Utilization

Biochemical Constituents Related to Odor Generation in Some ICRISAT Pearl Millet Materials

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Development of mousy odor in the meal shortly after grain milling is an important constraint to the wider acceptability and utilization of pearl millet (*Pennisetum glaucum* (L.) R. Br.). The hydrolytic breakdown of meal lipids (Kaced et al. 1984; Kadlag et al, 1995) and enzymatic degradation of meal phenolics, C-glycosylflavones (Reddy et al. 1986), have been speculated to cause odor generation in the stored meal. Recently, Bangar (1998) has shown that phenolics and peroxidase activity (POD), mainly from the germ fraction of the seed, are responsible for odor generation in pearl millet meal. To study genetic variation and identify low POD types, 29 pearl millet genotypes from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (including several parents of mapping populations) with green, brown, or white seed colors were analyzed for crude fat, fat acidity, total phenolics (AOAC 1990), polyphenol oxidase (PPO), and peroxidase (POD) activities (Kumar and Khan 1982).

The genotypes studied showed a wide variation in these constituents (Table 1). The total lipids ranged between 3.3 to 7.6%, the fat acidity (a measure of lipolytic fat degradation) in 30-day stored meal varied from 206 to 680 mg KOH (100 g meal)$^{-1}$, and the total phenolics from 228 to 486 mg (100 g)$^{-1}$. Seed color was not related with total lipids, fat acidity, or content of total phenolics except that IP 18293—which has a purple pericarp—had the highest total phenolics content and lowest POD activity. Among the enzymes, POD activity varied markedly (54-332 units g^{-1} min^{-1}) in different genotypes. The low POD activity genotypes identified are IP 18293, Banner Pop, 863B, and,ICMP 451-.P8. Since the POD activity is related to odor generation, the genotypes with low POD activities may be advantageous to develop new cultivars with improved meal shelf life. As three of the low POD activity lines identified in this study (IP 18293, 863B, and ICMP 451-P8) have been used as parents of pearl millet mapping populations (Hash and Witcombe 1994; Devos et al. 1995), it should be possible to rapidly map quantitative and quantitative trait loci associated with this trait at relatively low cost. Further, the substantial difference detected between near-isogenic lines ICMP 85410 (E_1E_1) and ICMR 94410 (e_1e_1) (Bidinger et al. in press) suggest that some of the genetic factors controlling this trait may be linked with alleles conferring early flowering.

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Table 1. Crude fat, fat acidity, total polyphenols, peroxidase (POD), and polyphenol oxidase (PPO) activity in whole-grain meal produced from some pearl millet genotypes with varying seed colors.

Cuitivar	Seed color	Crude fat (%)	Fat acidity[1]	Total polyphenols [mg (100 g)$^{-1}$]	POD[2]	PPO[3]
Raj 171	Green	6.12	451	282	136	66.4
ICMB 89111	Green	5.04	680	324	248	52.2
PT 732B	Green	3.30	343	330	240	67.4
CZ-IC 923	Green	6.26	603	312	160	80.0
GICV 93191	Green	5.62	451	396	200	77.1
PCB-IC 148	Green	5.62	343	360	168	83.8
CZ-IC416	Green	7.36	461	258	164	88.6
843B	Light green	4.30	559	390	112	69.6
ICMR 94410	Light green	4.02	304	288	184	88.6
1CMP 85410	Light green	6.01	284	270	332	69.6
LGD-1-B-10	Light green	6.14	412	282	192	91.2
TIft 238D$_1$	Light green	3.54	372	288	112	66.4
863B	Light green	4.16	255	300	64	83.8
ICMV 91773	Light green	5.02	412	270	188	60.8
ICMB 88004	Dark green	5.02	647	246	148	52.0
AIMP 92901	Dark green	5.54	363	300	138	60.8
RCB-IC 911	Dark green	5.16	265	228	136	60.5
ICMS 7703	Brown	6.60	539	228	120	66.4
ICMB 90111	Brown	7.60	274	312	116	75.2
ICMR 356	Brown	6.54	285	396	128	94.4
ICMP 451-P8	Brown	5.04	412	366	108	90.4
IP 18292	Brown	5.78	490	390	—	—
PRLT2/89-33	Brown	6.32	461	396	216	100.8
CZ-IC 618	Brown	5.77	274	258	124	89.6
Nokha Local	Brown	5.51	421	234	120	110.4
Barmer Pop	Brown	5.60	401	228	92	100.8
Balu Local	Brown	5.91	578	246	-	—
IP 18293	Dark brown	4.32	343	486	54	66.4
ICMB 88006	Light brown	4.88	206	312	184	60.5
Ranges		3.3-7.6	206-680	228-486	54-332	60.5-110.4

1. Mg KOH (100 g meal)$^{-1}$.
2. Units g^{-1} min^{-1}.
3. Units g^{-1} h^{-1}.