https://doi.org/10.29321/MAJ.10.A02316

Madras agric. J. 73. (10): 573-578 October, 1986

ESTIMATION OF HETEROSIS IN HYBRIDS AND SEGREGATING PATTERN IN F_2 GENERATION FOR APICULUS PIGMENTATION IN SPIKELETS OF RICE (*Oryza sativa* L.)

K. S. PARAMASIVAM

ıor parents namely T_7 and Triveni and four susceptible high yielding popular strains viz., IR 36, IR 50, TKM 9 and CO 44 were chosen for crossing work. Seven crosses were effected and hybrids were raised along with their respective parents, Quantitative characters Viz., plant height, number of productive tillers, panicle length, number of spikelets per panicle, 100 grains weight and grain yield per plant were recorded and studied. Four crosses viz., IR 50x T7, T7x TKM 9, Triveni x TKM 9 and Triveni x IR 36 expressed heterosis for the six yield contributing characters studied. In cross combinations viz., Triveni x TKM 9 and T7 x TKM9, study was undertaken in F_2 generation for the segregating pattern of apiculus pigmentation in spikelets. Apiculus pigmentation has been found to be complementary gene action.

Serious out breaks of insects on rice have occurred in several countries in recent years. Very little research has been done on the chemical control. Several insecticides have been identified but chemical control of high populations of insects for prolonged periods is very expensive. Hence, in recent years attention is being bestowed in resistance breeding to withstand biological stresses which occurred in nature. The use of host resistance to control inse cts is the best biological approach to overcome the difficulties. Hence, to develop brown plant hopper resistant cultures, hybridization programme was launched with resistant donors and susceptible high yielding popular strains at Paddy Breeding Station, Goimbatore.

MATERIALS AND METHODS

Two donor parents namely T7 and Triveni and four popular strain Viz., IR 36, IR 50, TKM 9 and CO 44 were chosen. Three sowings were taken up in the nursery beds with an interval of 10 days to synchronise flowering time. Seedlings were transplanted in the main field with a spacing of 30 cm between rows and 30 cm between plants in the row. Crossing was effected during May and June 1981. Crossed seeds were collected, dried and sown in the nursery beds along with their respective parents. Hybrid seedlings were transplanted in central row and parents on either sides, replicated twice. The length of the row was 5.00 m and spacing adopted was 20 x 10 cm. Observations were recorded in randomly selected ten hybrids and ten plants in each replication for the traits viz., height of the plant, number of productive tillers, panicle length, number of spikelets per panicle, 100 grain weight

Associate Professor (Rice), School of Genetics, TNAU, Coimbatore.

and grain yield per plant. Heterosis, heterobeltiosis and standard heterosis were computed and the significance was tested for heterosis. Chi-square test was done for the segregation of apiculus pigmentation of spikelets in two crosses.

RESULTS AND DISCUSSIONS

F_1 generation:

I Quantitative characters (Table I)

Plant height : Heterosis manifested for plant height ranged from +6.60 (IR 36 × T7) to +16·74 (IR 50 + T7) as reported by Singh *et al* (1980). Three crosses expressed highly positive and significant heterosis for the trait. While six crosses exhibited heterosis over mid-parent (di) and heterobeltiosis (dii) for plant height as found out by Paramasivan (1975) except the cross, CO 44 × T7.

Number of productive tiller: All the seven cross combinations expressed heterosis over mid-parent (di), over better parent (dii) and over the best parent (diii) for number of productive tillers. These seven crosses showed highly positive and significant heterosis as observed by Singh and Singh (1979) and the lowest value of heterosis (+ 42.65 per cent) by IR 50 × T7 and the highest by IR 36 × T7 (+126.84 per cent).

Panicle length: Among the seven crosses studied, six of them recorded highly positive and significant heterosis except the cross CO 44×T7. This finding is in conformity with the finding of Mallick *et al.* (1978). The lowest value of +9.13% of heterosis over mid-parent (di) was recorded by T7 X TKM 9 and the highest being +15.10 per cent which was recorded by IR 50XT7. Four crosses viz., IR 50 × T7, IR 36 × T7, T7 X TKM 9 and Triveni X T7 recorded heterosis for the three criteria viz., heterosis (di) heterobeltiosis (dii) and standard heterosis (diii) for panicle length.

Number of spikelets per panicle : Highly significant and positive heterosis was recorded for number of spikelets per panicle in the seven crosses studied. The lowest value of heterosis (+8.71%) was recorded by CO 44 × T7 and the highest (+76.22%) by Triveni × TKM9. This result is in agreement with the result of Singh *et al.* (1980). Seven cross combinations exhibited positive heterosis for the three criteria.

100 seeds weight: Highly significant and positive heterosis (*di*) was observed in three crosses viz., IR 36 × T7, T7 × TKM9 and Triveni × TKM9 for weight of 100 seeds. This observation is in agreement with the findings of Singh *et al.* (1978). Only one cross, Triveni × TKM9 showed positive heterosis over midparent (di) as well as over better parent (dii) for weight of 100 seeds as observed by Singh *et al.* (1980)

Teble 1. Percentage of heterosis over mid-parental value, better parent and superior parent in economic traits of rice hybrids

Hybrids/Parents	Plant height (cm)				Tiller number				Panicle length (cm)			
	Mean	di	dii	diii	Mean	di	dii	diii	Mean	di	dii	diii
IR 50 x T7	110.50**	+16.74	+32.12	+50.14	20.75**	+42.65	+22.89	+29.68	27.68**	+15.10	+25.43	+7 28
IR 36 x T7	97.33**	+ 6.60	+32.24	+32.24	21.55**	+126.84	+92.41	+34.69	26.60**	+12.71	+ 3.10	+3.10
T7 x TKM9	107.92**	+12.30	+23.71	+46.03	21.54**	+81.00	+34.63	+34.63	26.90**	+ 9.13	+ 4.26	+4.26
Triveni x TKM9	84.50	+ 3.94	+ 6.42	+14.80	19 25**	+50 39	+20.31	+20.31	25.97**	+12.18	+10.60	+0.66
Triveni x IR 36	81.17*	+ 6.80	+10.29	+10.28	18.50**	+77.88	+65.18	+15.63	24.43**	+10.54	+ 7.15	—5.54
Triveni x IR 50	77.50	+ 0.39	+ 3.33	+ 5.30	19.75**	+54.30	+23.44	+23.43	25.05**	+13.86	+ 9.87	—2.91
CO 44 x T7	96.00	— 1.56	+11.63	+30.43	18.50**	+55.46	+15.67	+15.63	25.63**	+ 2.52	— 0 66	—0.66
T7	109.00	—	—	—	7.80	—	—	—	25.80	—	—	—
IR 36	73.60	—	—	—	11 20	—	—	—	21.40	—	—	—
TKM9	83.20	—	—	—	16.00	—	—	—	23.50	—	—	—
Triveni	79.40	—	—	—	9.60	—	—	—	22.80	—	—	—
IR 50	75.00	—	—	—	16.00	—	—	—	21.20	—	—	—
CO 44	86.00	—	—	—	16.00	—	—	—	24.20	—	—	—

Table 1. (Contd).

Hybrids/Parents	No. of spikelets per panicle				100 Grain weight (g)				Graid yield/plant (g)			
	Mean	di	dii	diii	Mean	di	dii	diii	Mean	di	dii	diii
IR 50 x T7	164.70**	+25.68	+15.60	+18.49	2.520	+0.79	−12.70	−11.27	33.420**	+50.84	+33.99	+20.30
IR 36 x T7	154.30**	+45.91	+45.84	+ 0.11	2.150**	−11.89	−24.30	−32.09	40.500**	+150.77	+88.37	+45.78
T7 x TKM9	156.90**	+41.03	+ 0.35	+12.88	2.632**	+ 4.37	−74.65	− 7.32	26.000**	+80.36	+44.44	− 6.41
Triveni x TKM9	179.75**	+76.22	+ 0.54	+29.32	2.400**	+ 4.58	+ 0.42	−15.49	19.500**	+45.74	+83.83	−29.81
Triveni x IR 36	141.40**	+31.11	+2 .55	+ 1.73	2.220	+ 0.23	− 7.95	−21.83	20.250**	+33.84	− 5.81	−27.11
Triveni x IR 50	143.70**	+15.42	+ 3.38	+ 3.38	2.250	− 8.89	− 5.86	− 0.21	21.520**	+35.28	− 6.98	−22.53
CO 44 x T7	170 50**	+ 8.71	+35.32	+22.66	2.230	− 8.13	−20.42	−20.42	30.250**	+56.82	+ 8.89	+ 8.89
T7	105.80	−	−	−	2.840	−	−	−	10.800	−	−	−
IR 36	105.70	−	−	−	2.040	−	−	−	21.500	−	−	−
TKM9	116.70	−	−	−	2 200	−	−	−	18.000	−	−	−
Triveni	110 00	−	−	−	2.390	−	−	−	8.760	−	−	−
IR 50	139.00	−	−	−	2.150	−	−	−	22 060	−	−	−
CO 44	126.00	−	−	−	2.080	−	−	−	27.780	−	−	−

(di) = Heterosis = increase/decrease over mid parent
(dii) = Heterobeltiosis = increse/decrease over better parent
(dlii) = Standard heterosis = increse/decrease over the best parent
* Significant at 5% level
** Significant at 1% level

Grain yield: Significant heterosis for grain yield per plant was recorded by all the seven crosses studied as recorded by Shrivastava and Seshu (1982). The lowest value of heterosis (+33.84%) was registered by Triveni × IR 36 and the highest being +150.77 per cent by IR 36 × T7. Two crosses viz., T7 × TKM9 and Triveni × TKM 9 recorded heterosis for both criteria viz., heterosis (di) and heterobeltiosis (dii). This finding is in agreement with those of Murayama (1973). Three crosses viz., IR 50 × T7, IR36 × T7 and CO 44 × T7 expressed heterosis for the three parameters (di, dii and diii) studied. The maximum mean yield of grain (40.500 g) was recorded by IR 36 × T7.

F_2 generation:

II Qualitative characters (Table 2):

One hybrid in each cross combination namely Triveni × TKM9 and T7 × TKM 9 was chosen due to the presence of apiculus pigmentation. To study the pattern of segregation for anthocyanin pigmentation in F_2 generation, entire seeds of the hybrids were sown in the nursery beds and seedlings were transplanted separately. A total of 842 and 1147 plants in Triveni × TKM 9 and T7 × TKM9 were studied respectively (Table2). Segregation in F_2 population for qualitative characters like anthocyanin pigmentation affecting plant parts and expression gave definite ratio. It is revealed from the study that apiculu pigmentation has been found to be complementary gene action (9:7). These findings are in conformity with the reports of Hector (1922a) and Mitra *et al.* (1928).

From the study it is revealed that heterosis was manifested in hybrids for most of the yield components. The overdominance observed provide evidence for interactions of genes for both inter and intra allelic in nature. It could be inferred from the study that the manifestation of heterosis in most of the crosses and traits studied might be due to the additive genetic effects present in different parental lines and due to the dishormony of the of genes, negative heterosis was observed in few characters studied.

It is concluded from the study that four cross combination viz, IR 50 × T7, T7 × TKM9, Triveni × TKM9 and Triveni x IR 36 expressed heterosis for the six yield attributing components studied and hence, there is ample scope for improvement if these parents are utilised in crossing programme and selection procedures. On an overall

Table 2 Segregation of apiculus pigmentation in spikelets with phenotypic frequencies and probable ratios in F_2 generation.

Cross	Characters	Frequency	Ratio	'Chi' square	probability
Triveni x TKM9	*Apiculus pigmentation*				
	Present	499	9:7	3.02	5—10
	Absent	343			
T7 x TKM 9	Present	653	9:7	1.16	20—50
	Absent	494			

consideration, it could be observed that the donor parent, T7 produced better hybrids in combination with high yielding varieties like IR 50, IR 36 and TKM9 for most of the characters.

REFERENCES

HECTOR, G.P. 1922a. Correlation of colour characters in rice. *Mem, Dept, Agri Ind Bot' Ser* 11 : 153-183.

MALLICK, E.H., N.G. HARSON and P. BAIRAGI 1978. Heterosis in *Indica* rice. *Indian J. Agric. Sci., 48:* 384-387.

MITRA, S K., P.M. GANGOLI. and S.N. GUPTA 1928. colour inheritance in rice. *Mem. Dept. Agric Ind. Bot. Ser. 15*: 85-102.

MURAYAMA. S. 1973, Fundamental studies on the Utilisation of heterosis in rice. I degree of heterosis and its manifestation phenomenon *Jap. J. Breed; 23*: 22-26.

PARAMASIVAN, K S. 1975. Heterosis in Tal and Dwarf *Indica* Rice Varieties *Madras Agric J ,62*: 456-457.

SINGH,S.P. and H.3. SINGH. 1978. Heterosis in rice. *Oryza 15*: 173-175

SRIVASTSAVA, M N. and D. V. SESHU. 1982. Heterosis in rice involving parents with resistance to various stresses *Oryza 19*: 172-177.

SINGH, R.P. and R.R SINGH. 1979. Heterosis in rice *Oryza 16*: 119-122,

SINGH, S. P., R. R. SINGH and R. V. SINGH, 1980. Heterosis in rice, *Oryza 17:* 109-113.