

Ecology and Control of *Parthenium hysterophorus* Invasion in Veeranum Command Area

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ABSTRACT

Survey and field experiments were conducted in the Department of Agronomy, Annamalai University during 2000 and 2001 to study some of the ecological traits of Congress grass (*Parthenium hysterophorus* L.) in Veeranum Ayacut region of Tamil Nadu state and to compare the bio-efficacy of some herbicides for controlling this weed. Results showed that the weed had two generations in a calendar year. Congress grass germinated with maximum temperatures between 30° and 34° C coupled with available soil moisture between 40 and 60% coincided with February and September months. The weed occurred only in the wastelands and did not expand into cultivated fields. Associated flora included predominantly grasses. Glufosinate ammonium @ 2.5, 3.0 l/ha and glyphosate @ 2.5 l/ha were effective in imparting a complete control of Congress grass.

Key words : Invasive plant, weed ecology, weed management

INTRODUCTION

Veeranum Ayacut region is in the tail end of the Cauvery river irrigation system in Tamil Nadu state of India. The state is a forerunner in the per capita production of rice and this Veeranum Ayacut region forms the core of the Cauvery delta zone of the state otherwise called as rice granary of Tamil Nadu. The 27 distributaries of Veeranum Lake have a command area of nearly 18,000 ha of double cropped rice. However, the area under rice cultivation is facing a slow decline due to several factors such as inadequate water supply in the river, low margin, increased labour cost and increasing urbanization and industrialization. *Parthenium hysterophorus*, has been observed frequently on the road sides, railway tracks, wastelands and surroundings. A study was taken up with the objective of tracing the invasive behaviour of the weed as induced by the open niches due to decline in rice area and to identify suitable herbicides for its control.

MATERIALS AND METHODS

The study on eco-traits of the weed included monthly surveys on the infestation of *P. hysterophorus* and the co-existing flora, over a period of two years from 2000 to 2001. To correlate possible factors favouring the infestation, the mean monthly temperature

and available soil moisture in the habitat were recorded simultaneously. The survey was based on the principles of phyto-sociological survey outlined by Sen (1981) working out Importance Value Percentage (IVP) of the weed and co-existing plants in every sampling location. The sampling was done separately in cultivated fields and wastelands including road sides, railway tracks and building sites at every 5 km distance, throughout the length and breadth of Veeranum Ayacut region, in the middle of every month.

The study on herbicidal control of *P. hysterophorus* was taken up in the wasteland available near the New Vegetable Farm located at 11° 24' N latitudes, 79° 41' E longitudes and at an altitude of 5.79 m above mean sea level. The herbicides, glufosinate ammonium (Basta 15% SL by Aventis Crop Science, India) and glyphosate (Round up 41 % SL by Monsanto India) were used. Glufosinate ammonium was used at two different doses viz., 2.5 and 3.0 l/ha of formulated product/ha while, glyphosate was used at 2.5 l/ha of formulated product. These herbicides were sprayed using 500 l/ha of water through a knapsack sprayer fitted with flood jet deflector nozzle in *P. hysterophorus* infested plots of 3 x 3 m dimensions with the weeds in vegetative stage with medium stature 30-40 cm tall. The weed count on 30 days after application (DAA) and weed control efficiency were recorded at fortnightly intervals upto 45 days.

RESULTS AND DISCUSSION

Infestation of the weed *P. hysterophorus* was not observed in any of the sampling sites in cultivated lands during any time of the year, throughout the two-year study period. This indicates that the weed has not expanded into the cultivated lands in its process of invasion. This could be because of the fact that cultivated lands in this rice growing tract are puddled (ploughed with standing water) during preparatory tillage and water is impounded in the fields during majority of the rice crop duration that occupies a minimum of one fourth of the year. This soil environment with excess moisture could have proved lethal for the seeds of *P. hysterophorus*, thereby interrupting the process of invasion. However, in the wastelands, *P. hysterophorus* was observed with considerable IVP ranging from 76 to 84 during the first half of the year or spring commencing from February extending upto April (Table 1). With the onset of summer from May, as the maximum temperature increased with dwindling soil moisture, the regeneration of *P. hysterophorus* was not observed in these sampling sites on wastelands too. Cessation of hot summer in June and few showers of the first monsoon in July and August, recuperating the available soil moisture levels upto 42%, favoured sprouting of *P. hysterophorus* and the second generation commenced with IVP ranging upto 48. The second generation completed the life span before the heavy downpour of monsoon rains in the peak winter during mid November and another spell of interruption started during December and the same continued during

January of next year. This could be due to heavy downpours (with more than 65% of the annual rainfall of 1500 mm getting distributed during November and December months) over predominantly heavy clay soils in the coastal tract, resulting in frequent water stagnation.

Regarding the species of co-existence observed in the wasteland, it was only *Cynodon dactylon* (L.) Pers. that co-dominated with IVP ranging upto half of the IVP of *P. hysterophorus* during the first generation spread over February to May. Alongwith *C. dactylon*, *Chloris barbata* (L.) Sw. also shared the habitats with IVP equivalent to half or more than that of *P. hysterophorus* during the second generation extending over September to November months (Table 1). This observation indicates that either *P. hysterophorus* is aggressive over the broadleaf weeds or vice-versa and eco tolerance could have been more between the weed and grasses in general.

Regarding the herbicides tried, both glyphosate and glufosinate ammonium @ 2.5 l/ha of formulated product proved effective in exerting a complete control of the weed within 45 days (Table 2). These findings are in conformity with the reports of Yaduraju and Mishra (2003) Singh *et al.* (2004) and Naidu *et al.* (2005)

Invasion of *P. hysterophorus* in wastelands of Veeranum Ayacut has been observed. However, the weed is yet to expand into the cultivated agricultural fields. The weed has been observed to undergo two generations within a year that extends during February-May and September to November. Maximum temperature regimes of 30-34° C coupled with 40 to 60% of available soil

Table 1. Phyto-eco-sociology of *Parthenium hysterophorus* in Veeranum Ayacut region (Average values for 2000 and 2001)

Months	<i>Parthenium hysterophorus</i> (Important Value Percentage)	Available soil moisture (%)	Max. temperature (°C)	Co-existing species with more than or equal to half of IVP of <i>Parthenium hysterophorus</i>
January	-	-	28.65	-
February	76	55	32.00	<i>Cynodon dactylon</i>
March	81	42	32.40	<i>Cynodon dactylon</i>
April	84	32	34.35	<i>Cynodon dactylon</i>
May	11	29	37.55	<i>Cynodon dactylon</i>
June	-	25	36.25	-
July	-	29	36.00	-
August	-	40	34.65	-
September	48	42	33.75	<i>Cynodon dactylon</i> , <i>Chloris barbata</i>
October	51	58	31.65	<i>Cynodon dactylon</i> , <i>Chloris barbata</i>
November	32	81	29.80	<i>Cynodon dactylon</i>
December	-	86	28.05	-

Table 2. Effect of herbicides on weed density and weed control efficiency

Treatment	Weed density	Weed control efficiency (%)		
		15 DAA	30 DAA	45 DAA
Basta 15 SL 2500 ml/ ha	0.71 (0.00)	74.43 (92.80)	75.24 (93.51)	75.24 (93.51)
Basta 15 SL 3000 ml/ ha	0.71 (0.00)	75.34 (94.60)	76.83 (94.81)	76.83 (94.81)
Glyphosate 41 SL 2500 ml /ha	0.71 (0.00)	74.43 (92.80)	76.83 (94.81)	76.83 (94.81)
Untreated	4.18 (17.00)	-	-	-
LSD (P=0.05)	0.71	2.92	4.80	5.02

Figures in parentheses are original values before transformation.

moisture were found favourable in the sprouting pattern of *P. hysterophorus*. Herbicides glyphosate and glufosinate ammonium are effective in controlling the weed when used at 2500 ml/ ha of formulated product.

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