

Study of Alligator (*Alternanthera philoxeroids* (Mart.) Griseb.) Weed by Ecological Parameters and the Effectiveness to Control this Weed in the Traditional Agronomy of Meitei- Pangal Community of Manipur State, India

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Abstract – Alligator weed is regarded as potential threat to growth and development of the home garden plants. Alligator weed control is carried out by employing the methods of traditional knowledge procedures by the application of cost effective mulches by Meitei-Pangal community in Manipur state. Home garden or *Ingkhol* rather *Hingol* is unavoidable part of any household for this community. Quadrat (s) were laid down in the chilly and *Phaseolus* spp.(field bean) beds/plots to study the presence of alligator weed by ecological parameters i.e. density, % frequency and abundance. The density, abundance and frequency was recorded the least in the chilly beds/plots (experimental) under the application of mulches i.e. Straw of Garden Pea (SGP) (6 cm thick when measured), Seed Shell of Mustard (SSM) (4 cm). It was most recorded under the control category of Exposed Surface (ES) in the field bean plot. In yet another study, the mean length of alligator weed during January to June, 2012 of 10 alligator weed on 20th, 40th, 60th, and 80th days have been recorded as 17.7cm (4.71 S.D.), 27.35cm (7.27 S.D.), 70cm (13.1 S.D.), and 81.7cm (17.52 S.D.) whereas the mean length of 10 alligators weed during July 2012 to December 2012 on 20th, 40th, 60th and 80th days have been recorded as 18.8cm (10.57 S.D.) 21.5cm (11.9 S.D.), 22.8cm (11.75 S.D.) and 24 cm(18.5 S.D.). This indicates that the growth of alligator weed is aggressive during January to June, 2012 which is favourable time for good growth of alligator weed. The rate of growth by the measurement of active growth rate in both the seasons has indicated that the growth of this particular weed is active between 20th to 40th day and between 60th to 80th day in both the seasons. The overall result indicates that the alligator weed is a problem to home garden plants if there is no application of traditional, eco-friendly, cost effective mulches to control the weed.

Keywords – Eco-friendly, Mulches, Weed Control, Meitei Pangal (Muslim) *Hingol* (home garden), Alligator weed.

I. INTRODUCTION

Weed is a plant growing where it is not wanted. Weeds deprive mineral nutrients, water and light (Roberts, 1982)[1]. Weeds grow faster than native plants. Also weeds are one of the major threats to the natural environment, destroying native habitats, threatening native plant (cheminova.com, 2011[2]; Clements at al., 2011[3]; Drake et al., 1989[4]; David et al., 2001[5]; Masoodi and khan, 2012[6]). Alligator weed is a stoloniferous and rhizomatous perennial that grows rapidly under favourable conditions in both terrestrial and aquatic habitats (Maheshwari, 1965[7]; Sainty *et al*, 1998[8]. This weed, inter alia, poses significant economic and environmental threat. The controlling of the weed is the most cost-

effective and eco - friendly form to control weeds (Masoodi and khan, 2012[6]).

The mulching is an excellent way of controlling weeds. It works because mulches deprive unwanted plants of light. Without light the plants cannot photosynthesise and grow. Mulches include ornamental bark, shredded prunings, straw/hay, sawdust, tree mats, geo-textiles, black plastic film, cardboard, newspaper, wood chips, etc. (HDRA, 1998[9] ;gardenorganic.org.uk, 2012[10]). Application of *Azadirachta indica* as ine mulch is reported (Varshney and Kumar, 2008)[11]. The other experiments recorded the use of mulches as paddy straw, banana trash and black polythene (Babu and Sharma, 2003)[12].

Large/small, home garden or *Ingkhol* rather *Hingol* is unavoidable part of any household for this community in the study. Alligator weed is taken as potential threat to growth and development of the home garden plants. Alligator weed control is carried out by employing the methods of traditional knowledge procedures by the application of cost effective mulches by persons of Meitei-Pangal community in Manipur state, India. The mean length elongation and the active growth rate (growth kinetics/AGR-Active growth rate) of two seasons had to be compared.

II. METHODOLOGY

Traditional belief of application of mulches in the prevention of alligator weed under the traditional methods of agriculture was recorded during a field survey period from January 2012 to June, 2012 and July to December, 2012. The traditional methods of controlling the alligator weeds have been importantly looked into during the study period. Thus, the present study was developed based on the observations of alligator weed in the transplantation plots/beds(experimental plots) of chilly by the application of Straw of Garden Pea (SGP) (6cm), Seeds shell of Mustard (SSM) (4cm) and fallen leaves of bamboo (BL) (2cm and 4cm)and poultry manure (PM) (3 cm). Alligator weed was kept on monitoring at the plot/bed of *Phaseolus* spp.(field bean) where the mulches were not applied in such plot (Control plot). The required size of quadrat 20cm x 20cm was laid down to study the presence of alligator weed in the experimental plots and control plot. The calculation of ecological parameters i.e. density, abundance and frequencies were done in both kinds of plot accordingly. Also, the average length of alligator weed from their left over fragments below the soil on the 20th, 40th, 60th and 80th days after the preparation of the field bean plot was recorded as part of the study. Thus, for

comparison of growth between summer and winter alligator(s) the mean length of shoots growth of 10 alligators weed on the 20th, 40th and 80th days was also recorded. One graph (1) based on mean length of alligator shoots on the progressive days (record given in the table 2) was recorded. The active growth rate (AGR) of alligators between 20 to 40 day, 40 to 60 day and 60 to 80 day was also recorded of the two seasons and their comparison is shown with the help of a graph (2). The record of the experiment was carried out in the home garden of the owner, (L) Md. Sirajuddin Bogeemayum (Retired Clerk, Lilong Haoreibi College) at Lilong Haoreibi Turel Ahanbi Village (GPS information: N 24^o 41.341' E 0 93^o 56.097'; 765 msl). Frequent visit has been made to record the various measurements i.e. length of alligator weed, study of ecological parameters i.e. density, abundance, frequency and the observation of the nature of the weed. A particular care was given for the alligator weed by numbering under observations. The experiments were carried out on the given specific days. The statistical analysis of measurement of Means, Standard deviation wherever required was calculated. The necessary information of statistical data is provided in the tables.

III. MATH

A. Formula(s) applied in the study:

$$\text{Density} = \frac{\text{number of alligator weed}}{\text{Area sampled}}$$

$$\% \text{Frequency} = \text{number of plots in which alligator weed occurs} \times 100$$

$$\text{Dominance} = \frac{\text{Total no. of plots sampled}}{\text{Total cover or basal of alligator weed}} \times \frac{\text{Area sampled}}{\text{Area sampled}}$$

$$\text{Active growth rate (AGR)} = \frac{dn}{dt}$$

$$= \frac{n_2 - n_1}{t_2 - t_1}$$

where,

n_1 = growth in size length recorded first
 n_2 = growth in size length recorded second
 t_1 = time one (in days)
 t_2 = time two (in days)



Fig. 1. *Alternanthera philoxeroides* (Mart.) Griseb. in the field bean

IV. RESULTS AND DISCUSSION

A. Study of control of weed by the application of SGP, PM, BL, SSM and One Control exposed plot (ES) (by Quadrat method):

Table 1.: Density, Abundance, % Frequency of alligator weed measured on 40 days old different plots/beds where SGP, PM, BL, etc. applied

Name of weed		Quadrat (20cm x 20cm)										Total no. of individuals	Total no. of quadrates in which species occurred	Total no. of quadrates studied	Density	Abundance	% Frequency
		I	II	III	IV	V	VI	VII	VIII	IX	X						
<i>Alternanthera philoxeroides</i> (Mart.) Griseb. (Experimental Chilly plot)	BL, 2cm	2	0	0	1	0	0	1	0	1	0	5	5	10	.50	1	50
	PM, 3cm	0	1	0	0	0	1	0	0	0	1	3	3	10	.30	1	30
	BL, 4cm	1	0	0	0	0	1	0	0	0	0	2	2	10	.20	1	20
	SSM, 4cm	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0
	SGP, 6cm	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0
<i>Alternanthera philoxeroides</i> (Mart.) Griseb. (Control field bean plot)	Exposed Surface(ES), (40 days old)	4	1	1	3	1	5	5	12	7	6	45	10	10	4.5	4.5	450

In all 60 quadrats of 20cm x 20cm were studied. Calculation of density, abundance and % frequency of alligator weed in the applications of SGP, PM, BL and SSM showed significant values for the study. The population density of alligator weed was recorded highest, 4.5 in the control plot where no mulching was applied. The weed was recorded least i.e. 0 when SGP (6cm thick) and SSM (4cm thick). In the applications of mulches such as BL (2 cm thick), PM (3 cm thick) and BL (4 cm thick) the % frequency of alligator(s) weed were recorded in numbers i.e. 20, 30, and 50. The record of % frequency of the weed was increased from BL (4cm), 20%; PM (3cm thick), 30% to BL (2cm thick), 50%. The highest increase

in % frequency was recorded from the control bed of field bean where there was no application of mulches. The abundance of the weed was most (4.5) recorded in the control bed and the least under the application of SSM, (0) and SGP, (0) in the experimental plots. Thus, the overall result indicated that the overall Density, Abundance, and % frequency was recorded highest when there is no application of mulches in the control plot. This infers that the growth of weeds is checked by mulching of any kind, most successful being in the application of SSM (Seed shell of Mustard) and SGP (Straw of Garden Pea) in the experimental plots.

B. Average length of alligator weed on progressive days:

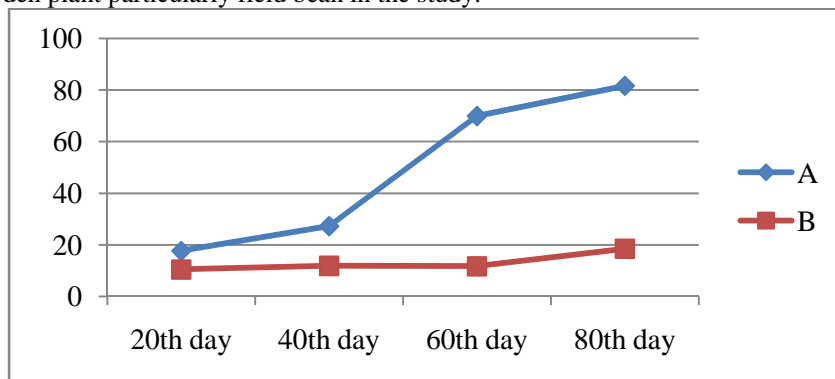
Table 2. : Alligator length on progressive days from January to June, 2012 and July to December, 2012.

Days	Minimum-Maximum height(length) (cm)		Mean length (cm)	
	January to June, 2012	July to December, 2012	January to June, 2012(A)	July to December, 2012(B)
20 th	9 – 24	6.8 - 41.3	17.7 (4.71 SD)	18.8 (10.57 SD)
40 th	16 - 41	8 - 49	27.35 (7.27 SD)	21.5 (11.9 SD)
60 th	50 - 91	9 - 50.5	70 (13.1 SD)	22.8 (11.75 SD)
80 th	55 - 110	10 - 35	81.7 (17.52 SD)	24 (18.5 SD)

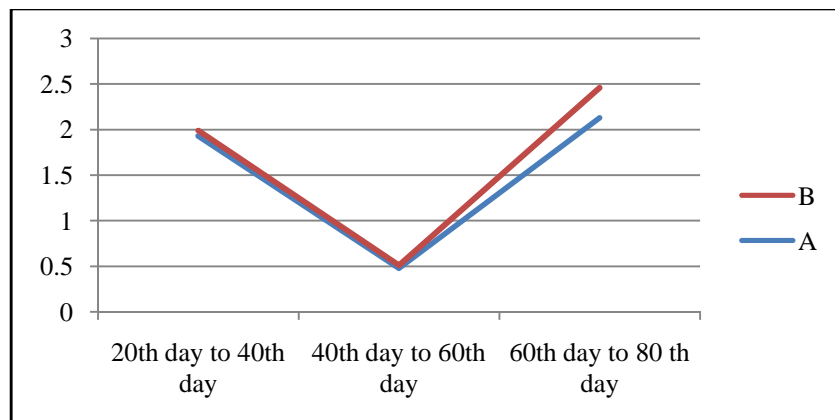
Table 3: Growth Kinetics (AGR)

Growth Kinetics		
Days	January to June, 2012(A)	July to December, 2012(B)
20 th to 40 th days	1.93	.06
40 th to 60 th days	.48	.03
60 th to 80 th days	2.13	.33

The mean shoot(s) length of alligator weed on 20th, 40th, 60th and 80th days old in 10 weed during January to June, 2012 (Graph1, A) is recorded as 17.7cm (4.71 S.D.), 27.35cm (7.27 S.D.), 70cm (13.1 S.D.) and 81.7(17.52 S.D.) whereas the mean length of 10 alligator weeds during July 2012 to December 2012 on 20th, 40th, 60th and 80th days were recorded 18.8cm (10.57 S.D.) 21.5cm (11.9 S.D.), 22.8cm (11.75 S.D.) and 24 cm (18.5 S.D.) (Graph 1, B). This indicates that the growth of alligator weed is aggressive during January to June 2012 and the trend is becoming a threat to normal growth to garden plant particularly field bean in the study.



Graph 1.: Histogram showing increase of shoot length of alligator weed on the progressive days



Graph 1.: Active growth rate (AGR) curve of alligator weed in different seasons

The rate of growth in the size lengths of alligator on the 20th, 40th, 60th and 80th days were recorded. The rate of increase during January to June, 2012 from 20th day to 40th day, 40th day to 60th day and 60th day to 80th day were

recorded i.e. 1.93cm, .48cm and 2.13 cm respectively. The rate of growth during June to December, 2012 from 20th day to 40th day, 40th day to 60th day and 60th day to 80th day was recorded i.e. 0.06cm, .03cm, and .33cm respectively. Sharp increase of growth has been recorded during 20th to 40th and 60th to 80th days of growth during

January to June, 2012. The sharp drop down of growth has been recorded in between 40th day to 80th day in both the seasons.

Agriculture is the mainstay of Indian economy because of its high share in employment and livelihood creation (Varshney and Babu, 2008)[13]. Estimates suggests that weeds are responsible for an overall reduction of somewhat more than 10% yield of the major world crops representing a huge annual loss of suppliers. According to some study biological control of *A.philoxeroids* by *Agasicles hygrophila* (flea beetle) is partially successful. Among the chemicals to control weeds, metsulfuron methyl emerged as safest herbicides to control alligator weed in terms of weed control (Sushilkumar *et al.*, 2003)[14]. In another report, although herbicides destroy leaves and shoots they do not cause direct mortality to roots and new sprouts appear soon after treatment (Bowmer and Eberbach, 1993[15]; Tucker *et al.*, 1994[16]). All herbicides treatment reduced below ground alligator weed biomass, eventhough, four applications at the highest listed concentration were not sufficient to eliminate alligator weed from the studied plots. But long term (1 month of selective herbicide application resulted in a sustained reduction in alligator weed biomass and an increase in monocot biomass (Schooler *et al.*, 2008)[17]. But in the republic of Croatia, it is reported that pre or post application of herbicide did not control a broad spectrum of weeds and did not provide the commercially acceptable full season control and the reduced rates of herbicide are not advisable under high weed pressure (Stefanic *et al.*, 2003)[18]. In yet another report for controlling alligator weed by mulches, all weed control measures markedly reduced the weed infestation; black polythene mulch was found the most effective weed control measure (Babu and Sharma, 2003)[12]. The most successful mulch in the study are SSM (Seed Shell of Mustard) and SGP (Straw of Garden Pea).

From the present study this has come to know that the summer crops are likely to be more affected by alligator weed. The weed crop competition would be more at this time. The active growth rate upto a certain level constantly increases with time (Wareing and Philips, 1981)[19] is similar in the results of present study. The active growth rate reduces after achieving peak rate of growth. In the present study the growth in elongation of the weed resumes after 40th day after it has been reduced in both the seasons. The mean length of alligator weed on 40th and 80th day between summer and winter are sharply differed from one another. Hence, the yield is likely to be affected more in the summer season. Therefore, the selected/useful application of mulches to control alligator weed during summer season will be very useful.

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