GENETIC ANALYSIS OF QUALITY TRAITS IN BIDI TOBACCO (*Nicotianatabacum* L.)

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ABSTRACT

Tobacco is one of the important commercial crops in the world. It has various types such as Flue Cured Virginia, Hookah, Cigar type , Lanka type Bidi type etc . All these are categorized based on their quality and consumption purpose. Among these Bidi tobacco is more widely grown in Pakistan and in India . The quality in bidi tobacco is assessed based on the spangle score, nicotine content,chloride content reducing sugars and the ratios between reducing sugar to nicotine The genetic work on the bidi tobacco quality parameters is very much limited. In this connection this work has been carried out in Agriculture research Station Nipani at Belgaum district in Karnataka . In this investigation six lines and eight testers were used to generate the F1 hybrids in all possible cross combination with line x tester design . Thus total experimental materials consists of 62 genotypes . All these genotypes were grown in lattice design with three replication . The quality characters observed for their genetic analysis viz nicotine content, spangles scrore(sort of puckering on the leaves indicates more quality), reducing sugar and chloride content in percentage is recorded using auto analyser readings. The investigation found out Vairam, MS NPN-190, MS A-119 and Kunkumatri are best combiners MS PL-5 ×Vairam and MS GT-4 ×Thangam are hybrids performed better compared to check on yield and quality parameters , MS NPN-190 ×Kunkumatri and MS A-119 ×Kunkumatri were best lines for nicotine content.

No:of Tables :3 **No: of References :13**

INTRODUCTION

Tobacco is one of the important cash crops the status which it attained in India since 1930. It is presently cultivated in about 0.4 million hectares accounting for 0.3 per cent of total cropped area. The economic viability of tobacco in Indian scenario is well documented. It earns nearly Rs. 825 crores as foreign exchange and about Rs. 5000 crores as excise duty per annum (Deo Singh, 2003). There are 68 species of *Nicotiana*. Among them only two are cultivable species *viz.,Nicotianatabacum* L. and *Nicotianarustica*L. Cultivation of *Nicotianatabacum*is practiced throughout the world, but that of *Nicotianarustica*is restricted to India, Russia and other Asian countries. Major countries involved in the cultivation of tobacco are Brazil, United States, India, Zimbabwe, China, Malawi, Turkey, Indonesia and Argentina. Different grades will be made in the market based on quality especially on the spangles score which gives sort of puckering and in turn also on appearance of golden colour which depends on content of nicotine and chloride

MATERIALS AND METHODS

The field experiment was carried out at Agricultural Research Station, Nipani, Karnataka in randomized block design with two replications. The materials consisted of 14 cultivars and 48 F_1 hybrids, which were generated by crossing them in LXT fashion. These hybrids along with parents were grown in plots consisting of two rows following 100 x 100 cm spacing. The recommend cultivation practices were followed to raise the crop. The method of estimation for simultaneous analysis of nicotine reducing sugar and chloride in tobacco using auto analyser is as follows. After harvest of the crop and sun-cured lamina of the main shoot, leaves from five plants were collected and mixed to get a composite sample from each entry and were taken to CTRI, Rajahmundry for quality analysis. The nicotine and reducing sugar were recorded on the autoanalysing readings and conversion factor as per the peocedures of Harvey *et al.* (1969) .ie 0.01 × AAR (Auto Analyzer Readings)/weight of the sample. Spangle scoreObservations were recorded at the time of harvest and rated for spangle development as Kadam*et al*.(1951).

RESULT AND DISCUSSIONS

For spangle score 39 out of 48 hybrids showed significant heterosis over mid parent suggesting non-additive gene action. Significant positive better heterosis over better parent was observed in two out of 48 crosses, suggesting dominance gene action. Thirty-three crosses registered negative heterosis of which the cross MS A-2×Vairam, MS A-119×Vairam, MS PL-5×Vairam and MS S-20× DWFC were highly heterotic. Twenty two crosses registered positive heterosis of which MS GT-4 ×Maragadham, MS GT-4 × DWFC and MS-GT-4 ×Kunkumatri were highly heterotic over check NPN-22. So both additive and dominance genes were involved in these crosses. Similar observations made by Khe*et al.* (2001). Twenty eight out of 48 hybrids showed positive significant heterosis over mid parent suggesting non-additive gene action for nicotine content. Twenty out of

48 (52.33%) hybrids recorded better parental heterosis in desirable direction. So, these 20 crosses could be used to develop high nicotine content genotypes as higher nicotine and reducing sugar content in tobacco give desired kick and sweetness, respectively with good satisfaction to the smokers. All 48 crosses studied were recorded positive heterosis over check NPN-22. Similar conclusions were drawn by Matzinger*et al*. (1971), Almost all the hybrids except MS A-2× NPN-22 and MS GT-4× DWFC registered significant heterosis over mid parent, out of which 64.58 per cent crosses were in desired direction, while 20 hybrids were superior over better parent for reducing sugar. These deviations indicated the existence of dominance for reducing sugar. Thirty nine crosses recorded significant positive heterosis and seven crosses showed significant negative heterosis over check NPN-22. These results are in agreement with Camas *et al.* (1998).All the hybrids exhibited significant heterosis over both mid and better parent for chloride content. Twenty-three crosses (62.25%) and 12 crosses (29.16%) were in desirable direction over mid and better parental level, respectively. The highest negative heterosis over better parent was observed in cross MS A-119 ×Bhagyashree followed by MS S-20 × NPN-22. The highest negative heterosis over better parent was observed in crosses *viz.*, MS A-119 ×Maragadham and MS A-119 ×Bhagyashree. Hence, these hybrids may be useful in isolating the genotypes with less chloride content. Similar observations were made by earlier worker Lamprecht and Botha (1975) were recorded. Twenty five crosses showed significant positive heterosis over mid parent for reducing sugar to nicotine ratio. It was observed that MS NPN-190 could be used to develop genotypes with optimum reducing sugar to nicotine ratio.Twenty hybrids recorded significant positive heterosis over better parent, 13 crosses registered significant heterosis over check NPN-22 indicating the dominance gene action in controlling reducing sugar to nicotine ratio. Similar observations were made by RamanaRao (1993)

Combining ability for gca:MS GT-4 showed significant gca effects for spangle score and thus it was a good general combiner but other female parents exhibited non-significant gca effects. Maragadham was also a good general combiner in desirable direction. MS S-20 and MS A-119 showed significant gca effects for nicotine content. However, MS S-20 had the highest positive gca effects and was thus a good combiner, whereas MS A-119 had negative gca effect indicating its poor combining ability. Among male parents (testers) only Kunkumatri was a good general combiner as it showed highly significant positive gca effects.MS A-2 female parent showed significant positive gca effects for chloride. In case of male parents, F_7-127 showed significant gca effects and it can serve as a good general combiner as its gca effects were in desirable direction. MS A-2 (female line) exhibited significant gca effects but in undesirable direction. F_7-127 (male parents) and MS NPN-190 (female parent) showed positive gcaeffects in desirable direction for nicotine to reducing ratio.

Combining ability for Sca: Three hybrids exhibited positive (desirable) sca effects indicating the non-additive gene action

in the inheritance of spangle score. The top specific combiners for spangle score was MS PL-5 × NPN-22, which had good amount of spangle. The rest of the crosses possessed non-significant sca effects suggesting the absence of non-additive gene action. These results are in conformity with Jadeja*et al.* (1984). Nicotine content is an important quality character in tobacco. Usually high nicotine content is preferred in bidi tobacco. Hybrids MS NPN-190 × DWFC, MS NPN-190 ×Kunkumatri, MS S-20 ×Bhagyashree and MS S-20 ×Vairam showed significantly positive sca effects. High amount of gca and parental *per se* correlation was prevailing compared to sca and crosses. Additive gene action for nicotine was reported by Lee (1982) .Two crosses showed sca effects in desirable direction indicating the presence of non-additive gene action in these hybrid combinations for reducing sugar content. Therefore, MS GT-4 ×Kunkumatri and MS NPN-190 × F_7-127 these could be considered as the best specific combiners for reducing sugar content. The rest of the crosses showed non-significance for reducing sugar which suggested absence of non-additive gene action. These findings are in agreement with Kara and Esendal (1997).Chloride should below negative sca is desirable. Hybrids MS A-119 ×Bhagyashree and MS NPN-190 ×Vairam recorded negative and significant sca effects. Ogilvie and Kozumplik (1980) reported negative general combining ability effects for this trait. The three crosses (MS A-2 ×Maragadham, MS A-2 ×Thangam and MS NPN-190 × F_7-127) were found to have positive significant sca effects suggesting presence of additive gene action. Thus, they emerge as good specific combiners for reducing sugar to nicotine ratio. These findings were in confirmation with Ogilvie and Kozumplik (1980) who reported negative gca for this character

Correlation : The characters namely spangle score and chloride showed significant and positive correlation with nicotine content. However, significant and negative association was recorded for days to flower, internodal length, total fresh weigh, leaf yield, reducing sugar and chloride at genotypic level. These suggested that nicotine and leaf yield were negatively correlated. Similar findings were observed by Smalcelji (1998) in DH-10 and Drava cured varieties.spangle score and nicotine content showed positive and significant association with chloride. Leaf length, leaf area and disease parameters recorded negative association with chloride, which suggested that chloride content could be improved by selecting genotypes with leaf length and leaf area. Patel *et al.* (1987) observed the similar findings in 100 genotypes selected for correlation studies.

Path analysis: Nicotine is an important quality character in bidi tobacco. It showed negative correlation with leaf yield because certain traits such as leaf area, internodal length, total fresh weight, frog eye leaf spot, reducing sugar and chloride had negative indirect effect which nullify the positive direct effect of nicotine on leaf yield. These conclusion in accordance with Collins *et al.* (1975). Reducing sugar exhibited the highest positive direct effect still it failed to develop positive correlation with leaf yield because of negative indirect effects of days to flower, number of leaves

Table 1: Estimates of specific combining ability effect in respect of quality characters in bidi Tobacco (*Nicotiatabacum*L.)

Sl. No.	Hybrids	SPA	NIC	RSU	CHL	RSN	Sl. No.	Hybrids	SPA	NIC	RSU	CHL	RSN
							29	MS GT-4 × Kunkumatri	0.01	-0.39	0.83*	0.01	0.16
1.	MS A-2 × Bhagyashree	0.01	-0.27	0.47	-0.02	0.10	30	MS GT-4 × Thangam	-0.07	-0.23	-1.10*	-0.02	-0.16
2.	MS A-2 × NPN-22	0.04	0.06	-0.22	0.07	-0.04	31.	MS GT-4 × Vairam	0.01	0.03	0.27	-0.10	0.04
3.	MS A-2 × Maragadham	0.01	0.36	-0.93	0.01	0.16*	32.	MS GT-4 × F_7-127	0.07	0.01	-0.80*	0.10	-0.15*
4.	MS A-2 × DWFC	0.10	0.08	-0.25	0.00	-0.06	33.	MS NPN-190 × Bhagyashree	-0.01	-0.34	-0.97*	0.05	-0.15*
5.	MS A-2 × Kunkumatri	0.03	0.31	0.04	-0.04	0.00	34.	MS NPN-190 × NPN-22	-0.14	-0.07	-0.18	-0.08	-0.04
6.	MS A-2 × Thangam	-0.04	-0.50*	0.69	-0.01	0.18*	35.	MS NPN-190 × Maragadham	0.13	-0.23	-0.32	0.04	-0.05
7.	MS A-2 × Vairam	-0.14	-0.06	-0.32	0.04	-0.06	36.	MS NPN-190 × DWFC	0.00	0.68*	0.44	0.03	-0.01
8.	MS A-2 × F_7-127	0.01	0.02	0.52	-0.05	0.05	37.	MS NPN-190 × Kunkumatri	0.08	0.69*	-0.52	-0.02	-0.13
9.	MS A-119 × Bhagyashree	0.10	0.15	0.20	-0.15*	0.03	38.	MS NPN-190 × Thangam	0.02	0.36	0.27	0.07	-0.01
10.	MS A-119 × NPN-22	-0.03	-0.20	0.04	0.10	0.03	39.	MS NPN-190 × Vairam	0.00	-0.32	0.18	0.05	0.05
11.	MS A-119 × Maragadham	-0.04	-0.14	-0.40	-0.09	-0.08	40.	MS NPN-190 × F_7-127	-0.09	-0.78*	1.10*	-0.13*	0.33*
12.	MS A-119 × DWFC	-0.04	-0.15	-0.15	0.19*	0.00	41.	MS S-20 × Bhagyashree	0.05	0.59*	-0.61	0.00	-0.14
13.	MS A-119 × Kunkumatri	-0.10	-0.06	-0.32	0.01	-0.05	42.	MS S-20 × NPN-22	0.00	-0.06	0.03	-0.06	0.01
14.	MS A-119 × Thangam	0.05	-0.04	0.45	0.03	0.08	43.	MS S-20 × Maragadham	-0.16	-0.40	0.68	-0.05	0.15
15.	MS A-119 × Vairam	-0.04	0.31	0.05	-0.06	-0.03	44.	MS S-20 × DWFC	-0.17*	-0.55	0.20	-0.04	0.08
16.	MS A-119 × F_7-127	0.10	0.13	0.14	0.03	0.01	45.	MS S-20 × Kunkumatri	0.07	-0.33	0.39	0.08	0.10
17.	MS PL-5 × Bhagyashree	0.03	-0.07	0.50	-0.02	0.08	46.	MS S-20 × Thangam	-0.01	0.04	-0.16	-0.06	-0.03
18.	MS PL-5 × NPN-22	0.27**	-0.21	0.48	0.00	0.11	47.	MS S-20 × Vairam	0.21**	0.52*	0.22	0.13*	-0.02
19.	MS PL-5 × Maragadham	-0.05	0.02	0.35	0.15*	0.05	48	MS S-20 × F_7-127	-0.03	0.18	-0.75	0.01	-0.15
20.	MS PL-5 × DWFC	-0.11	0.017	-0.17	-0.04	-0.03		Correlation *per se*(Hybrid)	0.35	0.62	0.56	0.22	0.54
21.	MS PL-5 × Kunkumatri	-0.10	-0.22	-0.43	-0.04	-0.08		CD at 5% (hy.)	0.162	0.50	0.80	0.09	0.13
22.	MS PL-5 × Thangam	0.05	0.36	-0.15	-0.01	-0.06		CD at 1% (hy.)	0.214	1.04	1.32	0.208	0.241
23.	MS PL-5 × Vairam	-0.04	-0.48	-0.40	-0.05	0.01		S. Em. ±	0.083	0.406	0.51	0.0.80	0.093
24.	MS PL-5 × F_7-127	-0.05	0.44	-0.19	0.06	-0.09							
25.	MS GT-4 × Bhagyashree	-0.17*	-0.07	0.40	0.10	0.09							
26.	MS GT-4 × NPN-22	-0.14	0.47	-0.14	-0.02	-0.07							
27.	MS GT-4 × Maragadham	0.06	0.39	0.62	-0.02	0.08							
28.	MS GT-4 × DWFC	0.22**	-0.23	-0.08	-0.04	0.01							

Table 2: Score for sca status of crosses for quality parameters in bidi tobacco (*N. tabacum* L.)

		SPA	NIC	RSU	CHL	RSN	Total	SCA
1.	MS A-2 × Bhagyashree	0	0	0	0	0	0	L
2.	MS A-2 × NPN-22	0	0	0	0	0	0	L
3.	MS A-2 × Maragadham	0	0	0	0	-1	-1	L
4.	MS A-2 × DWFC	0	0	0	0	0	0	L
5.	MS A-2 × Kunkumatri	0	0	0	0	0	0	L
6.	MS A-2 × Thangam	0	1	0	0	-1	-2	L
7.	MS A-2 × Vairam	0	0	0	0	0	0	L
8.	MS A-2 × F_7-127	0	0	0	0	0	0	L
9.	MS A-119 × Bhagyashree	0	0	0	1	0	1	H
10.	MS A-119 × NPN-22	0	0	0	0	0	0	L
11.	MS A-119 × Maragadham	0	0	0	0	0	0	L
12.	MS A-119 × DWFC	0	0	0	-1	0	-1	L
13.	MS A-119 × Kunkumatri	0	0	0	0	0	0	L
14.	MS A-119 × Thangam	0	0	0	0	0	0	L
15.	MS A-119 × Vairam	0	0	0	0	0	0	L
16.	MS A-119 × F_7-127	0	0	0	0	0	0	L
17.	MS PL-5 × Bhagyashree	0	0	0	0	0	0	L
18.	MS PL-5 × NPN-22	1	0	0	0	0	0	L
19.	MS PL-5 × Maragadham	0	0	0	1	0	1	H
20.	MS PL-5 × DWFC	0	0	0	0	0	-1	L
21.	MS PL-5 × Kunkumatri	0	0	0	0	0	0	L
22.	MS PL-5 × Thangam	0	0	0	0	0	0	L
23.	MS PL-5 × Vairam	0	1	0	0	0	0	L
24.	MS PL-5 × F_7-127	0	0	0	0	0	1	L
25.	MS GT-4 × Bhagyashree	0	0	0	0	0	0	L
26.	MS GT-4 × NPN-22	0	0	0	0	0	0	L
27.	MS GT-4 × Maragadham	0	0	0	0	0	0	L
28.	MS GT-4 × DWFC	1	0	0	0	0	0	H
29.	MS GT-4 × Kunkumatri	0	0	1	0	0	0	H
30.	MS GT-4 × Thangam	0	0	-1	0	0	-1	L
31.	MS GT-4 × Vairam	0	0	0	0	0	0	L
32.	MS GT-4 × F_7-127	0	0	-1	0	0	-1	L
33.	MS NPN-190 × Bhagyashree	0	0	-1	0	0	-1	L
34.	MS NPN-190 × NPN-22	0	0	0	0	0	0	L
35.	MS NPN-190 × Maragadham	0	0	0	0	0	0	L
36.	MS NPN-190 × DWFC	0	1	0	0	0	1	H
37.	MS NPN-190 × Kunkumatri	0	1	0	0	0	1	H
38.	MS NPN-190 × Thangam	0	0	0	0	0	0	L
39.	MS NPN-190 × Vairam	0	0	0	0	0	0	L
40.	MS NPN-190 × F_7-127	0	-1	1	1	0	1	H
41.	MS S-20 × Bhagyashree	0	1	0	0	0	1	H
42.	MS S-20 × NPN-22	0	0	0	0	0	1	H
43.	MS S-20 × Maragadham	-1	0	0	0	0	-1	L
44.	MS S-20 × DWFC	-1	0	0	0	0	-1	L
45.	MS S-20 × Kunkumatri	0	0	0	0	0	0	L
46.	MS S-20 × Thangam	0	0	0	0	0	0	L
47.	MS S-20 × Vairam	1	1	0	-1	0	1	H
48.	MS S-20 × F_7-127	0	0	0	0	0	0	L

Table 3: Relevant genetic information in respect of potential hybrids in bidi tobacco for quality parameters

Entry	Spangle score				Nicotine content				Rducing sugar content				Chloride content				Remarks
	performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	
MS PL-5 × Vairam	2.00	-7.40	L × L	L	5.26	18.46	L × L	L	2.60	4.83	L × L	L	0.39	-11.36	L × L	L	Hybrids
MS GT-4 × Thangam	2.23	3.24	H × L	L	5.81	30.85	L × L	L	1.80	-27.41	L × L	L	0.39	-11.36	L × L	L	
PL-5	2.38	-	L	-	5.63	-	L	-	1.7	-	L	-	0.36	-	L	-	Parents
Vairam	2.38	-	L	-	5.30	-	L	-	2.43	-	L	-	0.51	-	L	-	
GT-4	2.16	-	H	-	6.73	-	L	-	3.09	-	L	-	0.36	-	L	-	
Thangam	2.45	-	L	-	6.30	-	L	-	2.43	-	L	-	0.75	-	L	-	
NPN-22	2.16	-	L	-	4.44	-	L	-	2.48	-	L	-	0.44	-	L	-	Check

length, leaf breadth, internodal length, total fresh weight, root knot nematode, nicotine and chloride. These conclusions are in agreement with Smalcelji (1998).Chloride exhibited *i.e.,* negative correlation on leaf yield, even though it had strong positive direct effect. This was mainly due to nullifying action of certain traits on leaf yield via chloride. Such characters included plant height, leaf breadth, internodal length, total fresh weight, total dry weight, spangle, frog eye leaf spot, root knot nematode and reducing sugar.

SUMMARY

High nicotine content, high reducing sugar and low chloride content are desired in bidi tobacco. In this regard, hybrids were found to be promising with some exception like in case of reducing sugar content areMS PL-5 ×Vairam and MS GT-4 ×Thangam. Since the GCA and SCA variances were non-significant for these three quality parameters, the gca and sca effects were also generally non-significant. Therefore, ignoring gca and sca status of parents and the hybrids based on the *per se* performance and standard heterosis, these two potential hybrids may be recorded as highly promising. Therefore be concluded these two hybrids deserve attention in future.

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