INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
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www.vmsindia.org

PHYTOSOCIOLOGICAL ANALYSIS OF *ALTERNANTHERA TENELLA* FROM AGRICULTURAL FIELDS OF ASURLE, DISTRICT KOLHAPUR

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Abstract:
Phytosociological analysis with respect to percent frequency, density, abundance and their relative values of an invasive weed *Alternanthera tenella* Colla was carried out from agricultural fields of the village Asurle (Tahsil Panhala, District Kolhapur) during the period September, 2015 to August, 2016. Values for density and abundance were higher (6.65 per m^2) in the month of September and values of same were lowest (0.47 per m^2 and 1.8 per m^2) in the month of May and June respectively. The percent frequency of the weed was constant (95-100%) from September to February and a sharp decrease (30-40%) was observed in the month of May and June. The data was correlated with data on climatic conditions such as temperature, moisture, sunshine and rainfall. Such type phytosociological study may give an idea about distribution pattern of the invasive weed in agricultural fields of Asurle as well as its relationship with crops and environmental factors. An attempt was made to study the effect of petal leachates (5%, 10% and 20% concentrations) of *Gliricidia sepium* and *Cassia fistula* on germination and growth of *A. tenella* and found inhibition of seed germination and seedling growth. In petriplate bioassay seed germination was inhibited due to petal leachates at 24, 48 and 72 hours. Seedling growth with respect to root length and shoot length was reduced by the treatment of petal leachates in both petriplate and soil bioassays.
Key words: Agricultural fields, *Alternanthera tenella*, Petal leachates, Phytosociological analysis

Introduction

Phytosociology is most important facet to analyze the structure, composition and phytodiversity, which can give an idea about vegetation dynamics (1). According to European ecologists the system of classification and characterization of vegetation dynamics is termed as phytosociology. The dominant species by their bulk and growth modify the habitat and control the growth of other species of the community (2). An invasive weed *Alternanthera tenella* Colla has become aggressive in agricultural fields of Kolhapur District which may affect the growth, development and productivity of crop plants by its vigorous growth and competition for the resources. Now a day herbicidal weed management in world agricultural systems has become a common practice. Due to over use of herbicides problems like development of herbicide resistant weeds, environmental hazards and changes in soil profile are observed. So an attempt has been made to study phytosociological attributes with respect to frequency, density, abundance and their relative values of *A. tenella* from agricultural fields of village Asurle (Taluka Panhala, District Kolhapur) as well as to evaluate allelopathic potential of bioleachates of *Gliricidia sepium* (Jacq.) Kunth ex Steud and *Cassia fistula* L. against *A. tenella*.

Materials and Methods

Study Area: For Phytosociological study of *Alternanthera tenella* Colla site selected was Agricultural fields of village Asurle (Taluka Panhala, Kolhapur District). Quadrates of 1m x 1m (3) were placed randomly at 5 different places along the Agricultural fields of village Asurle covering 10 km of distance with the GPS Co-ordinates and elevation N- 16⁰46. 105' E- 074⁰ 09. 240' 567(m), N- 16⁰45. 982' E- 074⁰08. 659' 560(m), N- 16⁰46. 277' E- 074⁰ 08. 705' 569(m), N- 16⁰46. 482' E- 074⁰08. 599' 577(m) and N- 16⁰46. 717' E- 074⁰ 08. 430' 585(m). Data was compiled by placing total 40 quadrats per month (2nd and 4th Sunday) during the period from September 2015 to August 2016. The values of Percent frequency, Density, Abundance, with their relative values of *A. tenella* were calculated according to the formulae given by Curtis and McIntosh (4), Misra (3) and Dombois and Ellenberg (5).

Selected Plant Species: An invasive weed species *A. tenella* Colla was selected for the study. For evaluation of allelopathic potential two tree species *Gliricidia sepium* (Jacq.) Kunth ex Steud and *Cassia fistula* L. was selected.

Procurement of Plant Materials and Soil: Senescent dropped petals of *G. sepium* and *C. fistula* were collected from different localities of Kolhapur city during their respective flowering seasons. Petals were dried completely and stored in polythene bags at dry places. Seeds of *A. tenella* and soil samples were collected from agricultural fields of village Asurle in the month of December (2015) to May (2016).

Preparation of Petal Leachates: Method given by Jadhav and Gaynar (6) was followed for the preparation of 5%, 10% and 20% petal leachates. The clean petals were cut into small pieces of 1-

2mm^2 and 5g, 10g and 20g of petals after washing, separately soaked in 100 ml of distilled water for 24 hours then filtered through Whatman No. 1 filter paper and used for further study.

Seed Germination and Seedling Growth - Healthy seeds of *A. tenella* were cleaned by distilled water to remove surface dust and soaked in 200 ppm Gibberellic acid for 4 hours to break the dormancy. Ten sterilized seeds (with 0.1% $HgCl_2$) were placed in sterile petriplate (with sterile moistened filter paper). For treatment each petriplate was supplied with 8 ml of 5%, 10% and 20% petal leachates separately and 8 ml of distilled water for control. In soil bioassay, plastic trays (22cmx17cmx4.2cm with 750 g of soil) were supplemented with 25 seeds and 50 ml of leachates and distilled water. Germination percentage and seedling growth was recorded at 24, 48 and 72 and 120 hours stages for petriplate bioassay and of 10 days old seedlings for soil bioassay. The percentage of inhibition or stimulation was calculated by using the formula given by Zhang *et al.,* (7). Inhibition/Stimulation (%) = Treatment data- Control data)/ Control data X 100. Values are mean of three replicates± standard deviation with standard error.

Results and Discussion

Percent frequency of *Alternanthera* was maximum and constant from September to March (from 95 to 100%) and it was dropped from April to June with lowest value in the month of May (30%). Again it was increased in July and August (97.5 and 92.5%) (Fig.1). Density and abundance were higher (6.65 per m^2) in the month of September and density was lowest in June (0.47 per m^2) and lowest abundance was in May (1.8 per m^2) (Fig. 2 and 3). Relative values of frequency (23.36 per m^2) and Density (35.14 per m^2) were higher in the month of December and lower (8.79, 4.51 per m^2) in the month of May and June respectively. In case of abundance relative value was higher (23.80per m^2) in the month of September and lower (4.97 per m^2) in the month of June (Fig. 4, 5, 6). Present findings are in accordance with the reports of Ray and George (8) and Batista *et al.* (9) who have given data on phytosociological characteristics of *A. tenella*.

Germination percentage of *A. tenella* was reduced due to the treatment of petal leachates (5%, 10% and 20%) of *G. sepium* and *C. fistula* with complete inhibition at 24h and 48h due 20% petal leachate of *G. sepium* (Table. 1 and 4). Average root length(83%, 98.1%) and shoot length (56.56%, 96.37%) was decreased due to 20% petal leachate of *G. sepium* and *C. fistula* respectively (Table. 2 and 5). Regarding soil bioassays, root length and shoot length of *A. tenella* was diminished by the application of petal leachates of both the tree species. In case of root length decrease was more due to 20% *Gliricidia* (66.5%) and 10% *C. fistula* (60%) petal leachates. Higher decrease in shoot length was observed due to 10% *Gliricidia* (61.24%) and 20% *Cassia* (59.8%) petal leachates (Table.3 and 6). The results are concording with the results of Abugre *et al* (10) who have studied adverse effects of 2% aqueous extracts of root and leaves of *G. sepium* on germination and seedling growth of *Vigna unguiculata, Zea mays, Hibiscus esculentus* and *Lycopersicon esculentum*. Janet (11) has reported inhibitory effect of aqueous extracts of leaf and bark of *G. sepium* on germination and seedling growth of *Bidens pilosa*. Gulzar *et al.* (12) have studied the effect of aquous extract of *Cassia sophera* (0.5, 1 and 2%) on seed germination and seedling growth of *Chenopodium album, Meliotus alba* and *Nicotiana plumbaginifolia* and noticed reduced seed germination and decrease in the root length and shoot length of test plant species due to the treatment. Hong *et al.* (13) have conducted experiment on effect of aqueous extracts of fresh root, stem and leaves of *C. fistula* on germination and seedling growth of Radish by using petriplate bioassay and found suppression of germination and root elongation of radish. Inhibition of seed germination and seedling growth of *A. tenella* due to petal leachates may affect futher growth and development of the invasive weed species. As allelochemicals are released into soil, seeds are frequently revealed to allelochemicals and seed germiantion and seedling growth get distressed by the action of allelochemicals.

Table 1 Effect of petal leachates of *G. sepium* on seed germination of *A. tenella* (Petriplate bioassay)

Treatments	Germination percentage 24hrs		48hrs		72hrs	
		PI (-)/ PS(+)		PI (-)/ PS(+)		PI (-)/ PS(+)
Control	56.666±5.77 SE±3.333		83.333±2.886 SE±1.443		83.333±2.886 SE±1.443	
5% petal leachate	-	-	55±13.228 SE±7.63	34(-)	70±10 SE±5.773	16(-)
10% petal leachate	-	-	15±5 SE±2.886	82(-)	15±5 SE±2.886	82(-)
20% petal leachate	-	-	-	100(-)	13.333±5.773 SE±3.333	84(-)

Table 2 Effect of petal leachates of *G. sepium* on seedling growth of *A. tenella* (Petriplate bioassay)

Treatments	Seedling growth			
	Average root length		Average shoot length	
		PI(-)/PS(+)		PI(-)/PS(+)
Control	1.176±0.306 SE±0.177		1.296±0.056 SE±0.032	
5% petal leachate	1.093±0.110 SE±0.063	7.08(-)	1.16±0.045 SE±0.026	10.54(-)
10% petal leachate	0.52±0.03 SE±0.017	55.81(-)	0.8±0.02 SE±0.011	38.3(-)
20% petal leachate	0.2±0.091 SE±0.052	83(-)	0.563±0.063 SE±0.036	56.56(-)

*All values are means of three replicates ± Standard deviation with standard error
PI- Percent Inhibition, PS- Percent Stimulation

Table 3 Effect of petal leachates of *G. sepium* on seedling growth of *A. tenella* (Soil bioassay)

Treatments	Seedling growth			
	Average root length		Average shoot length	
		PI(-)/PS(+)		PI(-)/PS(+)
Control	0.986±0.015 SE±0.008		1.186±0.120 SE±0.069	
5% petal leachate	0.58±0.02 SE±0.011	41.22(-)	0.676±0.090 SE±0.052	42.98(-)
10% petal leachate	0.676±0.090 SE±0.052	31.42(-)	0.46±0.09 SE±0.051	61.24(-)
20% petal leachate	0.33±0.07 SE±0.040	66.55(-)	0.5±0.115 SE±0.066	57.87(-)

Table 4 Effect of petal leachates of *C. fistula* on seed germination of *A. tenella* (Petriplate bioassay)

Treatments	Germination percentage					
	24hrs		48hrs		72hrs	
		PI (-)/ PS(+)		PI (-)/ PS(+)		PI (-)/ PS(+)
Control	75±13.2 SE±7.6376		88.333±16.072 SE±9.279		88.333±16.072 SE±9.279	
5% petal leachate	8.333	88.89(-)	8.333	90.75(-)	26.66±5.77 SE±3.333	69.81(-)
10% petal leachate	3.333	95.56(-)	3.333	96.23(-)	10	88.68(-)
20% petal leachate	3.333	95.56(-)	3.333	96.23(-)	3.333	96.23(-)

*All values are means of three replicates ± Standard deviation with standard error
PI- Percent Inhibition, PS- Percent Stimulation

Table 5 Effect of petal leachates of *C. fistula* on seedling growth of *A. tenella* (Petriplate bioassay)

Treatments	Seedling growth			
	Average root length		Average shoot length	
		PI(-)/PS(+)		PI(-)/PS(+)
Control	1.226±0.166 SE±0.095		1.47±0.281 SE±0.162	
5% petal leachate	0.333±0.005 SE±0.003	72.83(-)	0.42±0.075 SE±0.043	71.43(-)
10% petal leachate	0.053±0.011 SE±0.006	95.65(-)	0.103±0.011 SE±0.006	92.97(-)
20% petal leachate	0.023	98.1(-)	0.053	96.37(-)

Table 6 Effect of petal leachates of *C. fistula* on seedling growth of *A. tenella* (Soil bioassay)

Treatments	Seedling growth			
	Average root length		Average shoot length	
		PI(-)/PS(+)		PI(-)/PS(+)
Control	1.01±0.085 SE±0.049		1.65±0.1 SE±0.057	
5% petal leachate	0.049±0.032 SE±0.018	51.82(-)	0.81±0.085 SE±0.049	50.91(-)
10% petal leachate	0.4±0.1 SE±0.057	60.4(-)	0.673±0.110 SE±0.063	59.19(-)
20% petal leachate	0.413±0.102 SE±0.059	50.08(-)	0.663±0.080 SE±0.046	59.8(-)

*All values are means of three replicates ± Standard deviation with standard error
PI- Percent Inhibition, PS- Percent Stimulation

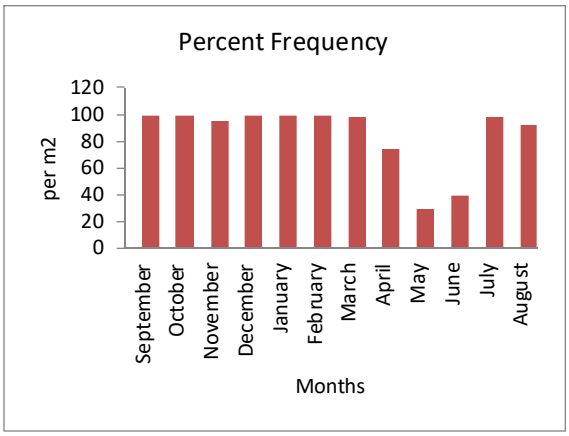

Figure 1 Percent Frequency of *A. tenella*

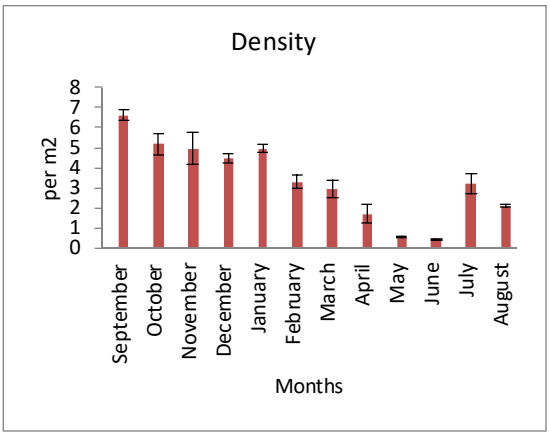

Figure 2 Density of *A. tenella*

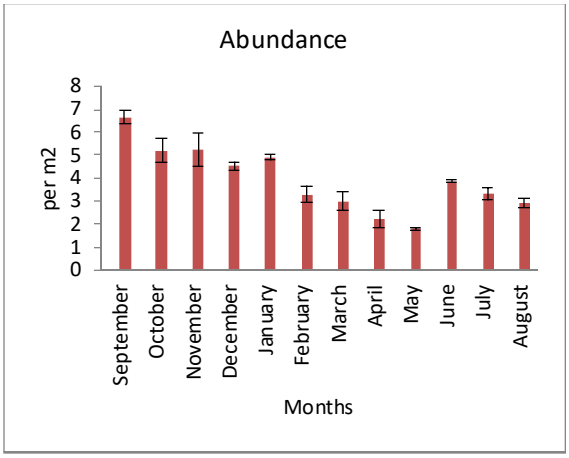

Figure 3 Abundance of *A. tenella*

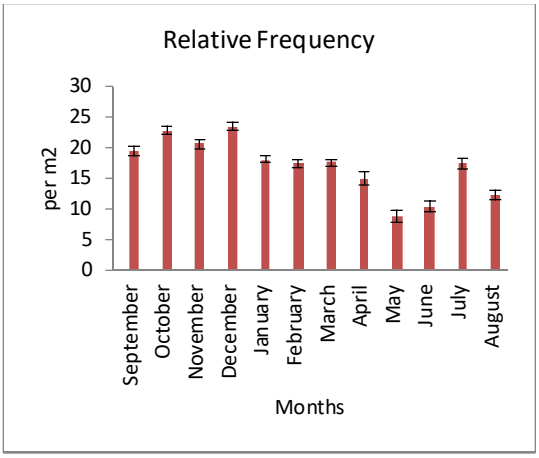

Figure 4 Relative frequency of *A. tenella*

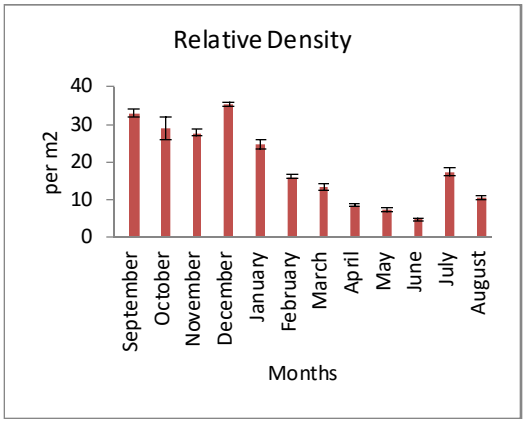

Figure 5 Relative frequency of *A. tenella*

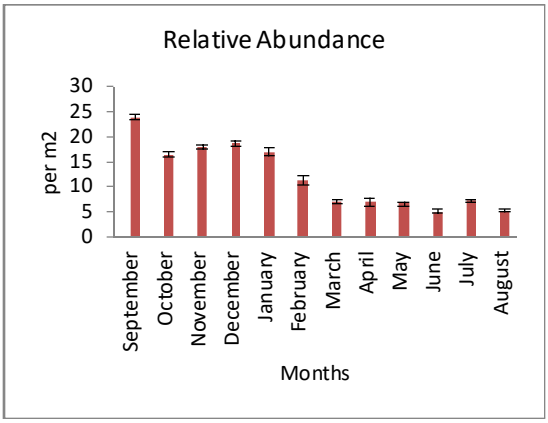

Figure 6 Relative abundance of *A. tenella*

Conclusions

Phytosociological analysis of *A. tenella* along the agricultural fields may help to understand the pattern of its distribution and aggressiveness and its relationship with the crops. At initial stages of growth both petal leachates are having adverse effect on *A. tenella*. Such type of phytosociological characterization and application of bio leachates to control an invasive weed *A. tenella* may help to develop management practices in relation to the issues of environmental threats and development of herbicide resistant weeds.

Acknowledgements

Authors are thankful to Head, Department of Botany, Shivaji University, Kolhapur for providing necessary research facilities.

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