show morphological differences when living under different environmental conditions. For instance, *Achillea lanulosa* plants living over the Sierra Nevada range, in the USA, grow tall and robust at 3000 ft. and progressively reduce their size until they reach 11000 ft. altitude (Clausen *et al.* 1948). *Plantago maritima* plants living in marshes along the coast of Sweden are tall and robust and those living on cliffs at Faeroe Islands are short and small (Turesson 1930).

According to the concept that plants become smaller in size as they progressively move up the mountains we set our project to determine the morphological differences expressed by *Calotropis procera* plants found at two different altitudinal ranges, in the southwestern part of Saudi Arabia, between 0-300 m and between 1700-2000 m.

Materials and Methods

Nine morphological characteristics were studied in *Calotropis procera* plants for the purpose of evaluating the performance of the species at low altitude, in the southwestern coastal area (0-300 m) and at high altitude, at the rainshadow area, to the east of Asir mountains (1700-2000 m), in Saudi Arabia. The selected morphological characters were as follows: plant height, leaf length, leaf width, leaf dry weight, fruit diameter, seed number per fruit, seed weight per fruit, corolla length and corona length.

Calotropis procera shrubs were examined at 20 of randomly chosen sites in lowland and 20 at highland. At each site 5 shrubs were randomly chosen and examined. One branch was taken from each selected shrub to examine the morphological characters listed above. Mean value of every parameter was determined from the five shrubs selected at each site. Further, T-test analysis was applied on the mean values determined at the 20 sites, in lowlands and highlands.

With regard to leaf weight, leaf length, leaf width, the reading represented the average values of 10 leaves taken from each of the chosen branches. These leaves were taken from node 3 to node 7, counting from the tip of the branch. Leaves at node number 1 and 2 were ignored because they were too small; and leaves found beyond the seventh node were ignored because they were too old.

Leaf weight was evaluated after oven drying at 70 °C. Seed weight was evaluated after air dried. All other readings were taken for the fresh plant material.

Climatic Conditions and Plant Distribution

The climate of the southwestern region of Saudi Arabia is affected by the prevailing southwesterly wind and the monsoon rain which falls mainly during winter and summer (Abulfatih 1992). The climate of each vegetation zone in the southwestern region of Saudi Arabia is unique with regard to temperature, rainfall and relative humidity (Fig. 1). *Calotropis procera* plants were common in the coastal plains zone (0-300 m) and the rainshadow slopes zone (1700-2200 m). The species is rarely found in the foothills zone (300-1000 m) and lower escarpments zone (1000-1600 m); and not found at upper escarpments zone (1600-2200 m) and high mountains zone (2200-3000 m). The coastal plains zone is generally characterized by lower rainfall, high temperature and high relative humidity (Fig. 2). On the contrary, the rainshadow slopes zone is characterized by lower annual rainfall and relative humidity, warmer summer and cooler winter.

Results and Discussion

Nine morphological characters of *Calotropis procera* plants living at two elevation ranges, 0-300 m and 1700-2000 m were examined. These characters were as follows: plant height, leaf length, leaf width, leaf dry weight, fruit diameter, seed number per fruit, seed weight per fruit, corolla length and corona length.

The comparison of each character between lowland and highland showed no significant difference, when tested by a T-test (Table 1).

Such results indicate that *Calotropis procera* plants were morphologically similar at both lowland and at highland, in spite of the fact that environmental conditions were different at these two altitudes. Such plant behavior make the species highly vigorous and express a high potential for survival and distribution in nature.

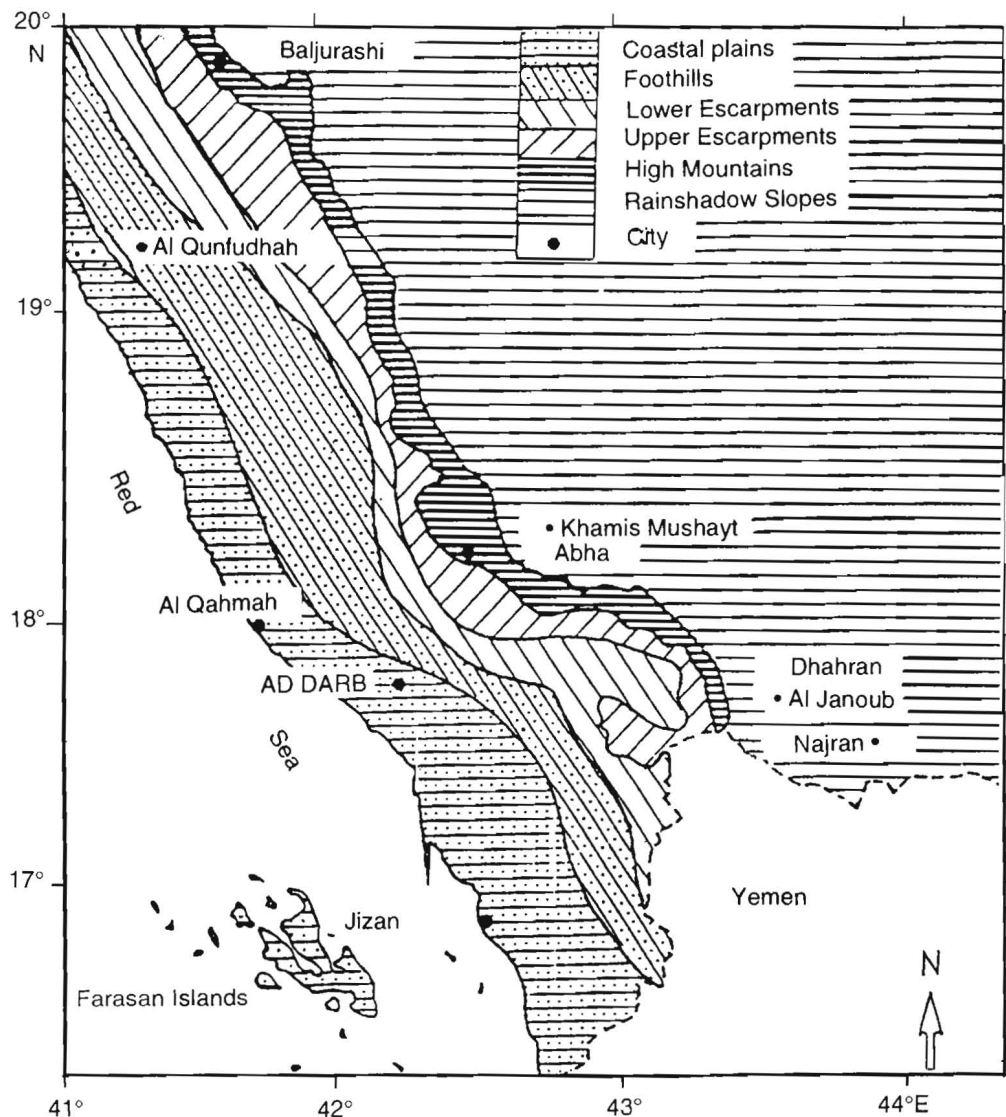
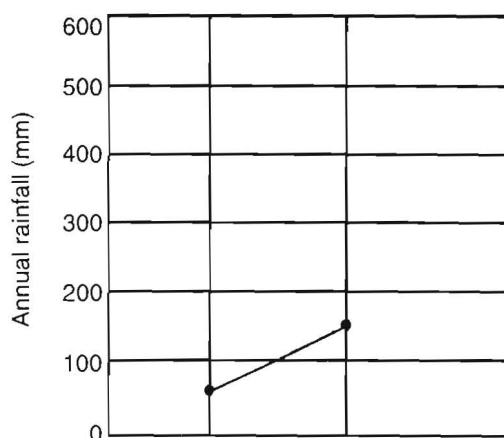


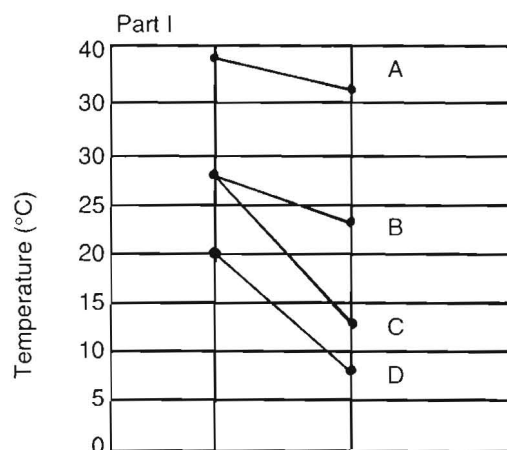
Fig. 1. Map showing the six vegetation zones of southwestern region of Saudi Arabia (Abulfatih 1992). *Calotropis procera* plants are common in the coastal plains (0-300 m) and rainshadow zones (1700-2200 m). The species is infrequently found in the lower escarpments zone (1000-1600 m), not encountered at upper escarpments (1600-2200 m) and high mountains zones (2200-3000 m).

Fig. 2. Climatic information of the vegetational zones where *Calotropis procera* plants were found, in the south-western region of Saudi Arabia, for the years 1975-1984, derived from Abulfatih (1992). Vegetation zones 1 and 2 correspond consequently with coastal plains zone (0-300 m) and rainshadow zone (1700-2200 m).

Part I. Average total annual rainfall.



Part II. July average daily maximum (A) and minimum (B) air temperature. December average daily maximum (C) and minimum (D) air temperature.



Part III. July average daily maximum (E) and minimum (F) relative humidity. December average daily maximum (G) and minimum (H) relative humidity.

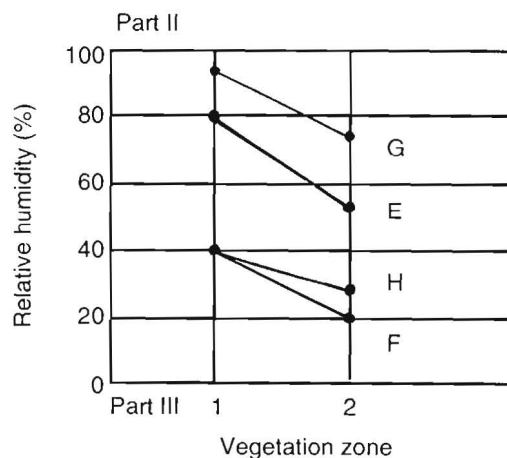


Table 1. Morphological characteristics of various parts of *Calotropis procera* plants, collected from high and low altitudes

Plant Part	At High Altitude (1700-2000 m)		At Low Altitude (0-300 m)		P Value**
	Mean	S.D*	Mean	S.D.	
Plant height (m)	2.2	0.4	2.4	0.8	0.464
Leaf length (cm)	16.2	3.5	13.7	3.0	0.181
Leaf width (cm)	11.2	2.4	9.3	1.9	0.567
Leaf dry weight (g)	1.3	0.4	1.1	0.3	0.446
Fruit diameter (cm)	25.5	5.9	23.5	7.0	0.909
Seed number per fruit	325	123	285	87.5	0.797
Seed weight per fruit	2.7	1.4	3.1	1.2	0.661
Corolla length (cm)	1.4	0.4	1.1	0.3	0.504
Corona length (cm)	1.4	0.5	1.6	0.5	0.888

* S.D. : Standard deviation.

** P value was measured between means at highland and lowland by T-Test. P values show that altitudes have insignificant effect on plant parameters used in this project.

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انتظام الصفات الشكلية لنباتات العشر *Calotropis procera* الموجودة ضمن ارتفاعين مختلفين ، في المملكة العربية السعودية

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صنعاء - الجمهورية اليمنية

درست خلال هذا البحث تسعة صفات شكلية لنباتات العشر الموجودة في المنخفضات (٠-٣٠٠ متر) ، والأخرى الموجودة فوق المرتفعات (١٧٠٠-٢٠٠٠ متر) ، في محاولة لمعرفة تأثير الظروف المناخية على أداء هذا النبات . والصفات التي تم دراستها تشتمل على ما يلي :

طول النبات ، وطول الورقة ، وعرض الورقة ، ووزن الورقة ، وقطر الثمرة ، وعدد البذور في الثمرة ، ووزن البذور في الثمرة ، وطول التويج ، وطول الكورونة .

وبعد اجراء التحليلات الاحصائية على هذه الصفات لمقارنة نباتات المنخفضات بنباتات المرتفعات تبين عدم وجود فروق بين هذه الصفات . وتدل هذه النتائج على أن نبات العشر قادرا على تحمل مدا واسعا من الظروف البيئية ، من درجات الحرارة ، والمطر ، والرطوبة النسبية ، ودون ان يبدي أي تغيرات ملحوظة في أشكال أجزائه . وهذه النتائج تشجع الباحثين لدراسة الجوانب الفسيولوجية والوراثية لهذا النبات ، لمعرفة مدى استجابتها للتغيرات المناخية في هاذين الارتفاعين المختلفين .