

Ecology (Growth & Phenology) study of *Desmodium* species in Alwar, Rajasthan

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ABSTRACT: *Desmodium repandum*, *Desmodium gangeticum* and *Desmodium triflorum* are herbs which grow commonly in Alwar district of Rajasthan. *Desmodium repandum* is an annual herb which grows on the hill slopes whereas *Desmodium gangeticum* grows commonly at the base of hill slopes and in the valleys in the tropical dry deciduous forests in Alwar district. It is a perennial, robust herb with erect stem. *Desmodium triflorum* grows in disturbed forest areas, wastelands abandoned fields and along road side and railway tracks in Alwar.

Phenology of tree species have been studied in forest ecosystem of central Himalayas (Ralhan et.al. 1985; Sundriyal 1990), North-Eastern Indian (Boojh and Ramakrishnan 1981, Shukla and Ramakrishnan 1982) and Sariska Tiger Reserve forest (Yadav and Gupta 2009). Yadav and Yadav (2007) has also evaluated the phenophases of tree and shrub species over a three year period in the Bala-Fort forest in Alwar, Rajasthan. So, far only a few attempts have been made to evaluate the phenology of a genus or species (Yadav et.al. 1992; Balalia and Chauhan 1994; Zhang et.al. 2006).

KEYWORDS: Phenology, *Desmodium*, Alwar, Rajasthan, Ecology, growth, conservation, habitat

I.INTRODUCTION

There is scanty information is available on the ecological studies of *Desmodium* species in India in general and particularly in Rajasthan. It is, therefore, imperative to study the biology of *Desmodium* species in Rajasthan for their conservation. Hence, the present study was carried out to study the ecology of three species of *Desmodium* in Alwar district of Rajasthan.[1]

II.MATERIALS AND METHODS

Three study sites were selected to evaluate the ecology of *Desmodium repandum*, *Desmodium triflorum* and *Desmodium gangeticum*. (1) Bala fort forest in Alwar which is a tropical dry deciduous forest. which is a protected forest with an area of about 2 km². (2) R.R. College campus in Alwar which is also a tropical dry deciduous forest and partially disturbed area. (3) Sariska Tiger Reserve forest is also a tropical dry deciduous forest but it is highly protected area. *Desmodium repandum* grows naturally in the Bala fort forest, *Desmodium gangeticum* in the Sariska Tiger Reserve forest and *Desmodium triflorum* in R.R. College campus.





Desmodium

The comparative morphology and growth behavior of three *Desmodium* species was evaluated in the three study sites where these species show normal growth. Five plants of each species were harvested from their respective natural growing sites. This is repeated during September, October and November in both the study years (2010 and 2011). The growth parameter such as length of shoot and root, number of branches, nodes and leaves per plant, leaf area per plant, fertile plants, number of pods and mericarps per plant were recorded. Then each plant was dried in hot air oven at 80°C for 48 hours for estimating the biomass following Misra (1968).

Five permanent quadrats of 1 m x 1 m each were fixed in each of the study site in July 2010 and July 2011 to study the phenology of three species of *Desmodium*. Observations regarding seed germination, vegetative growth, leaf initiation, leaf fall, flower initiation, fruit initiation, fruit maturation, senescence, seed dispersal, dormant stage of plants were taken at fortnightly intervals from July to December and monthly intervals from January to June. When, about 50% plants of each species were passing through a phenophase then the phenophase was considered at its peak.[2]

III.RESULTS AND DISCUSSION

Comparative morphology

The study of comparative morphology indicates that three *Desmodium* species exhibit great variation in vegetative features. The shoot length of *Desmodium repandum* was longer than the two perennial species. *Desmodium triflorum* shoots are prostrate and rooting at nodes, therefore, it reproduces by ramets also. The outline of the stem is angular in *Desmodium gangeticum* whereas it is cylindrical in the other two species. The leaf is trifoliolate compound, however, the lateral leaflets are reduced in size in *Desmodium gangeticum*. Similarly the three *Desmodium* species show differences in other vegetative characteristics.

The three *Desmodium* species also differ in their reproductive features. The inflorescence is axillary without peduncle in *Desmodium triflorum* while it is terminal and axillary in the other two species. The size of flower, pod and mericarp is larger in *Desmodium triflorum* than in other two species. They also differ in flower colour and pattern of constrictions of the pods. In case of *Desmodium repandum* the terminal mericarp of a pod is the largest whereas in the other two species all mericarps of a pod are equal in size.[3]

Growth behaviour

Desmodium repandum exhibited highest growth rate in September after which it did not exhibit vegetative growth. However, the root length increased even in October which may be an effort to get access to moisture and nutrients from deeper layers of the soil. Although the flowering was initiated in early September, the flowering and fruiting continued throughout the October. The maximum fruit production was achieved in the end of October. In the month of October there was drastic reduction in number of leaves and leaf area per plant while there is considerable increase in number of fruits. It may be inferred that maximum resources were mobilized to reproductive parts in October to maximize seed production for future generation. The relative growth rate was 0.97 in September and then declined abruptly.

In year 2011, *Desmodium repandum* exhibited similar trend of vegetative growth as in 2010. However, the reproductive growth in October 2011 was very reduced which may be due to decline in soil moisture may be due to less Rainfall. However, the reproductive growth was higher in October 2011 than that in October 2010. The relative growth rate was again higher in September (2.5) and then declined abruptly in October. The leaf area and biomass per plant were lower in October 2011 than that in October 2010. This may be attributed to low rainfall in 2011.[4]

Like *Desmodium repandum*, *Desmodium triflorum* exhibited the same pattern of growth. The growth rate was highest in September (4.8) and then declined abruptly. However, the development of reproductive structures was higher in October. It indicates that this species also mobilize large amount of resources to reproductive structures in October. The flowering and fruiting was low in September, however, it increased two fold in the month of October.

In the second year (2011), *Desmodium triflorum* exhibited the same pattern of growth as in first year of the study period (2010) (Table 3.6). However, the vegetative growth was higher in the first year of study (2010). The biomass per plant was lower in the second year (2011) as compared to the first year (2010). Therefore, the relative growth rate in September was lower in the second year than that of in the first year. In case of *Desmodium triflorum* the flowering and fruiting occurred from September onwards and it increased in the October. However, the reproductive growth was higher in September 2011 than that in September 2010.

Desmodium gangeticum exhibited a different pattern of growth behavior as compared to the other two species. Most of the growth parameters showed increase until the first week of November. The leaf area and biomass per plant was higher than that of the other two species. Flower and fruiting commences from September onwards with peak of fruiting in the end of October. The relative growth rate was highest in September (4.8) which continued until the first week of November (1.6).

In the second year (2011), *Desmodium gangeticum* exhibited the same trend of growth as in first year (2010) of the study period. However, like the other two species of *Desmodium* evaluated, it also showed higher growth rate in August which continued until the first week of November. Therefore, the relative growth rate in September (2011) was lower than in September (2010). The reproductive growth was delayed to October, however, the fruit production per plant was same as in the first year of the study (2010). It may be inferred that the three species of *Desmodium* exhibit slightly different growth pattern in Alwar, Rajasthan. *Desmodium repandum* and *Desmodium gangeticum* which thrive in natural, undisturbed forest areas produce greater biomass per plant than *Desmodium triflorum* which colonize disturbed areas. *Desmodium gangeticum* continues to exhibit higher relative growth rate until the first week of November while the relative growth of other two species is limited up to the first week of October. These growth trends suggest that the growth of these *Desmodium* species is independent of their annual or perennial growth habit. However, the production of fruit per plant produced was significantly higher in the annual herb, *Desmodium repandum*, than that in the two perennial herbs. This indicates that the former species is r-strategist while the latter two species tend to be k-strategist (Mc Arthur and Wilson 1967). However, among the two perennial species, *Desmodium gangeticum* produces more fruits/mericarps per plant than that of *Desmodium triflorum*. The latter species also reproduce by vegetative propagules (ramets).[5,6] This indicates that *Desmodium triflorum* has higher tendency to be k-strategist than that of *Desmodium gangeticum*.

Implications

Phenology

Desmodium repandum is an annual herb. Its phenology is chiefly controlled by the pattern of rain fall during rainy season. The seed germination commences with the onset of pre-monsoon showers in the end of June and Seed germination continued upto July. It grows vegetatively until August when flower bud initiation begins in first week of September with peak of flowering in the mid of September. The flowering and fruiting is continuous till the end of October. Seed dispersal and leaf fall take place from November onwards which is followed by senescence of plants by mid December. The withdrawal of monsoon in mid September triggers the fruiting, seed dispersal and leaf fall, ultimately the senescence of the whole plant. Almost same pattern of phenophases were observed during the second year study period. However, leaf fall, seed dispersal and senescence of plants of *Desmodium repandum* were advanced by 15 days in the second year (2011-12). It may be attributed to early withdrawl of monsoon in the second year.

Desmodium triflorum is a perennial herb. Its phenology is also influenced by the pattern of rainfall. Seed germination and sprouting of perennial branches begins with the onset of pre-monsoon rains in the end of June. Seed germination peaks in July-August and the vegetative growth continues from July to mid- September. The flower bud initiation takes place in mid-September and peak of flowering occurs in late October. Then fruit initiation commences in September with peak in October- November. Leaf fall begins in the end of November followed by drying up of vegetative branches by the end of December. In the winter season, the leaf initiation takes place in February with the occurrence of winter rains. The shoots grow vegetatively until March and again dry up in April with decrease in soil moisture content. In the second year (2011-12) the flowering, [7,8]fruiting and leaf fall were advanced by 15 days as compared to first year (2010-11) which may be attributed to variations in rainfall during the years. Further, in the second year (2011-12), there was no sprouting of branches in February. However, the sprouting occurred in May and the vegetative shoots again dried up in June with decrease in soil moisture content. The seed germination also did not commence in June end in the second year of study.

Desmodium gangeticum is also a perennial herb. Its seed germination commences with the onset of pre- monsoon showers in the end of June. Seed germination continues until mid July. The vegetative growth takes place from mid – July to mid – September. The flower bud initiation begins in mid-September and followed by flowering and fruiting simultaneously from late September end to mid – November. Leaf fall begins from mid-November along with seed dispersal followed by drying up of vegetative shoots by the end of December. In winter season, the sprouting of dormant branches takes place in February with the occurrence of rainfall which is followed by short duration vegetative growth in February- March. Then, the flower bud initiation occurs from mid – March onwards followed by flowering and fruiting in March- April. The vegetative shoots again dry up in the end of March-April. Thus, *Desmodium gangeticum* completes its life cycle twice in a year.[8]



IV.CONCLUSIONS

The comparative study of the three species indicates that the phenology of these species is mainly influenced by the pattern of rain fall in this region. The advancement of flower initiation and fruiting with decrease in rainfall supports this assumption. The perennial species *Desmodium triflorum* and *Desmodium gangeticum* showed regeneration of vegetative shoots after rains even in winter season. This further confirms the main role of soil moisture content in the phenology of these species. The other important observation is that with change in growth form, the life cycle of these species also exhibit change. All the three species exhibit seed germination only in June – July which suggest that high temperature and soil moisture are required for seed germination. However, in second year of the study, the seed germination did not takes place in June in the perennial species while those of *Desmodium repandum*, an annual species germinated. It may be possible that both perennial species exhibit seed coat dormancy, therefore, sufficient rainfall is required to break their dormancy whereas those of annual species germinate even in low rainfall as they may have no dormancy. The other important observation was that the annual species completes its life cycle once a year, the perennial herb, *Desmodium triflorum*, although completes life once a year but the sprouting of vegetative shoots takes place in winter also when there is rainfall. The other perennial herb *Desmodium gangeticum*, completes life cycle twice a year. Similar results were observed by Soni (2010), who reported that among the two perennial species *Evolvulus nummularius* and *Evolvulus alsinoides* which grows in Alwar, the former completes life cycle once while the latter completes life cycle twice in a year.[8]

REFERENCES

1. "Desmodium (Beggarlice, Beggars Lice, Hitch Hikers, Tick's Clover, Tick-trefoil) | North Carolina Extension Gardener Plant Toolbox".
2. ^ "The Plant Encyclopedia - Desmodium". The Plant Encyclopedia. Retrieved 17 January 2014.
3. ^ "Plants Profile for Desmodium (ticktrefoil)". plants.usda.gov.
4. ^ "Know Your Deer Plants: Beggar's Lice - Quality Deer Management Association". 25 January 2012.
5. ^ ILDIS (2005)
6. ^ "Desmodium Desv". Plants of the World Online. Royal Botanic Gardens, Kew. Retrieved 20 January 2018.
7. ^ Pires Lima LC, de Queiroz LP, de Azevedo Tozzi AMG, Lewis GP (2014). "A Taxonomic Revision of Desmodium (Leguminosae, Papilionoideae) in Brazil". *Phytotaxa*. **169** (1): 1–119. doi:10.11646/phytotaxa.169.1.1.
8. Trout, K. (2002). Trout's Notes on the Genus Desmodium. Mydriatic Productions. Better Days Publishing.