Annals of Arid Zone 26 (3) : 203-206, 1987

ADAPTIVE FEATURES OF *CROTALARIA BURHIA* BUCH. HAM. IN INDIAN DESERT

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In order to survive, plants must adapt to soil moisture stress, dryness of air and high atmospheric temperature associated with intense solar radiations in the Indian desert. Differentiation of a species into a number of morphologically distinct populations is one such adaptation in all extreme environmental conditions. The present study relates to such adaptation displayed by *Crotalaria burhia* Buch. Ham. in Indian arid tracts.

While studying the various adaptive features of desert vegetation during rainy, winter and summer seasons of the year 1985-86 two distinctly variable populations of *C. burhia* were observed in two different habitats, viz. open places (sand dune and abandoned fields) and shady and protected sandy plains. Observations on morphological variations in root, stem, leaf, etc. were recorded at various growth stages (Tables 1 and 2). The epidermal hairs were measured with a pre-calibrated microscope and the leaf area (4th node from apex) measured by graph paper method.

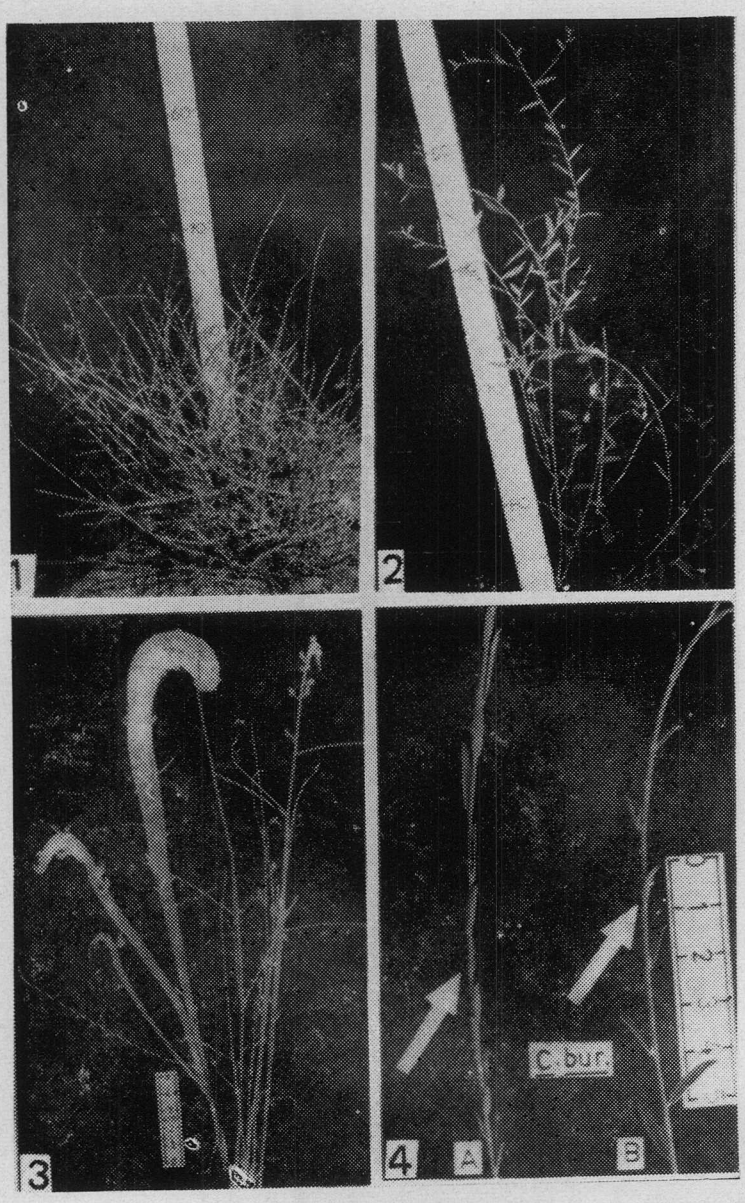
Based on the distinct morphological variations, *C. burhia.* populations have been classified as 'erect-bushy' (EB) and 'sub-erect spreading' (SS) forms (Figs. 1 & 2). The EB form survives throughtout the year and SS form dries completely during summer season, as the plants of SS form here are not equipped to face the onslaught of arid environment. Sen (1972) also reported that SS forms of *Convolvulus microphyllus* Sieb. ex Spreng completely disappeared during summer season. The survival of EB form is mainly due to its various adaptive strategies. *C. burhia* root structure is an extremely interesting example of ecological adaptation. Sen (1978) reported that in the perennating root centrally placed stele is surrounded by 8-10 smaller steles protected from the uncongenial surrounding atmosphere. This type of root system was commonly met with in EB form and is regarded as an important adaptation.

The condensed growth of the EB form helps the plants to withstand the strong desert winds and to accumulate sand particles against the danger of uprooting. Interestingly ribbon-like flattened stems (Fig. 3) were observed only in EB form during post-monsoon period. However, during the rainy season stem growth was normal.

Table 1. Comparative morphological variations of errect bushy (EB) and sub-erect spreading (SS) forms of *Crotalaria burhia*

Parameter	EB form	SS form
Habitat	Sand dunes and sandy plains, abundant in open places	Restricted to protected and shady places, often in association with youug *Prosopis cineraria.*
Roots	Deep and extensive perennation of plants mainly by strong ropelike root	Comparatively thin and tapering
Shoot	Condensed (30 cm high). Stem is stiff, hoary white with adpressed pubescence striatus, woody. Bunch of errect, stiff green shoots sprout from perennating roots, give bushy appearance.	Spreading shoot system; stem round, slightly woody, sem-erect, spreading branches often grow upto 80-100 cm in height
Stem fiattening	Striated stem (6 cm) flattened like a ribbon (32 cm).	Stem flattening absent
Leaf	Leaf area variation is distinct in relation to season. Leaf orientation parahelionastic.	Large leaves throughout the life cycle which dry completely during summer season. Leaf orientation absent.

Leaf area was greatly variable (Table 2). The small summer leaves were very important as they do not beeome overheated in dry environments (Slatyer, 1964). SS plants eompletely shed their large leaves during summer season. Leaves in EB form showed parahelionastic movement (Fig. 4) in the sense that winter leaves stand parallel to the stem axis so that both leaf surfaces are only partially exposed to the sun. Leaves thus escape the heat load and conserve water by minimum transpiration. The increase in covering of hairs in EB plants is also an important adaptation as it forms a non-conducting screen against heat (Sen & Lekhak, 1984). Thus the populations of EB form are considered to be drought tolerant whereas the populations of SS form are drought escaping.



Figs. 1 & 2. Variation in shoot system of the two forms (EB & SS) of *C. burhia.*

Fig. 3. Ribbon-like flattened stem in form EB of *C. burhia*

Fig. 4. Parahelionastic leaf orientation (A) normal (B) in form EB of *C. burhia*

Table 2. Seasonal variations in the leaf area (4th node and the number of leaf epidermal hairs (per mm^2) in the erect-bushy (EB) and sub-erect spreading (SS) forms of *C. burhia*

Season	*Leaf surface	Epidermal hairs EB	Epidermal hairs SS	Leaf Area (sq mm) EB	Leaf Area (sq mm) SS
Rainy	U	24.14±6.87	42.9±23.33	80.0×13.22	116.66±.3688
	L	15.36±6.81	31.9±15.59		
Winter	U	33.76±5.18	26.7±5.99	42.85±15.66	62.83±7.7J
	L	34.86±4.12	4.77±1642		
Summer	U	79.36±14.05	—	21.33±9.21	—
	L	70.95±21.0	—		

*U = Upper, L = Lower

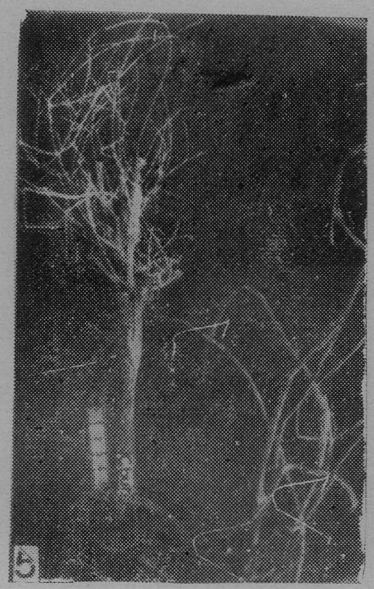


Fig. 5. Deep, rope-like root system in form EB of *C. burhia.*

We are thankful to Prof. N. Sankhla, the Head of Botany Department, for providing facilities. Financial assistance received from the Department of Science and Technology is also acknowledged.

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