COMPARATIVE STUDIES OF QUALITATIVE MACROMORPHIC CHARACTERS OF THE NATURAL AND CULTURAL POPULATION OF ECLIPTA PROSTRATA LINN.

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ABSTRACT

The investigation were taken during 2018-2019 at experimental garden of Dept. of Botany, MU to investigate the qualitative macromorphic characters of the natural and cultural population of Eclipta Prostrata Linn. Among the various morphological characters the plants with decumbent habit are common in HER (50%), followed by EMP (32%). The HER, the leaves are linear – lanceolate (94%) and lanceolate (6%). In case of EMP the leaves are mostly (90%) sessile and (8%) appears to be sub-sessile. The achenes are mostly light brown with (90%) in HER and (80%) in EMP. The petiolar condition in HER two characters and in EMP three characters are visible at 1% significance level and in EMP one character exhibits variation at 5% significance level.

Keywords :- HER, EMP, Petiole, lanceolate, achenes.

INTRODUCTION :

Most of geneecological studies were limited to between population variation (inter-population) and morphological variable (Heslop-Harrison 1964). Subsequently, there was the inclusion of cytological (Babcock 1947 a & b Stebbins 1950) and physiological variables (Epstein and Jefferies 1964). Recently, within population (intra-population) and within genotypes (i.e. heterozygosity and phenotypic plasticity) have received greater attention, within population variation is being measured by using morphological, cytological and biochemical in nature (Johnson 1973 ; Bryant 1974). In case of within genotypes variation the heterozygosity of individuals has drawn greater attention mainly due to increasing interest in allozyme polymorphism. It is interesting to notes that considerably high degree of heterozygosity has been recorded (Hedrick *etal* 1976 ; Brown 1979 ; Hamrick 1979) even in cases of habitual inbreeding.

The present study is a humble attempt to measure the magnitude of between – population and within – population infra-specific variation in *Eclipta Prostrata Linn*.

MATREIALS AND METHODS :

Two natural populations of Eclipta Prostrate have been selected for the present study. One from Imphal West District (24.30^{0}N to 25.00 N latitude and 84^{0}42' to 86^{0}4'E longitude) at an elevation of 58m above sea level. The metropolis covers an area of 519.9 sq.km. The soil is a typical alluvium. And another one is collected from the salt springs of Thoubal District (25^{0}02' north latitude and 85^{0}30' east longitude) at an elevation of 68 m above sea level. The soil is alluvium consisting of gravel, silt and clay.

The experiment was done with 15 days old seedling. To maintain lower range of temperature (15 to 20^{0}C) the thermostatically controlled growth room of the Dept. of Botany Manipur University was used. Forty pots, each with 10 seeds were prepared for each population.

The variations in qualitative characters have been estimated by means of chi-square test using 2 x 2 and 2 x 3 contingency table based on the equal probability hypothesis. The expected frequency (E) was calculated by the following formula :

(i) Intra – population variation ;

$$E = \frac{N}{Number\ of\ Cells}$$

Where, N = Grand total of rows and columns.

(ii) Inter – population variation ;

$$E = \frac{\varepsilon K_1 \text{ x } \varepsilon R_1}{N}$$

Where, K_1 = sum of columns, R_1 = sum of rows, N = Grand total of rows and columns.

The Chi-square value were calculated by using the formula :

$$X^2 = \frac{(0-E)^2}{E}$$

Where, 0 = observation frequency.

The significance of x^2 values have been tested at 5% and 1% levels at a particular degree of freedom. The degree of freedom was calculated by using the formula :

(r – 1) (c – 1)

Where, r = Number of rows, C = Number of columns.

The chi-square has not been applied where the cell frequency for a character is less than five.

TABLE – 1 COMPARATIVE VALUE OF THE QUALITATIVE MACROMORPHIC CHARACTERS OF THE NATURE AND CULTURE POPULATIONS

		Erect		Decumbent		Prostrata		Row Total	
Habits		Natural	Cultured						
	* EHR	20(40%)	45(43%)	25(50%)	50(48%)	5(19%)	10(9%)	50	105
	** EMP	34(68%)	64(53%)	16(32%)	50(42%)	0(-)	6(5%)	50	120
Petiolar Condition	EHR	Petiolate		Sub-Sessile		Sessile		Row Total	
		0(-)	0(-)	0(-)	0(-)	50(100%)	105(100%)	50	105
	EMP	0(-)	0(-)	4(8%)	14(12%)	46(92%)	106(88%)	50	120
Shape of Leaves	EHR	Elliptic Lanceolate		Lanceolate		Linear Lanceolate		Row Total	
		0(-)	0(-)	3(6%)	10(95%)	47(94%)	95(90.5%)	50	105
	EMP	0(-)	5(4%)	50(100%)	115(96%)	0(-)	0(-)	50	120
Margin of Leaves	EHR	Wavy & closely Serrate		Closely Serrate		Distantly Serrate		Row Total	
		0(-)	0(-)	0(-)	0(-)	50(100%)	105(100%)	50	105
	EMP	0(-)	0(-)	4(8%)	5(4%)	46(92%)	115(96%)	50	120
Colour of Leaves	EHR	Pale Green		Dark Green		Row Total			
		0(-)	0(-)	50(100%)	105(100%)	50	105		
	EMP	0(-)	0(-)	50(100%)	120(100%)	50	120		
Colour of Mature Achenes	EHR	Pale – Brown		Dark Brown		Black		Row Total	
		45(90%)	95(90%)	5(10%)	10(10%)	0(-)	0(-)	50	105
	EMP	40(80%)	84(70%)	10(20%)	36(30%)	0(-)	0(-)	50	120

* Eclipta prostrate Linn. population growing on the bank of Nambul river.

** Eclipta prostrate Linn. population growing on the salt spring.

TABLE – 2 X^2 VALUE FOR VARIATIONS IN QUALITATIVE MACROMORPHIC CHARACTERS OF COMPARATIVE NATURAL AND CULTURE POPULATION

Characters	Natural Population			Culture Population		
	Intra-Population Variation		Intra-Population Variation	Intra-Population Variation		Intra-Population Variation
	Ungrouped Data		Group Data	Ungrouped Data		Group Data
	HER	EMP	HER – EMP	HER	EMP	HER – EMP
Habit	12.99**	6.48*	25.79**	27.1*	45.8**	3.33
Petiolar Condition	-	35.3**	4.16	-	70.5**	13.05**
Shape of Leaves	-	-	88.68**	68.8*	100.8*	188.02*
Margin of Leaves	-	35.5**	4.16	-	100.8*	4.46**
Colour of Leaves	-	-	-	-	-	-
Colour of mature Achenes	32.0**	18.0**	1.96	68.8*	19.2**	14.44**

Significant at 1% level.

Significant at 5% level.

RESULT AND DISCUSSION :

Table 1

Three distinct habit forms namely, erect, decumbent and prostrate have been observed. The plants with decumbent habit are common in HER (50%), followed by EMP (32%). Thus habit wise, the HER is the most homogenous one with 68% erect and 32 decumbent plants. The EMP is the most heterogeneous one with all habit form in seed proportion (erect 40% decumbent 50% and prostrate 10%).

The leaves in the two populations appear to be generally devoid of distinct petiole. The HER is characterized by having only sessile leaves. In case of EMP the leaves are mostly (90%) sessile and only a fraction (8%) appears to be sub-sessile. The EMP is characterized by lanceolate leaves. In EHR, the leaves are linear – lanceolate (94%) and lanceolate (6%).

The colour of nature achenes is also visible. In EHR and EMP, the achenes are mostly light brown (90% and 80%) respectively, the rest are dark brown in colour. Black achenes are altogether lacking in both EHR and EMP.

Table 2 : Group Data

a) Intra-population variations :
   Variations in the habit forms is significant at 1% in EHR and at 5% level in EMP. The petiolar condition and margin of leaves in EMP is variable at 1% significance level. Thus, in EHR two characters, and in EMP three characters are variable at 1% significance level and in EMP only one character exhibits variation at 5% significance level.

b) Inter-population variations :
   Population HER – EMP exhibits variation at 1% significance level only in habit form and shape of the leaves. The rest of the characters are either significantly variable or does not show any variation e.g. colour of the leaves.

Ungroup Data :

The chi-square test applied to the data obtained by grouping the populations into one unit, reveals that all the qualitative character are variable at 1% significance level.

The population selected here represent having dark green herbage with lanceolate or linear – lanceolate leaves. This morphotype corresponds to the "Seyah bhengra" (white form) of Ali (1979). The EHR is form the bank of the stream coming out of the radio-active spring of Thoubal the EMP from that of a road side "nallah" in Central Imphal. The habitats are different both topographically and edaphically and suffer from varying degree of biotic interference. The EHR grows at an elevation of 68 m above sea level on sandy loam with pebbles and is irrigated by hot and radio-active water of the spring. The soil is poor in moisture and mineral contents EMP grow at an elevation of 58M above sea level and found on sandy loam with rich humus and high contents of soil moisture and mineral nutrition. The habitats of EHR and EMP are relatively unstable and physically severe. The severity is due to frequent variation in activities. The instability is due to frequent variation in the course, depth and dimension of the streams along which they are located.

Studies on the variations in morphological features have long providing useful information for understanding the evolutionary dynamics of the plant species. Earlier studies were limited to variation at geographical level (Turesson. 1922 a ; Clause, kick and Hiesey, 1940). However, recent studies on many plant species have clearly indicated that microhabitat features and biotic factors are almost equally responsible for creating phenotypic variation in natural populations (Ramakrishnan, 1960 b and c, 1972 ; Bradshaw, 1965 ; Antonovics 1971 ; Snaydon 1973 ; Hamrick and Allard 1975). Much of these variations are genetically controlled (Nei, 1975 and Hamrick 1982). The morphological variations in two natural population of E. prostrate have been analysed statistically at intra- and inter-population levels in three steps. Firstly, the variations in the samples of the two population collected from the nature directly have been measure. The second step consisted of analyzing the variation of the populations raised under uniform cultural conditions from the seed progeny populations have been compared with those of their respective parents.

Following conventional system of classification, three sets of morphological features have been selected for the present study ; the first consisted of characters from external morphology, the second characters from leaf epidermis and the third of characters from pollen morphology.

Six qualitative characters of external morphology of natural population samples have been found to be significantly variable (Table 1). At intra population level, the EHR varies only in two features viz., habit and colour of mature achenes while the EMP in four features viz., habit. Petiolar condition, leaf margin and colour of achenes. The leaf colour is non-variable in all cases. At inter-population level, the EHR and EMP do not differ in leaf colour in both the cases leaves are dark green. They also vary insignificantly in petiolar condition, leaf margin and colour of mature and dark green and the cases the leaves are predominantly sessile and dark green and the achenes pale brown.

CONCLUSION :

The population raised from the seed samples of natural population exhibits a more or less similar pattern of variations. The exceptions are the variation at intra-population level in leaf shape in EHR and EMP and those at inter-population level in leaf shape in EHR and EMP and those at inter-population level in habit, petiolar condition and achene colour between EHR and EMP. However these difference between the parent and progeny populations are statiscally insignificant. It may, therefore be concluded that the variation in the qualitative characters of external morphology analysed here are genetically controlled.

REFERENCE :

1. Ali, S.S. (1979). "Unani Advia Mufreda" Taraqqi Lurdu Board New Delhi.
2. Babcock, E.B. (1947a). The genus Crepis. Part I. The taxonomy phylogeny, distribution and evolution of Crepis. Univ. Calif. Publ. Bol. No. 21. 19 pp.
3. Babcock, E.B. (1947b). The genus Crepis. Part II, Systematic treatment. Ibid. No. 22. 197 pp.
4. Bradshaw, A.D. (1965). Evolutionary significance of phenotypic plasticity in Plants. Adv. Genet. 13 : 115 – 155 p.
5. Brown, A.H.D. (1979). Enzyme polymorphism in plant populations. Theoretical Population Biology. 15 : 1 – 42.
6. Bryant, E.H. (1974). On the adaptive significance of enzyme polymorphism in relation to environment variation. Am. Nat. 108 : 1-19.
7. Clausen J., Keck D.D. and Hiesey, W.M. (1940). Experimental studies on the nature of species. I. Effect of varied environment on Western North American Plants. Carnogi. Inst. Wesh. Publ. 520, Washington D.C. 452 pp.
8. Epatein, E and Jefferies, R.L. (1964). The genetic basis of selective ion transport in plants. Ann. Rev. Pl. Physiol. 15 : 165 – 184.
9. Hamrick, J.L. (1979). Genetic variation and longevity. In "Types in plant population Biology" (O.T. Selbrig, S. Jain, G.B. Johnson and P.H. Raven, eds) PP. 84 – 107. Columbia University Press, New York.
10. Hamrick, J.L. (1982). Plant Population Genetics and Evolution Ann. J. Bot. 69(10) : 1685 – 1693.
11. Hamrick, J.L. and Allard, R.W. (1975). Correlation between quantitative characteristic and allozyme genotypes in Avena barbata. Evolution 29 : 438 – 442.
12. Hedrick, P.W., Ginevan M.E. and Ewing, E.P. (1976). Genetic polymorphism in heterogeneous environments. Ann. Ecol. Syst. 7 : 1 – 32.

13. Heslop – Harrisen, J. (1964). Forty years of genecology. Adv. Ecol.
14. Ramakrishna, P.S. (1960a). Distribution of Euphorbia thymiafolia Linn. In relation to soil calcium. J. Ind. Bot. Soc. 3 : 52 – 57.
15. Ramakrishna, P.S. (1960c). Ecology of Echinochloa colono Link. Proc. Ind. Acad. Sci. 52 : 73 – 90.
16. Ramakrishn, P.S. (1972). Edaphic ecotypes. In "vistas in plants science" (T.M. varglese and R.K. Grove eds). II PP. 1 – 22.
17. Stebbins, G.L. (1950). "Variation in Evolution in Plants" Columbia Univ. Press, New York, 643 pp.
18. Turesson, G. (1922a). The species and the variety as ecological units. Hereditas 3 : 100 – 113.