It is significant to note that coleoptiles of tall cvs. (resistant to *A. oryzae*) contain greater amount of momilactone A (12.91-21.36 μg g fresh wt.) while the semi-dwarf cvs. contain relatively lower amount (5.58-8.13 μg g fresh wt). Difference in momilactone A content of leaf sheaths of tall cv. Mahsuri (19.36 μg g fresh wt.) and semi-dwarf cv. Jaya (8.64 μg/g fresh wt.) was also significant. Antifungal nature of the said compound was confirmed by TLC[2], petridish[4] and slide[5] bioassay tests. However, it is not judicious to generalize that all tall cvs. are resistant and all semi-dwarfs are susceptible to sheath rot disease. But there is an indication that resistant cvs. contain relatively higher amount of momilactone A than susceptible ones irrespective of coleoptiles or leaf sheaths. Momilactone A has only been estimated in this study. Since the concentration of momilactone B is comparatively much lower than momilactone A it has not been possible to detect it in all cases and hence it is not included.

Response of *A. oryzae* to different doses of momilactone A was also studied *in vitro*. Momilactone A isolated by TLC from 12.5 g (fresh wt.) of dark grown coleoptiles of rice (cv. Rupsail) was dissolved in 1 ml. of purified ethanol, this concentration was designated as 'x' About 50% reduction in germtube growth of *A. oryzae* was observed when fresh spores were suspended in diluted solution (x/8). At 'x' concentration there was no germination of spores.

The authors are thankful to the C.S.I.R. for providing financial assistance. Thanks are also due to Dr. P. Langcake, Shell Biosciences Laboratory, Sittingbourne, U.K. for his helpful suggestions.

29 May 1982, Revised 13 September 1982

1. Amin K. S., Sharma, B. D. and Das C. R., *Plant Disease Reporter*, 1974, **58**, 358.
2. Cartwright D. W., Langcake, P., Pryce R. J., Leworthy D. P. and Ride J. P., *Nature (London)* 1977, **267**, 511.
3. Purkayastha R. P. and Mukhopadhyay R., *Z. Pflkrankh Pflschutz*, 1976, **83**, 221.
4. Keen N. T., Sim J. J., Erwin D. C., Rice E. and Partridge J., *Phytopathology*, 1971, **61**, 1084.
5. Cartwright D. W., Langcake P. and Ride J. P. *Physiol. Plant Pathol.*, 1980, **17**, 259.

INHERITANCE AND LINKAGE RELATIONSHIPS OF THREE QUALITATIVE CHARACTERS IN SORGHUM

B. Y. KULLAISWAMY AND J. V. GOUD
Department of Agricultural Botany, College of Agriculture, Dharwad-580 005, India.

THE available literature on sorghum linkages was summarised by Ghawghawe *et al*[1]. This paved the way to a comprehensive understanding of the linkage groups in sorghum. There were very few reports on sorghum linkages during the period from 1966-1978. The present investigation in an attempt to fill in the said gap.

A cross was made between two genotypes-SB1066 and IS873. The F_2 consisted of 1130 plants. F_2 ratios were confirmed by the F_3 breeding behaviour. The recombination values were computed according to Kolhe[3].

The phenotypes of the parents, F_1 and F_2 ratios are presented in table 1.

A. *Inheritance studies.*

1) *Internode covering*: Sreeramulu[4] was the first to probe into the inheritance of this contrasting character normal vs telescopic leaf sheath. He obtained a monogenic F_2 ratio of 3 telescopic: 1 normal in his studies. However we [5,6] obtained a trihybrid ratio of 54 normal: 10 telescopic in our previous studies. We designated the factors concerned as Lt_1, Lt_2, Lt_3. All these factors are duplicate but complimentary in action. Our results from the present study are in concurrence with our previous reports[5,6]. However, two duplicate genes were found responsible in governing the inheritance of this contrasting pair of character in the studies of Jayaramaiah and Goud[2]. This clearly indicates that the factors concerned in the present study and those reported by Jayaramaiah and Goud[2] appear to be different.

2) *Dry glume colour*: A ratio of 111 coloured: 145 colourless was fitted in for this character. A basic gene Cg and three inhibitory complimentary genes I-Cga, I-Cgb and I-Cgc were contemplated to govern the inheritance of this character. The three inhibitory genes compliment together and prevent the appearance of the colour. The inheritance of this character *viz.*, colourless *vs* coloured dry glume is being reported for the first time.

3) *Panicle drooping*: The inheritance of this character drooping *vs* erect is reported for the first time. The F_2 populations segregated in a ratio of 54 (drooping): 10 (erect). The gene action involved here is the same as that explained for internode covering. New gene symbols Pdr_1, Pdr_2 and Pdr_3 were

TABLE- 1

Morphology parents, F_1 and F_2 ratios.

Character	Parents SB1006	Parents IS873	F_1		F_2 Segregation		X^2	Probability with F_2 ratio	
Internode Covering	Telescopic	Normal	Normal	Obs	Normal 946	Telescopic 184	0.37	0.70–0.50	(54:10)
Dry glume colour	Coloured	Colourless	Colourless	Obs	Coloured 490	Colourless 640	0		(111:145)
Panicle drooping	Erect	Drooping	Drooping	Obs	Drooping 944	Erect 186	0.59	0.50–0.30	(54:10)

TABLE 2

F_3 Breeding behaviour in the sorghum cross SB1066×IS873

Character		No. of families: Breeding true for	Segregating into 3:1	Segregating into 9:7	Segregating into 15:1	Segregating into 54:10	Breeding true for	X^2	Probability
Internode covering		Normal					Telescopic		
	O	12.0	17.0	18.0	15.0	13.0	10.0		
	E	13.3	15.9	15.9	15.9	10.7	13.3	1.9	0.9–0.8
Panicle drooping		Drooping					Erect		
	O	20.0	11.0	13.0	16.0	15.0	10.0		
	E	13.3	15.9	15.9	15.9	10.7	13.3	8.1	0.2–0.1

O, observed; E, expected on 10:12:12:12:8:10 ratio.

TABLE 3

F_3 Breeding behaviour in the sorghum crass SB1066× IS873 for dry glume colour.

	Breeding true for	No. of families Segregating into							Breeding true for	X^2	Probability
		1:3	3:1	7:9	37:27	21:43	111:145				
	Coloured								Colourless		
O	15.0	2.0	20.0	1.0	2.0	2.0	12.0	4.0	27.0		
E	12.3	2.0	24.6	4.0	4.0	2.6	8.0	5.3	22.2	8.3	0.5–0.3

O, observed; E, expected on 37:6:74:12:12:8:24:16:67 ratio.

TABLE 4

Joint segregation of characters.

Characters with ratio	Joint ratio	Assumption	Obs/ Exp	Phenotypes AB	Ab	AB	ab	X^2	Probability
Internode covering (54:10) with dry glume colour (111:145)	5994:7830: 1110:1450		Obs	396	550	94	90		
		Independence	Exp	413.4	540.0	76.6	100.0	5.9	0.2–0.1
		*Linkage[1]	Exp	339.9	553.5	90.1	86.5	0.4	>0.9
Internode covering (54:10) with panicle drooping (54:10)	2916:540: 540:100		Obs	814	132	130	54		
		Independence	Exp	804.5	149.0	149.0	27.5	29.7	<0.01
		Linkage[2]	Exp	826.8	126.7	126.7	49.8	1.3	0.9–0.7
Dry glume colour (111:145) with panicle drooping (54:10)	5994:1110: 7830:1450		Obs	400	90	544	96		
		Independence	Exp	413.4	76.6	540.0	100.0	3.0	0.5–0.3
		*Linkage[3]	Exp	404.3	85.7	549.2	90.8	0.6	0.9–0.7

1. Lt_1 linked with Cg with crossover % 17.32
2. Lt_1 linked with Pdr_1 with crossover % 10.00
3. Cg linked with Pdr_1 with cross over% 31.62

*Data fits in for linkage as well as independence.

tentatively assigned for the three complimentary duplicate factors that controlled the inheritance of this character pair. The F_3 breeding behaviour of the three characters can be had from Table-2 and 3.

B. ***Linkage.***

Table 4 indicates the joint segregation pattern. The factors Lt_1, Pdr_1 and Cg, controlling internode covering, panicle drooping and dry glume colour respectively were found to be linked. The linear order and the cross over values between the linked factors were as follows:

Cg Lt₁ Pdr₁

← 17.32 → ← 10 →
← 31.62 →

We have placed Lt_1 (Kullaiswamy and Goud[4]) in the second linkage group. Hence the other linked factors Cg and Pdr_1 also belong to the second linkage group.

9 July 1982, Revised 16 November 1982

1. Ghawghawe, B. G., Bhale, N. L. and Shekar, V. B., *Indian J. Genet*, 1966, **205.**
2. Jayaramaiah, H. and Goud, J. V., *Indian J. Genet.*, 1982 (in press).
3. Kolhe, A. K., *Indian J. Genet.*, 1972, **32**; 35.
4. Sreeamulu, C., *Curr. Sci.*, 1958, **27**, 59.
5. Kullaiswamy, B. Y. and Goud, J. V., *Crop Sci.*, 1979, **19**, 775.
6. Kullaiswamy B. Y. and Goud, J. V., *SABRAO.*, 1982 (in press).

SENESCENCE BEHAVIOUR/GAMMA-IRRADIATED DETACHED BETEL (*PIPER BETLE* L.) LEAF

S. D. Mishra and B. K. Gaur
Biology & Agriculture Division, Bhabha Atomic Research Centre, Bombay 400 085, India.

Deferral of senescence in betel leaf by mechanical manipulations like depetiolation was earlier reported[1]. Such an effect of depetiolation-induced delay in senescence was later confirmed[2,3]. Also, ionizing radiations, as a physical means, are known to affect the shelf-life of many perishable commodities[4]. The present study examines the role of gamma radiation in regulating the senescence in detached betel leaf.

Betel leaves of about the same size and age (6th from the terminal apex) were collected from the field and grouped within 6-8 hr as petiolated (P) and depetiolated (DP) lots. While P set had 20 mm long, smooth petioles intact, the DP set was devoid of them. Keeping one of P and DP leaves as unirradiated control, other sets were put in perforated 0.22 mm thick polythene bags and exposed to ^{60}Co-gamma rays (6 kR/min). All the treatments and controls were replicated thrice with 50 leaves per replicate. Method of storage and measurement of senescence of the irradiated leaves were same as reported earlier[1]. Data in table 1 for HMS_{50} (time taken by 50% leaf population to attain half midrib senescence stage) in control confirm our earlier observation of DP-induced delay in senescence[1]. Values for HMS_{50}, expressed as percent of respective controls, showed that up to 3 kR, there was about 20% delay in senescence, the effect being more in DP than in P leaves (figure 1). On the other hand, 10 kR and higher doses brought about marked hastening, the effect being again more in DP than in P leaves. Another observation worth noting was that doses higher than 10 kR induced laminar browning which was intensified with the increasing doses. Darkening of skin has also been reported in the fruits, especially in banana, exposed to higher doses of gamma radiation and attributed to the activation of polyphenol oxidase[5].

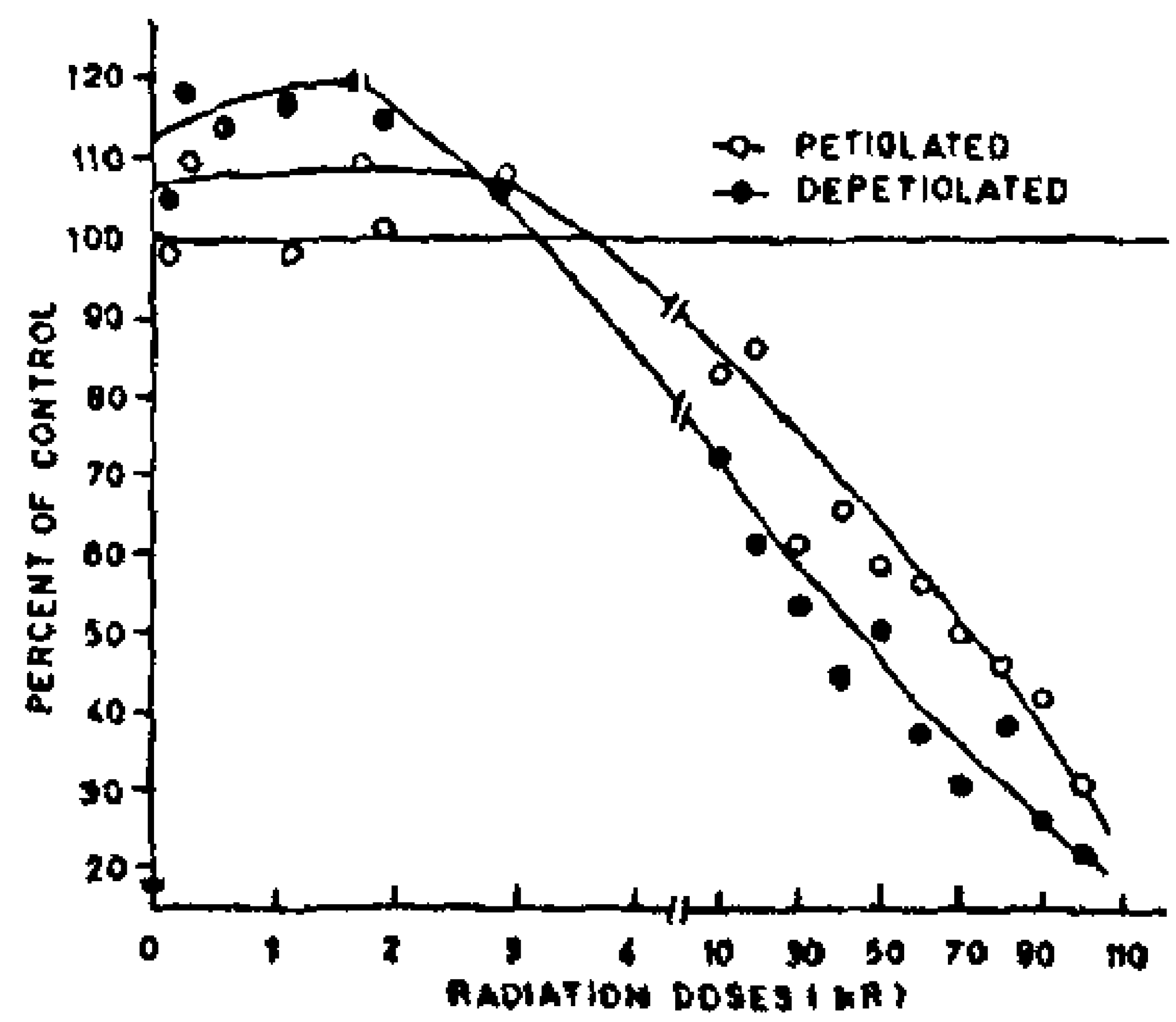

Figure 1. Dose-dependent control of senescence in betel leaf by gamma radiation; HMS_{50} values at different doses were used to obtain percentages with reference to respective unirradiated control.

Senescence delay (~20%) at lower doses and hastening at higher ones may be among other reasons, due to change in the levels of endogenous hormones[6-10]. The effect of hormone level, specially kinetin, is known to regulate chlorophyll (Chl) level[11]. Besides, radiation is known to have a controllling effect on Chl content as such[12]