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# Distribution pattern and growth assessment of *Corchorus depressus* in semi arid Indian desert

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The importance of spatial pattern of the plants may be realized directly, as in the provision of biomass or indirectly through modification of microclimates. The spatial and temporal variability of herb layer diversity remains largely unexplored and poorly understood (Christine & McCarthy 2002; Goebel *et al*. 1999). The arrangement of species on an environmental gradient will determine which species will be able to interact in future (Dale 1999). The plants that are closest on the gradient are the ones that are expected to compete most strongly. Similarly, the arrangement of the plants along the gradient will determine what potential positive interaction between species may actually occur (Bertness & Calloway 1994). In desert conditions, the natural availability and distribution mechanisms of plants are extremely variable and largely influenced by the climatic conditions. Goldberg & Novoplansky (1997) proposed "two-phase resource hypothesis" and made the distinction between the period when resources are available ("pulse") and when resources are too low for plant use ("interpulse"), during which time most mortality will occur. In low productive environment, these interpulses may be the primary environmental factors to which plants respond, possibly superceding in importance the dynamics that take place during pulse.

Experiments were conducted for the evaluation of distribution pattern of *Corchorus depressus* in three seasons at five sites in a semi arid region (Jodhpur) of Indian desert. We also tried to assess the reproductive and aggressive capacity of this plant in different soil mixtures.

*Corchorus depressus* Linn. is a member of the family Tiliaceae distributed in almost all parts of the world and abundantly occurs in Tropical Africa, Afghanistan, Arabia, Pakistan, India (Gujarat; Punjab; Rajasthan). Sen (1982) placed this plant in *Prosopis- Zizyphus - Capparis* division. It is a woody perennial, prostrate, the branches radiating from a woody crown, closely appressed to the ground and the plant is regarded as good sand binder in the desert. Fruit is a capsule, 8-15 mm long, often curved upwards from the underside of the branches, cylindrical, beaked, 4 valved, septate between the seeds. Seeds are minute and chocolate coloured. Medicinal uses of this plant in general weakness, gonorrhea, diabetes, treachery troubles, improved sexual vigor have been reported (Chopra *et al*. 1956; Kirtikar & Basu 1975; Kumar *et al.* 2003; Shekhawat 1986).

The studies were carried out in the semi arid region (20°11'33.4" – 26°21'5.5"N; 73°0.0'58.9"E) in and around Jodhpur. Phytosociological parameters (frequency, density, abundance and biomass) were assessed using 1 m$^2$ quadrats (Kent & Cooker 1992) in five sites (Jalamand, Kudi villages, disturbed situation, University campus and

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Mandor area, respectively) representing rural (Sites I & II), urban disturbed (Sites III & V) and protected conditions (Site IV). Phytosociological observations were carried out at all the five sites during different seasons i.e. rainy, winter and summer. The distribution pattern of *C. depressus* was assessed by using indices like Index of Dispersion (ID i.e. variance to mean ratio), Index of clumping (IC), Green index and Morista index (Ludwig & Reynolds 1988). After the identification of dispersion pattern, different allocation parameters (biomass of root, shoot, leaves and capsule), edaphic factors (moisture, pH, electrical conductivity, organic carbon, nitrogen, C: N ratio, available phosphorous and soil texture) were correlated with Morista index to assess the probable causal factor.

In a pot culture experiment, the seedlings were grown with different soil mixtures for the quantification of reproductive capacity and aggressive capacity. The reproductive capacity was quantified as per Salisbury (1942) as the product of average seed output and the fraction represented by the average germination. Aggressive capacity (AC), which denotes the potentiality of species to colonise and spread in nature, is the product of average reproductive capacity and percentage survival of seedlings in the experiment.

An ID value equal to 1.0 indicates a random distribution; zero indicates uniform, more than one the clumped distribution. In our study the ID index ranged from 0.2 to 1 except for site I. In most of the cases *C. depressus* population exhibited a move towards random distribution from the uniform especially when the moisture resource was low. The departure from the randomness has been statistically tested with Chi square test and all the calculated values of chi square were lower than the tabular value at 5% probability (Table 1). If population is clumped, ID is strongly influenced by the number of individuals (n) in the SUs (Sampling Units; Ludwig & Reynolds 1988), therefore ID is useful as a comparative index of clumping only if n is the same in all SUs (Darin *et al.* 2002)

David & Moore (1954) proposed a modification of ID, i.e. index of clumping (IC). The negative value of this index predicates uniform distribution where as a value of 0 indicates random distribution and a value equal to n-1 maximum clumping. In our study the value of IC index ranged from -0.8 to 0.0. Similar to ID index this index is also influenced by the number of individuals (n) in the SUs (Malhado & Petrere 2004). As compared to ID and IC indices, Green index (GI; Green 1966) better measures dispersion since it is independent to the number of individuals (Ludwig & Reynolds 1988). The values of GI ranged from 0.0 to -0.2 indicating random distribution.

Morista (1971) proposed an index that is theoretically independent of the total count, mean density, and also from size and the number of quadrats (Malhado & Petrere 2004). The value of this index equal to 1 indicates random, more than one indicates aggregated, and less than one uniform distribution. Our results revealed the random distribution of this plant at all the sites.

Focht & Pillar (2003) studied the spatial patterns of grassland communities in relation with the site factors. They concluded that the vegetation patterns in the study area are associated with relief position and other related factors such as soil moisture. In our study, the different allocational, edaphic and phytosociological factors were correlated with Morista index. Around 16 different regression analyses were tested, out of which two parameters i.e. mean clay content and mean phosphorus content were significantly related with distribution pattern of *C. depressus* [Y (Morista index) = 0.87 +

**Table 1.** Values of various indices of *C. depressus*.

| Indices | Site I | | | Site II | | | Site III | | | Site IV | | | Site V | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | W | S | R | W | S | R | W | S | R | W | S | R | W | S |
| Index of Dispersion | 0.9 | 0.6 | 1.0 | 0.4 | 0.8 | 0.5 | 0.3 | 0.7 | 0.7 | 0.3 | 0.3 | 0.6 | 0.5 | 0.2 | 0.8 |
| Chi Square | 8.3 | 5.6 | 9.4 | 3.3 | 6.8 | 4.7 | 2.5 | 6.7 | 6.2 | 2.7 | 2.5 | 5.5 | 4.3 | 2.0 | 7.4 |
| Index of Clumping | -0.1 | -0.4 | 0.0 | -0.6 | -0.3 | -0.5 | -0.7 | -0.3 | -0.3 | -0.7 | -0.7 | -0.4 | -0.5 | -0.8 | -0.2 |
| Green Index | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.2 | 0.0 | -0.1 | -0.1 | -0.1 | 0.0 |
| Morista index | 1.0 | 1.0 | 1.0 | 0.9 | 1.0 | 0.9 | 0.9 | 1.0 | 1.0 | 0.9 | 0.7 | 1.0 | 0.9 | 0.9 | 1.0 |

R-Rainy, W-Winter, S-Summer

**Table 2.** Growth assessment of *C. depressus* under different soil mixtures.

| Soil ratio (Sand: Clay: FYM: Gravel) | Reproductive capacity* | Aggressive capacity* |
|---|---|---|
| 1:1:1:1 | 13.16 | 746.67 |
| :2:1:2 | 40.5 | 2800.8 |
| 2:1:2:1 | 10.33 | 428.33 |
| 2:2:1:2 | 49.16 | 3853.33 |
| 1:2:2:2 | 55.66 | 5010 |
| CD (at 0.05 level) | 1.59 | 188.22 |

*Average of five estimates

0.001 X - 4.1 $X^2$ (X= mean clay content; $R^2$ =0.99; P <0.001; Y= 24.57 + 6.6 mean available P (in log); r = - 0.68; P<0.01].

The results from the experiment under controlled conditions with different soil ratios (Table 2) revealed that increase in clay or FYM can promote aggressiveness and reproductive capacity of this plant.

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