significant increase in the efficiencies of soil and fertiliser nitrogen under 80 hills m^{-2} as compared to 66 hills m^{-2} population level (Table 3).

Influence of N levels on Cf under varying population levels

The influence of different levels of N on Cf was studied. The mean Cf ranged from 30.80 to 35.38 per cent for different levels of N with 66 hills m^{-2} and 32.29 to 38.02 per cent of different level of N with 80 hills m^{-2} respectively. The results revealed that at each population level, the increase in N level decreased the Cf which was statistically significant (Table 4).

Grain and straw yield and N uptake by rice

The mean yields of grain and uptake of N by rice are furnished in Tables 5 and 6. The statistical analysis of the data clearly revealed that in all the experimental sites, application of higher doses of N (for 8 t ha^{-1} yield target of rice) with a plant population of 80 hills m^{-2} recorded significantly higher grain and straw yields as well as N uptake. This might be due to the better utilisation of added nitrogen. The better root proliferation under higher population density might have resulted in higher N uptake and consequent increase in the efficient utilisation of added N (Paraye *et al.* 1996 and Verma *et al.* 1988).

From the study it could be concluded that whenever we aim for higher yield target of rice the population density may be increased to 80 hill m^{-1} for short / medium duration rice varieties in light textured Irugur soil series so as to increase the efficiency of added fertiliser nitrogen.

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Influence of larval density as stress factor for rearing of CSR hybrid silkworms

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Abstract : Newly evolved productive bivoltine hybrid CSR2 x CSR5 rearing was conducted with different larval densities ranging from 50 larvae / sq.ft to 100 larvae / sq.ft in fifth instar. The cocoon character, cocoon yield and disease incidence was recorded with optimum rearing conditions as well as in the presence of 1 per cent infectious source (Flacherie and Grasserie). The results revealed that the cocoon characters were significantly improved and diseases incidence were reduced under low densityrearing (50 & 60 larvae/ sq.ft). However, there was no significant difference between 50 & 60 larvae/sq.ft. treatments with regard to spread of flacherie and grasserie. (***Key Words*** *: Cocoon characters, Disease incidence, Disease spread, Flacherie, Grasserie, Larval density).*

Adequate rearing space has an impact on the vigorous growth of the silkworms. The space available for larva appeared to be more important than the quantity of food (Rapusas and Gabriel, 1976). Therefor, it is essential that the larval density in the rearing bed should be regulated and sufficient rearing bed area should be provided to minimize the crop losses. The larval density in an unit area had a direct effect on the incidence of grassier (Samson 1992) and crowding as a stress has been used to bring out latent disease (Helms and Rawn 1971). Rearing of different instars of silkworm *Bombyx mori* L in different spacing has a direct effect on cocoon production. Hence, it was felt necessary to study the effect of larval density on cocoon yield, cocoon characters and disease incidence in newly evolved productive breed CSR2 X CSR5 under normal and infectious source of disease.

Materials and Methods

New bivoltine hybrid (CSR2 xCSR5) eggs were received from Bivoltine Silkworm Breeding Laboratory and surface disinfected with 2% formalin. The eggs were incubated at optimum conditions and the larvae were reared following standard rearing practices till 3rd moult. Immediately after the 3rd moult 100 larvae were inoculated with Bm NPV (1 x 10^6 polyhedra/ml/100 larvae) and continued to rear separately till the fourth moult. Another set of larvae were inoculated with BmIFV (1 ml of 10% BmIFV larval homogenate smeared uniformly on the mulberry leaf surface and fed to a population of 100 larvae on first day and *Streptococcus* bacteria (1 x 10^7 bacterial cell/ml/100 larvae) on the second day and reared as above. The remaining larvae were reared upto the fourth moult. On resumption they were replicated for treatments. In first set of treatment, the larvae were grouped into six batches representing different larval densities *viz.,* 50, 60, 70, 80, 90 and 100 larvae/sq.ft. Each treatment had three replications and 200 larvae/replication. In second set the larvae were replicated as above and each treatment had inoculation of 1per cent infectious source of either flacherie or grasserie. The inoculation was made at the beginning of the fifth instar. The larvae of both sets were reared under optimum rearing conditions except for the bed area which form the treatment. The larvae were fed with equal quantity of mulberry. The disease incidence was recorded during the rearing and on the mountages. The larvae were also weighed (10 mature larval weight) for growth prior to spinning. After completion of spinning, cocoons were harvested on sixth day and assessed for survival percentage, single cocoon weight, single shell weight and shell ratio.

Results and Discussion

The results of the influence of larvae density during 5th instar on cocoon yield and economic characters of CSR2 x CSR5 is presented in Table 1 and 2.

Table 1. Rearing performance in 1% infectous source of flacherie Vs control batch

Treatment	Larval weight		ERR %		Single cocoon weight (g)		Shell weight (g)		Shell Ratio %	
	Control	Infectious source	Control	Infectious source	Control	Infectious source	Control	Infectious source	Control	Infectious source
50 Larvae/Sq.ft	47.52	41.98	98.05	46.78	1.876	1.518	0.422	0.332	22.49	21.86
60 Larvae/Sq.ft	46.56	41.42	96.45	44.89	1.796	1.525	0.399	0.331	21.21	21.73
70 Larvae/Sq.ft	45.83	40.51	94.45	37.61	1.720	1.468	0.370	0.307	21.80	20.99
80 Larvae/Sq.ft	45.01	39.69	93.25	42.23	1.684	1.463	0.359	0.301	21.36	20.57
90 Larvae/Sq.ft	43.97	37.47	90.64	31.35	1.663	1.470	0.345	0.304	20.78	20.48
100 Larvae/Sq.ft	42.50	36.12	86.14	14.50	1.643	1.450	0.331	0.273	20.15	18.86
S.E+	0.563		4.46		0.025		0.007		0.317	
C.D. at 5%	1.585		12.54		0.072		0.019		0.893	
	**		**		**		**		**	

Fig. 1 : Influence of larvel density on Flacherie disease

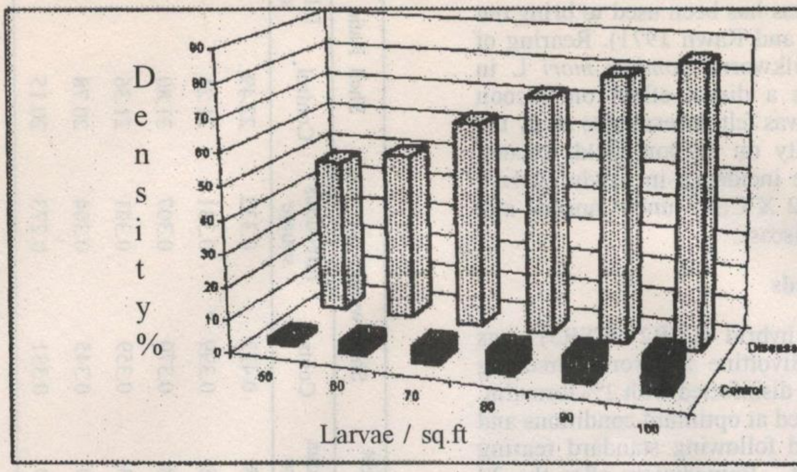
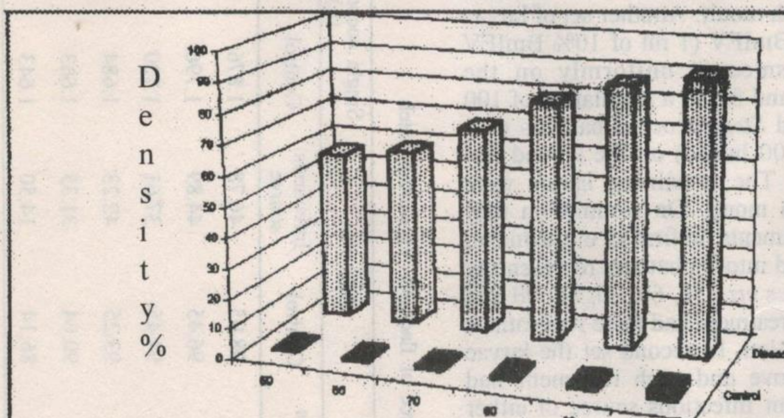


Fig. 2 : Influence of larvel density on Grasserie disease



- Rearing without infectious source
- Rearing with 1% Flacherie infectious source
- Rearing with 1% Grasserie infectious source

Weight of 10 mature silkworms:

The result indicated the negative influence of larval density on the larval weight. Silkworm reared on low density developed higher weight than the high density rearing. The larval weight in a density of 50 larvae/sq.ft area was 47.52g while in the 100 larvae/sq.ft it was 42.50g. The difference was also observed in treatment having 1% of infectious source of flacherie are grasserie. The difference in larval weight among the treatment with infections source was significant. The difference among the treatments may be due to the shortage of food and space for the growth. Similar observation has been made by Wafa and Eid (1966) where crowding was reported to induce smaller larvae.

Effective Rate of Rearing (ERR%)

The survival of larvae represented by ERR % was significantly high with 98.05% survival in larval density of 50 larvae/sq.ft and significantly reduced in overcrowded rearing of 100 larvae/sq.ft. with a survival of 86.14 per cent. In low density rearing, in presence of the infectious source, the survival due to high rate of spread of disease was significantly low compared to without infectious source (Control). The ERR% with 1per cent infectious source of flacherie and grasserie was 46.78 per cent and 53.44 per cent compared to 98.05 in control. The survival of gases larvae with infectious source and high larval density (100 larvae/sq.ft.) was only 14.50 and 8.48 per cent with regards to flacherie and grasserie respectively. Under the crowed condition the larvae spread the pathogens and its increased rate of availability, the accumulation of gases, heat and fermentation of faecal matter which in turn leads to unhygienic, unhealthy growth of the larvae and higher rate of spread of diseases leading to mortality. The wider spacing plays a positive significant role in improving the growth and rearing parameters (Roychoudhury *et al.* 1992 and Haque *et al.* 1992) as well as improved environmental factors for healthy growth.

Cocoon weight, shell weight and shell ratio

The cocoon characters *viz.*, single cocoon weight, shell weight and shell ratio were significantly higher in larval density of 50 larvae / sq.ft. compared to 100 larvae / sq.ft. The single cocoon weight, shell weight and shell ratio were 1.879g, 0.422g and 22.49 per cent respectively in treatment 50 larvae/sq.ft. and the characters were significantly lower (1.643g, 0.331g and 20.15 per cent) in 100 larvae/sq.ft, the same observation was also made in the treatment having 1 per cent infectious source of flacherie and grasserie batches. Similar observation was made by the earlier workers. (Roychoudhury *et al.* 1992). The significant decrease in these characters under high density rearing may be due to shortage of available food to each individual in the population as well as uncongenial conditions created by over crowding. Therefore larval density has a significant influence on the cocoon characters.

Incidence of disease

The results of the study revealed that the incidence of flacherie and grasserie were significantly lower in treatment with 50 larvae/sq.ft. under normal rearing condition and the 1 per cent infectious source of diseases. There was no significant difference between treatment with 50 and 60 larvae/sq.ft. However the rate of spread of disease *viz.*, Flacherie and grasserie in presence of 1 per cent infectious source, even under treatment 50-60 larvae/sq.ft., was significantly higher compared to control having no infectious agents. The spread was to an extent of 47.26 - 51.17 per cent with respect to flacherie and 56.33 - 59.55 per cent with respect to flacherie and 56.33 - 59.56 per cent with respect to grasserie. In case of 100 larvae/sq.ft. the spread was 85.56 per cent with regard to flacherie and 91.11 per cent with regards to grasserie (Fig.1 & 2). These observations are an agreement with the earlier observation of Sivaprakasam *et al.* 1997 and Das *et al.* 1993.

The high rate of spread of the diseases in the high density rearing may be due to closer proximity of the host population to the pathogen released in closer rearing area by diseased host which leads to higher rate of contamination of the feed. This mean larger number of individuals feeding on contaminated food and getting diseased. In low density rearing the proximity of the host to the pathogen is not as closer as is in higher density rearing. As such the rate of spread is comparatively lower.

From the results, it may be concluded that high density rearing creates environment uncongenial for growth and health of individuals in the population. The conditions become very much in presence of infectious source in the colony leading high rate of spread of diseases, mortality/poor productivity having lower economic characters. The present study clearly demonstrated the need of rearing bed area of at least 60 larvae/sq.ft. or 660 sq.ft/ 40,000 larvae. This level of spacing is essential for rearing of the newly evolved productive CSR bivoltine hybrids in order to harvest its full potential.

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Correlation and path analysis in the F_2 generation of greengram (*Vigna radiata* (L.) Wilczek)

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Abstract : The correlation and path coefficients were worked out in seven parents and F_2 population of their 21 crosses in greengram for 13 characters. Seed yield had significant positive genotypic correlation with number of secondary roots at maturity, dry weighty of plants at maturity, plant height, clusters per plant, pods per plant, seeds per pod and hundred grain weight and harvest index. Number of pods, clusters per plant and harvest index showed high positive correlation on grain yield and also with each other. Path analysis revealed that pods per plant had the highest positive direct effect on grain yield followed by hundred grain weight and number of seeds per pod. Plant height showed high indirect effect through number of pods, seeds per pod and hundred grain weight on grain yield. The study revealed that genetic improvement of grain yield is possible by selecting characters having high positive correlation and positive direct effect. *(Key Words : Greengram, F_2 generation, Correlation, Path analysis).*

Yield is a complex character, controlled by polygenes. Therefore, selection made on the basis of its phenotypic expression alone are likely to be misleading. It is therefore essential to measure the contribution of various traits to the yield through correlation and partitioning the correlation coefficient into the components of direct and indirect effects. The present study was undertaken to derive information on phenotypic and genotypic correlation, direct and indirect effect of various traits, in the F_2 generation of greengram and effectively utilize the transgressive segregants for evolving superior variety for higher yield with good nitrogen fixing potential for the effective contribution of sustainable agriculture.

Materials and Methods

The experimental material consists of seven promising parental varieties, Pusa-9333, KM-1285, NDM-88-14, MG-368, IIPRM-3, CoGG-902 and LGG-444 and F_2 seeds collected from their 21 crosses. The F_2s along with the parents were raised in randomized block design with three replications during 1998-99 in rabi season. The seeds were sown at a spacing of 25 x 10 cm in $3m^2$ plots, so that 240 plants could be accommodated in each plot. Recommended package of practices of Kerala Agricultural University were followed to raise a good crop (KAU, 1996). Observations were recorded from ten plants selected at random from each treatment on