THE STUDY ON HETEROSIS IN THE F_1 HYBRID OF TWO LOCAL VARIETIES OF BRINJAL (*Solanum melongena L.*)

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INTRODUCTION

Brinjal (*Solanum melongena* L.), is one of the most popular and principal vegetable crops widely grown in subtropical and tropical countries, including Sri Lanka. In Sri Lanka, brinjal is one of the most popular local vegetables and is cultivated by farmers in fair quantities in hot and rainy seasons, when other vegetables are in short supply. Brinjal is practically the only vegetable that is available at an affordable price to the rural and urban poor and the daily sale of its produce serves as a ready source of cash income to the farmers for a period lasting 3-4 months. Brinjal, which is commonly known as eggplant is also known by several other names and a large number of varieties is grown in different countries. In our country it is well known as '*Katharikai*' in Tamil and '*Buttu*' in Sinhala.

The recommended varieties in the list in Sri Lanka are '*SM 164*', '*Thinnavely purple*' and '*Lena hiri*'. However, a local cultivar '*Palukamam purple*' is famous in the Batticaloa district for its quality fruits which has high consumer acceptability. This variety is a locally adapted land race collected from 'Palukamam' village in the Batticaloa district. Plants are erect and tall; they bear large, long cylindrical shaped purple colored fruit, about 90-100gin weight. '*Mudduvilmuddi*' is a traditional short duration variety from Jaffna with white colored, fleshy, and less seeded fruit. The average fruit weight is about100-125g.

In spite of its popularity among small and resource- poor farmers in the Batticaloa district brinjal cultivation is often input intensive, especially in relation to insecticide and fungicide applications. Brinjal is prone to attack from insect pest and diseases which cause severe problems in its cultivation, making the fruits unsuitable for the market and unfit for human consumption. If a hybrid is to be accepted commercially, it must be superior to the cultivars presently grown. This superiority may be expressed in terms of total yields, early yield, nutritional quality, post harvest life, insect pest disease resistance, adaptability, etc. (Shafeeq *et al.*, 2006).

The high degree of heterosis in eggplants has been reported in several studies in world-wide literature (Monteiro, 1975; Dixit *et al.*,1982; Singh and Kalda, 1989; Chadha *et al*., 1990; Sousa, 1993). Most authors recommended the commercial use of eggplant hybrids because of heterosis for fruit yield traits (Monteiro, 1975). In view of the above facts, the aim of this study is to evaluate the desirable traits in the 'F_1 hybrid' so that an ideo-type is evolved for economic production and to find whether the F_1 would possess the combination of all characteristics of economic importance.

METHODOLOGY

The experiment was conducted in the green house of the Department of Agricultural Biology, Faculty of Agriculture, Eastern University, Sri Lanka during the period January to June, 2013. The parent '*Palukamam purple*' (female parent), '*Mudduvilmuddi*' (male parent) and 'F_1 hybrid' of those varieties were used as experimental variables and arranged in CRD with six replications.

The top soil was mixed with well rotted cow dung and red soil. This mixed soil was sterilized with sunlight for about 7 days by air tight polythene method to eliminate infection from soil borne pathogen. Subsequently the sterilized potting media was transferred to the pots. The 40

day old seedlings of two parent and 'F_1 hybrid' were transplanted into the experimental pots. A liquid organic fertilizer named "Jewa Amirtha" was applied after two weeks from the transplanting to the time of the last harvest at two weeks intervals. Watering was done twice a day up to four weeks after transplanting and then every day up to the final harvest. Manual weeding was done twice a month.

Measurement & Observation

Data collection was initiated from the day of germination and continued up to the last harvest. Agronomically important parameters such as the date of first flowering, plant height at first flowering, date of first fruit formation, plant height at first fruit formation, weight, length and width of the fruits at first, second, third, fifth and eighth harvest were taken into consideration. In addition to these, shoot borer and mealy bug damages and qualitative characteristics of fruits were also assessed.

STATISTICAL ANALYSIS

Analysis of variance, using general linear model was used to analyze the data collected on yield, yield components and other agronomic characteristic and the mean was compared by using SAS statistical package.

RESULTS AND DISCUSSION

DAYS TAKEN TO FIRST FLOWERING AND FIRST FRUIT FORMATION

Early flowering and early maturity are desirable characters of plants (Sousa and Wilson, 1994). It was found that 'F_1 hybrid' and the parents '*Palukamam purple*' and '*Mudduvilmuddi*' had taken 45, 51.7 and 48 days respectively to initiate flowering and fruits were formed at 50, 60.6and 53.3 days respectively after flowering (Table 1). Variety '*Mudduvilmuddi*' and the 'F_1 hybrid' showed no significant difference in the above parameters. However, significant differences were noticed between the 'F_1 hybrid' and female parent ('*Palukamam purple'*). Days to flowering and fruit formation were respectively 4.9 and 7.0 earlier than the mid parent values. This is a positive indication of genetic advancement and a desired characteristic in breeding.

Table 1: Days taken to first flowering and first fruit formation

Treatment	Mean value of days to first flowering	Mean value of days to first fruit formation
'*Pulukamam purple*'(pp)	51.7[a]*	60.6[a]
'*Mudduvilmuddi*' (mm)	48.0[b]	53.3[b]
'F_1 hybrid' (pp x mm)	45.0[b]	50.0[b]
Mid parent value	**49.9**	**57.0**

*Figures followed by same letters in each column do not differ significantly at p=0.05, base in DMRT.

PLANT HEIGHT AT FIRST FLOWERING AND FIRST FRUIT FORMATION

Significant differences in plant height were noticed among parents and their 'F_1 hybrid' at first flowering and first fruit formation. The male parent '*Mudduvilmuddi*' had the lowest value of plant height compare to the female parent '*Palukamam purple*' and 'F_1 hybrid'. However, the 'F1hybrid' showed the intermediate effect of the parents (Table 2),which would have been due to gene dispersion on the parents, and could be considered an additive gene effect.

Table 2: Plant height at first flowering and first fruit formation

Treatment	Mean value of height at first flowering (cm)	Mean value of height at first fruit formation (cm)
'*Palukamam purple*'(pp)	49.9[a]*	60.3[a]
'*Mudduvilmuddi*' (mm)	25.3[c]	35.0[c]
'F_1 hybrid' (pp x mm)	38.7[b]	41.3[b]
Mid parent value	**37.6**	**47.7**

*Figures followed by same letters in each column do not differ significantly at p=0.05, base in DMRTWeight, length and width of pod

In this investigation, a remarkable increase in pod weight was observed in the 'F_1 generation' (Fig. 3) of the cross between '*Palukamam purple*' (Fig. 1) and '*Mudduvilmuddi*' (Fig. 2) and significant differences were noticed between the parents and their F_1 hybrid at p= 0.05. It was also more than the better parent. The calculated increase of fruit weight up to 71 percent over mid parent value was obtained from the fruit weight in the second harvest (Table 3) and can be possibly attributed to the effect of the combination of dominant genes together in the hybrid (dominance hypothesis). When the yield characteristics are used as assessment criteria, it is desirable that the heterosis and heterobeltiosis level, shown in the hybrid combinations, be as high as possible. Mean fruit weight and mean weight of early fruit are an exception since very high heterosis and/or heterobeltiosis values may lead to fruit much heavier than those established by the market gardeners (Sousa and Wilson, 1994).

Table 3: Weight of fruits at first, second, third, fifth and eighth harvests

Treatment	**Mean weight of the fruit (g)**				
	1st	**2nd**	**3rd**	**5th**	**8th**
pp	99.7[b*]	96.0[b]	89.7[b]	72.7[c]	79.1[b]
mm	115.3[b]	119.0[b]	165.0[ab]	93.7[b]	81.0[b]
ppX mm	137.6[a]	183.6[a]	121.3[a]	120.0[a]	108.0[a]
Mid parent value	**107.5**	**107.5**	**127.3**	**83.2**	**80.1**

*Figures followed by same letters in each column do not differ significantly at p=0.05, based on DMRT

Fig 1. Palukamam purple (pp)

Fig 2. Mudduvilmuddi (mm)

Fig 3. F_1 hybrids (pp X mm)

The variety '*Palukamam purple*' had the longest pod, followed by 'F_1 hybrid' and '*Mudduvilmuddi*' (Table 4). The 'F_1 hybrid' produced intermediate fruit length and fruit length intermediate between parents will have been due to gene dispersion in the parents (additive gene effect). Several workers have reported that fruit length is influenced by the

additive gene effect (Peter and Singh, 1973; Vadivel and Bapu 1990) High heritability and high genetic gain have also been observed for fruit length by many workers (Vadivel and Bapu 1990).

Table 4: The length of fruits at first, second, third, fifth and eighth harvests

Treatment	Mean length of the fruit (cm)				
	1st	**2nd**	**3rd**	**5th**	**8th**
pp	21.4[a *]	21.0[a]	19.7[a]	17.3[a]	17.5[a]
mm	10.6[c]	11.0[c]	11.4[c]	10.6[c]	9.7[c]
ppX mm	15.8[b]	14.1[b]	15.9[b]	14.4[b]	15.0[b]
Mid parent value	**16.0**	**16.0**	**15.6**	**13.9**	**13.6**

*Figures followed by same letters in each column do not differ significantly at p=0.05, based on DMRT

Also, the male parent '*Mudduvilmuddi*' and their hybrid had the highest pod width at 1st, 2nd and 3rd harvest and the mean values are similar in the 5th and 8th harvest. Meanwhile, the other parent '*Palukamam purple*'had the lowest fruit width. 'F_1 hybrid' did not exceed their better parent but exceeded the mid parent value in fruit width (Table 5).

Table 5: Width of fruits at first, second, third, fifth and eighth harvests

Treatment	Mean width of the fruit (cm)				
	1st	**2nd**	**3rd**	**5th**	**8th**
pp	13.5[b *]	13.1[b]	15.3[b]	13.7[c]	12.7[b]
mm	25.7[a]	24.7[a]	21.0[a]	22.4[a]	20.0[a]
ppX mm	25.4[a]	22.9[a]	20.7[a]	18.4[b]	15.2[ab]
Mid parent value	**19.6**	**18.9**	**19.1**	**18.1**	**16.4**

*Figures followed by same letters in each column do not differ significantly at p=0.05, based on DMRT

Other characteristics under study

The 'F_1 hybrid' produced light purple with white shaded colored and elongated fruits with intermediate fruit length (Fig.3). A mild attack of Mealy bug insect was observed in the F_1 plant but shoots and fruit borer damage was not noted.

CONCLUSIONS

The important features of this study are to evaluate heterotic effect of 'F_1 hybrid' of the crosses of two local varieties for many characteristics of economic importance. The study reveals that heterotic effects can be positively exploited for many agronomic characteristics of economic importance in brinjal and further more heterobeltiosis is clearly manifested in fruit weight. This is well applicable when parents of diverse origin are used in hybridization of brinjal.

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