

## ECO-PHYSIOLOGICAL STUDIES ON ALHAGI PSEUDALHAGI (M. BIEB.) DESV. EX B. KELLER & SHAP. IN GANGANAGAR DISTRICT (RAJASTHAN)

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Alhagi pseudalhagi (M. Bieb.) Desv. ex B. Keller & Shap. an economically and medicinally important plant was studied under various eco-physiological conditions in Ganganagar District of Rajasthan. Phenological studies revealed that the plant completes its life cycle before the onset of winter season. Phytosociological analysis showed that the two communities studied (Erigeron- Ageratum- Coronopus community- UB site and Ageratum- Nicotiana- Cyperus community- AM site) were sufficiently similar in respect of their constituent species as indicated by the high community coefficient (54.368). The vegetation at both these localities was dense and heterogeneous. Chemical constituents showed positive correlation with the standing crop of above ground biomass. Seeds required scarification with concentrated sulphuric acid for germination. The germination is epigeal and required 2-5 days in continuous light.

**Key words :** *Alhagi pseudalhagi,* eco- physiology, seed germination.

Alhagi belonging to family- Papilionaceae comprises of five species however, only one species, Alhagi pseudalhagi is reported from India. The species is a common weed in warm regions of the world.

The plant possesses laxative, diuretic, antibilous and antiseptic properties. The twigs and flowers are used for fumigation in piles. Twigs used for making (cooling mats) 'Tatties' (Ambasta, 1992). The 'Manna' or sweet exudation from leaves and branches is restorative, aphrodisiac, aperient, cholagogue, expectorant, diuretic and blood purifier (Nair and Mohanan, 1998).

The widespread distribution and economic importance of the plant prompted the authors to undertake eco- physiologal studies.

## MATERIALS AND METHODS

Study Area: The investigation was conducted

at Ganganagar District during year 2000- 2001. It is situated in the North of Rajasthan state between  $28^{0}.40'-30^{0}.6'$  North latitude and  $72^{0}.36'-74^{0}.16'$ East latitude. Two sites selected for study were Udhyan Bhawan (UB) and A- Minor (AM). A-Minor water course a branchlet of Gang Canal water channel, the major source of irrigation in Ganganagar District.

Climate of District Ganganagar is very warm during summer and cool and dry in winter. May and June are the hottest months with maximum temperature reaching up to  $48.7^{\circ}$ C whereas December and January are the coldest months during which temperatures falls to  $2^{\circ}$ C. During monsoon (July to September) relative humidity ranges from minimum of 39.5 % to maximum of 78.1 % in August.

**Phenology:** Phenology was studied with reference to *Alhagi pseudalhagi* for one year by undertaking field trips to note the seasonal changes in the composition of plant species. Major phenological events are described on the basis of 'Hindu' system of 'Ritus' as suggested by Misra-(1959).

*Phytosociology:* Phytosociology was studied following the standard methods (Misra, 1968 and Misra *et al.*, 1970). Plants in each quadrat were identified with the help of local flora (Brar, 1981). Density, frequency and dominance were determined. These values were computed into relative values, which on addition give Importance Value Index (IVI), a concept developed by Curtis McIntosh (1951).

Following indices were also calculated from the basic data:

(i) Generic coefficient = 
$$\frac{\text{Number of genera}}{\text{Number of species}} \times 100$$
  
(ii) Maturity index =  $\frac{\text{Total frequency}}{\text{Total number of species}} \times 100$ 

*Biomass:* The below ground and above ground biomass was collected on  $15^{\text{th}}$  and  $20^{\text{th}}$  of every month from UB and AM localities. Fresh biomass was brought to laboratory in polythene bags dried at  $80^{\circ}$ C for 72 hours to determine the dry weight.

*Soil Analysis:* Soil samples were collected from study sites from surface, 10, 20 and 30 cm depths. Moisture content, pH, electrical conductivity, organic matter, total nitrogen, total phosphorus, sodium, potassium and calcium were determined using standard procedures (A.O.A.C., 1995).

*Chemical constituents:* Chlorophyll content was determined as per Arnon's (1949), lipid by Folch *et al.*, (1957), protein by Lowry's (1951), total soluble sugar by Dubois *et al.*, (1956) and crude fibre by A.O.A.C. (1995).

Seed germination: Seeds were collected from both the study sites during the months of July and August. Freshly collected seeds were scarified with concentrated sulphuric acid for 5 minutes, washed thoroughly in tap water for 30 minutes and kept in different chemicals for 12 hours. After treatment, the seeds, kept in sterilized petri dishes over filter paper for germination up to period of 10 days. The seeds soaked simultaneously in distilled water constituted the control. In other experiments germination under different light conditions and allelopathic effects of aqueous leaf extract of some plant were also studied.

## **RESULTS AND DISCUSSION**

**Phenology:** At AM site, plants showed sprouting in the mid of 'Vasant Ritu', produced pinkish flower in the end. In Varsha Ritu, mature brownish pods were produced, by mid of this Ritu plants become naked and aerial parts completely dried up by mid of Sharad Ritu. At UB site, sprouting occurred by the end of Vasant Ritu, pods formed in the end of Greesham Ritu, became naked when Varsha Ritu is departing and aerial parts perished by the end of Sharad Ritu. In Hemant and Sisir there was no sign of plant at both sites.

**Phytosociology:** Table 1 shows the IVI and other parameters for the communities, *Erigeron-Ageratum- Coronopus* community at site UB and *Ageratum- Nicotiana- Cyperus* community at site AM. At UB site, *Erigeron bonariensis* occupies the first position, followed by *Ageratum conyzoides*, *Coronopus didymus*, *Dactyloctenium aegyptium* and *Nicotiana plumbaginifolia*. At this site *Alhagi pseudalhagi* occupied the 10<sup>th</sup> position.

At AM site, the first five dominant species of the community were Ageratum conyzoides, Nicotiana plumbaginifolia, Cyperus kyllingia, Cenchrus ciliaris and Alhagi pseudalhagi.

Generic coefficient and maturity index were higher for UB site. The community at site UB had the highest maturity index (9.02) where the IVI of *Alhagi pseudalhagi* was (8.573). However, this value is low and hence the community is distant from the climax stage. Generic coefficient at both the sites was above 75% which showed that each community has a larger number of genera as compared to the number of species.

Community coefficient was found to be 54.368, which shows that the vegetation was sufficiently similar at the two sites, 44 species were common to both the areas. Higher the coefficient value, more similarity will be between communities. On the basis of present investigation, it can be concluded that both the community have mixed vegetation and hence heterogenous.

**Biomass:** The peak value of above ground, 284.3 g/m<sup>2</sup> (in August) at UB site and 340.5 g/m<sup>2</sup> (in July) for AM site. The minimum value was found in April (10.21 g/m<sup>2</sup>) for UB site and in March (2.5 g/m<sup>2</sup>) for AM site. Maximum value for below ground was

 Table 1: Phytosociological observations in two study sites during year 2000-2001

Table 1: Phytosociological observations in two study sites during           vear 2000-2001		Name of species	Importance value inde		
				Site: AM	Site: UB
Name of species	Importance value inde		Medicago polymorpha	1.575	-
	Site: AM	Site: UB	Malvastrum coromandelianum	1.519	0.178
			Leucas aspera	1.457	-
Ageratum conyzoides	19.835	20.092	Tribulus terrestris	1.428	-
Nicotiana plumbaginifolia	12.692	11.273	Aerva persica	1.423	-
Cyperus kyllingia	11.147	-	Alternanthera sessilis	1.412	-
Cenchrus ciliaris	10.276	1.878	Cassia occidentalis	1.322	-
Alhagi pseudalhagi	10.276	8.573	Solanum nigrum	1.175	4.897
Centella asiatica	9.698	-	Abutilon indicum	1.169	-
Polygonum barbatum	9.266	9.439	Cyperus exaltatus	1.090	-
Polygonum glabrum	8.616	3.812	Dactyloctenium scindicum	1.073	-
Digitaria adscendens	8.061	1.837	Arenaria serpyllifolia	1.073	2.258
Cynodon dactylon	7.595	8.885	Cannabis sativa	1.062	5.298
Eragrostris ciliaris	7.572	-	Cassia tora	0.937	-
Cyperus rotundus	7.283	5.199	Malcolmia africana	0.926	-
Oxalis corniculata	7.250	9.912	Anagallis arvensis	0.777	1.842
Coronopus didymus	7.163	12.968	Sorghum halepense	0.772	0.622
Doctyloctenium aegyptium	6.109	11.418	Trianthema portulacastrum	0.652	-
Pouzolzia pentandra	5.605	0.347	Ranunculus cantonensis	0.646	-
Z <b>aleya</b> govindia	5.593	2.980	Verbascum thapsus	0.581	-
Bacopa monnieri	5.450	-	Abutilon pannosum	0.495	-
Veronica agrestis	5.038	2.636	Ipomoea aquatica	0.494	-
Achyranthes aspera	4.776	3.226	Ludwigia adscendens	0.386	-
Chenopodium ambrosioides	4.688	3.089	Heliotropium strigosum	0.381	1.374
Solanum surattense	4.580	-	Withania somnifera	-	7.632
Saccharum spontaneum	4.580	-	Oxalis corymbosa	-	6.222
Cenchrus setigerus	4.523	1.658	Gnaphalium peregrinum	<u> </u>	6.016
Stellaria media	4.362	4.404	Lophochloa phleoides	-	5.752
Soliva anthemifolia	4.287		Eragrostis nutans	-	4.251
Datura innoxia	4.160	-	Phyllanthus fraternus	-	4.207
Chenopodium murale	4.028	7.182	Amaranthus viridis	-	4.059
Calotropis procera	3.973	5.605	Euphorbia helioscopia	-	3 497
Euphorbia hirta	3.962	5.871	Eclipta prostrata	-	3 207
Launaea procumbens	3.690	1.364	Portulaca meridiana	-	2 904
Cirsium wallichii	3.684	6.193	Verbena bipinnatifida		2.500
Oenanthe javanica	3.656	_ 6 ,	Mukia maderaspatana		1.519
Convolvulus arvensis	3.269	7.154	Lathvrus aphaca	_	1.515
Euphorbia chamaesyce	3.214	-	Euphorbia microphylla	-	1.515
Fumaria indica	3.085	2.856	Eragrostis gangetica	-	1.434
Bidens biternata	2.981	5 481	Echinochlog colonum	-	0.005
Acalypha indica	2.850	-	Cenchrus biflorus	-	0.903
Parthenium hysterophorus	2.000	8 396	Vicia sativa	-	0.892
Chenopodium album	2 653	8 590	Asnhodelus tenuifalina	-	0.743
Ranunculus sceleratus	2.000	0.512	Heliotropium allipticum	-	0.629
Spergula arvensis	2.511	2 139	nenonopium empticum	-	0.462
Signathrium iria	2.470	2.138	Community and for its of		
Dumax dantatus	2.445	-	Community coefficient	54.368	•
Cumex demands	2.3.7	5.024	Generic coefficient	79.74	81.81
Sonchus brachyolus	2.327	4. /98	Maturity index	7.40	9.020
Sonchus asper	2.212	-	found in August (62.20	$q/m^2$ ) for 1	UB and in
nyla nodiflora	2.158	0.471	Southern $(65.20 \times 1.2)$	g/m ) 101	
enchrus pennisetiformis	2.078	-	September $(05.20 \text{ g/m}^2)$ f	or AM. The	minimum
eronica anagallis - aquatica	2.068	-	values were 12.32 $g/m^2$ (in	April) for I	JB site and
crigeron bonariensis	1.930	20.628	$16.20 \text{ g/m}^2$ (in March) for A	Maita	
rgemone mexicana	1.904	2.851	10.20 g/m (m watch) for A	tivi site.	
Polygonum lanigerum	1.895	0.379			
Snaphalium luteo-album	1.732	-	Sou analysis: Soil and	alysis show	s the mean
aunaea fallax	1.713	1.304	value of organic matter rang	ed from 0.2	5 % to 0.29
<i>Aelilotus indica</i>	1.663	2.043	% at LIP site and 0.27.0/	0 20 0/	Maita The
			$\frac{1}{20}$ at UB site and $0.27$ % to	0.30% at A	wi site. The







Figs 1 A-C: Histograms showing effects of chemical scarification, different wavelengths of light and leaf extracts of *Cassia occidentalis*, *Parthenium hysterophorus*, *Peganum harmala* and *Xanthium strumarium* on seed germination of *Alhagi pseudalhagi*.

maximum pH was 8.17 and 8.14 for UB and AM sites, respectively. At both the sites potassium was higher (3.67 mg/g) than sodium (0.61 mg/g) and exchangeable calcium (0.59 mg/g). The maximum nitrogen was recorded 0.07 mg/g which was very low. Phosphorus was the highest 0.03 mg/g at the surface of the soil at both sites. It decreased with increase in depth. The studies reveal that soil of both the localities was low in organic carbon, medium in

phosphorus and potassium.

*Chemical constituents:* Table 2 shows chemical constituents of various plant organs of *Alhagi pseudalhagi* at both sites. The mean value of chlorophyll 0.674 mg/g fresh wt. and 0.695 mg/g fresh wt. were recorded from leaf of *Alhagi pseudalhagi* at UB and AM site, respectively. It was observed that the chlorophyll content in *Alhagi pseudalhagi* showed positive correlation with standing crop of above ground biomass.

It has been found that maximum lipid content was present in leaf and minimum in root, higher amount of protein in fruit and lower in stem, carbohydrate amount was more in root and less in stem while crude fibre content was higher in stem and lower in fruit.

Seed germination: The effect of chemical scarification, different wavelengths of light and various concentrations of leaf extracts of different plants on seed germination of Alhagi pseudalhagi is presented (Figs A- C). The average number of seeds is 3-6 per pod. The germination occurs with in 2-5 days in continuous light condition and is epigeal. Seeds germinate in laboratory conditions only when they are scarified with concentrated sulphuric acid. 83.33- 100 % germination was observed in Alhagi pseudalhagi when scarified by concentrated H<sub>2</sub>SO<sub>4</sub> for 5 minutes under continuous light.

Among all the light qualities employed in the present work, percentage of germination was reduced except for far red which was similar in comparison to control. Maximum shoot length was also observed for far red light.

Allelopathic effects of aqueous leaf extracts of *Cassia occidentalis*, *Parthenium hysterophorus*, *Peganum harmala* and *Xanthium strumarium* had been inhibitory on seed germination. 20 %<sup>4</sup> concentration of leaf extract of *Cassia occidentalis* and *Xanthium strumarium* completely inhibited the germination. On the contrary, 0.5 and 1 % concentration of leaf extract of *Parthenium hysterophorus* were promotory for root and shoot

Contents	Site - UB Plant parts			Site - AM Plant parts				
	Root	Stem	Leaf	Fruit	Root	Stem	Leaf	Fruit
Chlorophyll (mg/g fresh wt.)	-	-	0.674	-	-	-	0.7	-
Carbohydrate (mg/g fresh wt.)	9.003	3.959	8.910	5.497	9.17	4.209	9.020	5.540
Protein (mg/g fresh wt.)	6.152	3.770	5.192	7.16	6.17	3.824	5.660	7.297
Lipid (mg/g fresh wt.)	0.015	0.051	0.1	0.09	0.016	0.056	0.103	0.089
Crude fiber (% dry wt.)	52.101	67.034	52.022	41.267	53.803	69.301	50.010	41.100

Table 2: Mean chlorophyll, carbohydrate, protein, lipid and crude fibre of various plant parts of *Alhagi pseudalhagi* during year 2000-2001

(-) shows absence of data

lengths.

The writers studied that Cassia occidentalis, Peganum harmala and Xanthium strumarium showed inhibitory effects on seed germination as well as root- shoot growth of Alhagi pseudalhagi at various concentrations under continuous light. Exceptionally, leaf extract of Parthenium hysterophorus was found to be stimulatory effect for root- shoot growth. Narwal (1994) found the stimulatory effect on seed germination of wheat when different parts of Parthenium hysterophorus decayed for specific period used in the experiments. This may be due to the interaction between microorganisms and plant material which might have produced some allelochemicals having stimulatory effect on germination.

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