

BIODIVERSITY STUDY OF THE GENUS *Luffa* (CUCURBITACEAE)

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Key words : *Cucurbitaceae, morphological attributes, tolerance, conservation.*

The Family Cucurbitaceae is interesting with respect to its outbreeding behaviour and wide range of diversity even within population. It exhibits bizarre behavior in its morphological and genetic attributes. The present study is aimed at exploring the morphological diversity with conservation point of view and correlating its range of tolerance and phenotypic plasticity with diversity in germplasm, which is still to be explored for future conservational strategies.

INTRODUCTION

Cucurbitaceae, popular as 'gourd family', is more interesting taxonomically as observed through numerical taxonomic studies. The family has been in association with human civilization since ages as it has got a place in 'Charak Samhita' (Roy and Singh, 1974). Being a typically outbreeding family it has evolved through a lot of diversity features which are quite interesting if recorded for their qualitative and quantitative attributes; which reflects a lot of information in their reproductive behavior and evolutionary process (Whitaker and Bemis, 1975). Hence, conservation of germplasm becomes very important before their extinction under man-made impacts. (Whitaker and Cutler, 1971).

As the Department of Botany, Patna University has been one of the pioneer schools of conservation study in the family Cucurbitaceae, the present investigation has been carried out on the samples collected from the surrounding areas of Patna.

Luffa cylindrica is an annual monoecious species cultivated in the local areas. Being an important part of our staple food, it adds significance to this study. Its availability in the local market almost round the year has been an additional advantage.

MATERIALS AND METHODS

Materials for the present study were collected from the local population comprising five varieties for evaluating their importance as germplasm. The agroclimatic conditions of both the mesic segments and diara land were also studied specially during summer and rainy seasons. Varieties chosen for this study could withstand a temperature range of 27-42°C and average annual rainfall between 400-800 cm. The soil condition in the area of varietal collection was observed to be mainly alluvial or riverine.

The morphological studies were performed on five populations around Patna district during the time of fruit and seed setting. Different qualitative (growth, habit, inflorescence, flower colour, fruit colour, shape of fruit and seed coat, etc.) and quantitative characters (length of vine, size, length of petal and sepal, peduncle, length and diameter of fruit, number of seeds, etc) were recorded. The names and size of population and the site of collection have been recorded in Table-1.

Morphological attributes were recorded on 10 random samplings and their statistical analysis has been recorded in Table 2 and 3 showing ample diversifications. The statistical analysis is done by coefficient of variance.

$$\text{Co-efficient of variance} = \frac{\text{standard deviation} \times 100}{\text{mean}} \quad (1)$$

Leaf area ratio was calculated with (max length x max width) x 0.704 (Putta Swami *et al.*, 1976) with 0.704 as correction factor.

Taxonomic relationships were studied using operational taxonomic formula (Sokal and Sneath, 1965) and similarities were compared following Jaccard's co-efficient(sj) as

$$sj = \frac{a}{a + b + c} \quad (2)$$

The results have been compared and analyzed following Sokal and Sneath (1965).

OBSERVATION

1. *Luffa cylindrica* L. (Roem) is an annual monoecious species cultivated extensively in this region and used as a staple food of vegetables, flowers and tender leaves. Stems are glabrous with leaves of 5-7-lobes, 10-12 cm long and 5-7 cm wide with cordate shape (plate 1). Tendrils are bi-and trifid, flowers form probract 3-7 x 2-4 mm, flowers are brightly yellow. Male flowers are formed in fascicles whereas female flower was solitary axillary in usual habit but also show cluster of 2 or rarely 3 (plate-1). Flowers are entomophilous (ant and butterflies). The best qualitative characters are observed in VLC and PLC populations. Fruits with high yield and low taste and quality were observed from the boarder areas of Patna (BLC population). Detailed analysis has been recorded in Table-1. Flowers open between 5.30-6.30 a.m. HLC and PLC varieties had dark green fruits with white stripes (Plate-1); seeds were of 1-2 mm x 0.5-0.8 mm size and of black, brown and white colours. Cluster of characters are shown in the Fig.G-1.

DISCUSSION

The present study is aimed mainly at *pro tempore* protectionism in the family Cucurbitaceae with protrusions of ontogenic and taxonomic importances. Taxonomic studies have been discussed in detail in warmer regions of the world (Jeffery, 1983; Chakravarty, 1982).

Members of *Luffa cylindrica* have been surveyed, collected and conserved and have been well adapted in the mesic soil and diara lands of the gangetic plains. *Luffa* from across the places like Nalanda, Rajgir and Patna have exhibited penta-fid and octa-fid tendrils which may be due to environmental stress

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(Metcalf *et al.*, 1983). Inflorescences are axillary solitary or clustered or both (Plate 1) which may be of greater conservational value to increase food production. There is no doubt to the scattered ideas of conserving this family and a holistic approach is still lacking (Chandel *et al.*, 1988). Hence ontogenic studies and conservational strategies should be offered together for the betterment of mankind. The occurrence of two or more pistillate flowers from diara land around Patna was also reported in other genera (Trivedi *et al.*, 1991). This is also not an exception from conservational point of view.

We find each and every population able to exist and

reproduce successfully only in a definite range of climatic and edaphic factors. This range represents the tolerance of a species for certain characters following the laws of organic evolution. But the habitat distribution of species with similar range of tolerance is finally determined by the results of competition among them (Naik, 1984). *Luffa* occupies an intermediate position in accumulating genetic variability under domestication. Hence the observations of this study can be profitably used in numerical taxonomy, ontogeny and in neo-systematics despite concurrent challenges of descriptive biology of conservation.

Table-1

Sl. No.	Name of species	Locality	Population No	Size of population
1.	<i>Luffa cylindrica</i> (Roem)	Hilsa	HLC	50
		Parwalpur	PLC	50
		Vaishali	VLC	70
		Maner	MLC	80
		Balua	BLC	80

Key to polygraphs of the genus *Luffa* (Fig. G-1)

Sr.	Characters	Code of axis	Scale
1.	Size of population	1	10 Div = 1 plant
2.	Length of vine	2	10 Div = 1 ft
3.	Number of branches	3	10 Div = 1 Branch
4.	Length of internode	4	10 Div = 2 cm
5.	Number of young leaf	5	10 Div = 10 leaf
6.	Number of mature leaf	6	10 Div = 20 Leaf
7.	Length of Petiole	7	10 Div = 2 cm
8.	Length of tendril	8	10 Div = 10 cm
9.	Length of leaf	9	10 Div = 5 cm
10.	Width of leaf	10	10 Div = 5 cm
11.	L/B ratio	11	10 Div = 1 P. unit
12.	Av. Area of leaf	12	10 Div = 100 cm ²
13.	Number of male flowers	13	10 Div = 10 Flowers
14.	Number of Female flowers	14	10 Div = 10 Flowers
15.	Length of pedicel	15	10 Div = 1 cm
16.	Length of petal	16	10 Div = 1 cm
17.	Length of sepal	17	10 Div = 1 cm
18.	Length of stamen	18	10 Div = 1 cm
19.	Diameter of open flower	19	10 Div = 1 cm
20.	Diameter of calyx	20	10 Div = 10 Unit
21.	Number of young fruits	21	10 Div = 1 Fruit
22.	Number of mature fruits	22	10 Div = 10 Fruits
23.	Number of seeds/fruit	23	10 Div = 1 seed
24.	Size of the seed	24	10 Div = 2 cm
25.	Length of fruit	25	10 Div = 1 cm
26.	Diameter of fruit	26	10 Div = 1 cm
27.	Wt of one fruit	27	10 Div = 1 gm
28.	Wt of 100 seeds	28	10 Div = 1 gm
29.	Survival value	29	10 Div = 1%
30.	Harvest interval	30	10 Div = 1 Day

Table-2

Quantitative characters of five populations of *L. cylindrica* (Roem)

Sr.	Characters	HLC	PLC	VLC	MLC	BLC
1.	Habit	Annual	Annual	Annual	Annual	Annual
2.	Surface of stem	Smooth	Smooth	Rough	Rough	Smooth
3.	Texture	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous
4.	Branching	Simple	Simple	Profused	Profused	Profused
5.	Leaf colour	Deep green	Deep green	Deep green	Green	Green
6.	Shape	Cordate	Palmately lobed	Palmately lobed	Cordate	Cordate
7.	Surface	Rough	Smooth	Smooth	Rough	Rough
8.	Apex	Acute	Acute	Acute	Acute	Acute
9.	Margin	Serrate	Serrate	Entire	Entire	Dentate
10.	Tendril	Trifid	Trifid	Pentafid	Pentafid	Pentafid
11.	Inflorescence	Fasciculate raceme	Fascicles of raceme	Fascicles raceme	Fascicles of raceme	Fascicles of raceme
12.	Flower colour	Bright Yellow	Bright Yellow	Bright Yellow	Bright Yellow	Bright Yellow
13.	Sex form	Monoecious	Monoecious	Monoecious	Monoecious	Monoecious
14.	Position of Flower	Fasciculate	Fasciculate	Fasciculate	Fasciculate	Fasciculate
15.	Anther	Free locular	Free locular	Free locular	Free locular	Free locular
16.	Position of Filament	Basifixed	Basifixed	Basifixed	Basifixed	Basifixed
17.	Stigma	Trifid	Trifid	Trifid	Trifid	Trifid
18.	Ovary	Fusiform	Fusiform	Oblong	Cylindric	Cylindric
19.	Placentation	Parietal	Parietal	Parietal	Parietal	Parietal
20.	Shape of fruit	Oblong	Fusiform	Oblong	Cylindric	Cylindric
21.	Colour	White	Whitish green	Deep green	Dark Green Striped	Greenish White
22.	Surface of Fruit	Smooth	Smooth	Rough	Rough	Rough
23.	Taste	Sweet	Sweet	Sweet	Sweet	Sweet
24.	Seed Shape	Ovate	Ovate	Ovate	Ovate	Ovate
25.	Surface	Smooth	Smooth	Smooth	Smooth	Smooth

Table-3

Av. Quantitative characters in *Luffa cylindrica* (Roem) of different populations

Sr.	Quantitative Characters	Mean	Std. dev	Variance	Co-variance	Std. error
1.	Size of population	28.27	05.83	33.98	20.6	0.2062
2.	Length of vine	32.423	03.334	11.115	10.28	0.1028
3.	Numbr of branches	04.96	01.297	01.682	26.14	0.2614
4.	Length of internode	11.54	02.394	05.731	20.74	0.2074
5.	Number of young leaf	63.372	04.873	24.74	07.68	0.0768
6.	Number of mature leaf	139.21	06.975	47.938	04.98	0.0498
7.	Length of Petiole	11.23	03.289	10.817	29.28	0.2928
8.	Length of tendril	28.3	02.934	08.608	10.36	0.1036
9.	Length of leaf	16.39	03.234	10.432	19.70	0.1970
10.	Width of leaf	20.632	04.642	21.54	22.49	0.2249
11.	L/B ratio	00.786	00.0239	00.00057	03.04	0.0304
12.	Av. Area of leaf	334.43	12.69	12.69	03.80	0.0380
13.	Number of male flower	38.38	03.87	14.976	10.08	0.1008
14.	Number of Female flower	24.34	04.83	23.328	19.84	0.1984
15.	Length of pedicel	01.362	00.987	00.9741	72.40	0.7249
16.	Length of Petal	07.39	02.873	08.254	38.87	0.3887
17.	Length of sepal	02.32	00.934	00.8723	40.25	0.4025
18.	Length of stamen	01.321	00.7632	00.5824	57.70	0.5774
19.	Diameter of open flower	09.38	02.342	05.4843	24.96	0.2496
20.	Diameter of calyx	03.684	01.294	01.674	35.16	0.3516
21.	Number of young fruit	16.34	03.632	13.191	22.22	0.2222
22.	Number of mature fruit	06.32	02.432	05.914	38.48	0.3848
23.	Number of seeds/fruit	59.60	06.342	40.195	10.63	0.1063
24.	Size of the seed	01.23	00.639	00.4083	51.90	0.5195
25.	Length of fruit	16.83	02.87	08.236	17.05	0.1705
26.	Diameter of fruit	04.32	01.342	01.8009	31.06	0.3106
27.	Wt of one fruit	72.32	08.342	69.58	11.53	0.1153
28.	Wt of 100 seeds	32.34	07.329	53.71	22.66	0.2266
29.	Survival value	07.89	00.342	00.1169	04.33	0.0433
30.	Harvest interval	04.20	01.032	01.0557	24.46	0.2446

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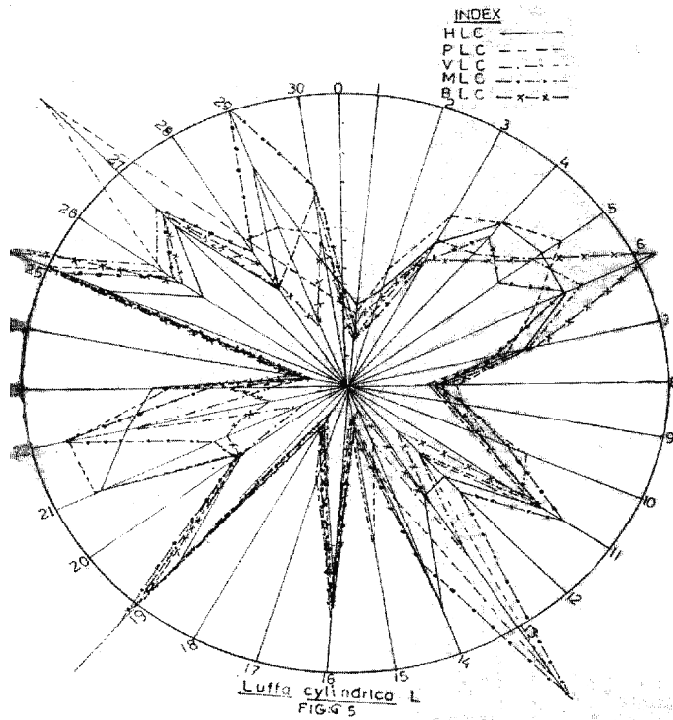


Fig. G1

