Identification of Photosensitive Lines in Black Gram and their Characterization

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One hundred and sixty accessions of black gram (*Vigna mungo*) germplasm were characterized and evaluated for 22 qualitative and quantitative agro-morphological traits during *kharif* (rainy) and *rabi* (post-rainy) seasons of 2005 and 2006. Two accessions, *viz.,* IC343880 and IC426765 did not flower during the rainy season of 2005-06 and 2006-07, while they produced flowers and pods in the successive post-rainy season and, therefore, were identified as photosensitive. These two accessions were studied for their qualitative and quantitative traits in comparison with the check varieties (LBG-20, T-9 and PU-19). A comparative account of morphological traits of these identified germplasm lines with that of published literature on photosensitive released variety (LBG-17) are also provided. The uses of these potential genotypes in black gram improvement as also their alternative use as green manure and cover crop, are discussed.

Key Words: Black gram, Germplasm, Photosensitivity, *Vigna mungo*

Introduction

Black gram [*Vigna mungo* (L) Hepper] is an important short duration pulse crop grown in many parts of India, in an area of about 3.18 m ha with a total production of 1.47 million tons with an average productivity of 461 kg/ha. Andhra Pradesh leads with the highest area and production among states with an annual production of 3.5 lakh tons from 4.97 lakh has with an average productivity of 704 kg/ha (www.dacnet.nic.in/pulses/APR,06-07,pdf).

Most of the varieties released are photo-insensitive and, therefore, can be grown during any time of the year. However, one photosensitive line (LBG-17) is known to exist in black gram, which flowers under short-day conditions (NORV database, www.nbpgr.ernet.in). There is a need to identify more photosensitive lines in order to have parental diversity for varietal development, keeping the location specific requirements like combining resistance to numerous pests and diseases and other desirable traits (seed quality, plant type and photoperiod sensitivity) as reported in cowpea (Timko and Singh, 2008)

Material and Methods

One hundred and sixty accessions of black gram germplasm lines, collected during exploration from different agro-climatic zones of Andhra Pradesh, India, were grown at the NBPGR RS experimental farm (17^0 19'N, 78^0 23'E, 542 m above msl) Hyderabad, India, during rainy 2005, 2006 and post-rainy seasons 2005-06, 2006-07 respectively. The crop was raised in Augmented Block Design (ABD) with three checks *viz.* T-9, LBG-20 and PU-19. The crop was raised following standard package of practices (Anonymous, 1991). The qualitative and quantitative traits as per minimal descriptors (Srivastava *et al*., 2001) were recorded. Freely downloadable Web Agri Stat Package (WASP2) developed by ICAR Research Complex Goa, was used for statistical analysis (htpp://icargoa.res.in/wasp2.0/index.php).

Result and Discussion

Wide range of variation was observed for days to 50% flowering during rainy (34 to 52 days) and post-rainy (46 to 60 days) seasons. Interestingly, two accessions, IC343880 (SKN-71) and IC426765 (BAR-62), did not flower at all during the rainy seasons of both the years. However, these two accessions exhibited 50% flowering by 46 and 49 days, respectively, during the post-rainy season and produced pods, indicating their photosensitive nature. The passport data of these accessions show that, accession IC343880 was collected from Pathapatnam (18º45' N & 84º05'E), in Srikakulam district of Andhra Pradesh during December 2001 (post-rainy crop) from farmer's field and IC426765 was collected from Mandasa

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(18º51' N & 84º05'E) in Srikakulam district in April 2003 (post-rainy crop).

The performance of these photosensitive lines was analyzed in comparison to released check varieties in the post-rainy 2005-06 and 2006-07 (Table 1). ANOVA revealed that there was significant difference ($p<0.05$) among these photosensitive lines and released checks with respect to days to 50% flowering, 100-seed weight and pod length. In post rainy 2005-06, accession IC343880, performed better than checks T-9 and LBG-20 at CD 0.05 with respect to peduncle length. However, in post-rainy 2006-07, significant variation ($p<0.05$) with respect to days to 50% flowering, plant height, pods per cluster, seeds per pod and 100-seed weight were recorded. Accession IC426765 performed better than LBG-20 with respect to plant height and 100-seed weight (CD 0.05) and IC343880 was superior to PU-19 with respect to seeds per pod. The superior performance of these accessions in some of the quantitative traits *viz.,* seeds per pod and 100-seed weight over released checks indicate their potential in the breeding programmes for black gram crop improvement.

The qualitative traits of these photosensitive lines and the local checks including a photosensitive variety, LBG-17 are presented in Table 2. Both the germplasm accessions (IC343880 and IC426765) had indeterminate growth habit and dense pod pubescence. These qualitative characters indicate that they are primitive landraces. The comparative study further supports the fact that these photosensitive accessions are distinctly different from the local check varieties with respect to primary leaf shape, pod pubescence and leaf pubescence (see Table 2). These two accessions, IC343880 (SKN-71) and IC426765 (BAR-62), are new reports of photosensitive black gram germplasm lines. The dominance of photoperiod insensitivity over photoperiod sensitivity has already been reported (Verma, 1971) It is well documented that, the photosensitive trait in any plant is a primitive character as loss of photoperiodic response is considered to be a sign of domestication (Paroda *et al.*, 1988). Further, the alternate use of these accessions as a forage, cover crop and green manure crop can also be exploited during the rainy season by carrying out detailed studies on the biomass yield and nitrogen fixation in the field in view of the prolonged nodulation in the absence of reproductive phase. Disintegration of the nodules has been correlated with the onset of pod formation stage (Singh, 1974). Therefore, these lines can be utilized in the pulses breeding programmes for developing multipurpose varieties of blackgram suitable for different agro-climatic zones of Andhra Pradesh. As these photosensitive lines are adapted to a particular climatic condition, they perform the best under that condition and this quality should be effectively exploited by assessing these lines in alternative cropping systems.

Table 1. Performance of the photosensitive black gram germplasm lines as compared to released varieties

Blackgram/Traits		Year	1	2	3	4	5	6	7	8	9	10
Photosensitive lines	IC-343880	2005	46.0	26.500	3.800	14.400	3.6	6.000	6.132	4.120	11.400	35.400
		2006	49.0	14.400	3.800	9.200	2.800	5.400	2.900	4.120	5.620	18.200
	IC-426765	2005	49.0	29.580	3.200	9.400	4.800	5.930	6.062	3.680	7.760	23.800
		2006	49.0	11.440	2.400	5.600	2.400	3.600	3.560	3.820	3.840	11.000
Released varieties	T-9	2005	46.2	27.088	2.200	7.452	3.664	5.926	5.746	4.168	8.188	14.464
		2006	48.4	18.292	2.862	7.328	3.262	4.528	3.896	4.410	3.620	11.860
	PU-19	2005	46.0	26.676	2.864	8.464	4.528	5.812	5.640	4.232	10.116	20.732
		2006	47.2	17.206	2.930	7.194	2.528	4.262	3.336	4.308	3.992	13.128
	LBG-20	2005	46.8	32.504	3.260	12.664	4.600	6.088	5.994	4.672	8.012	29.864
		2006	46.2	19.792	3.660	7.930	3.530	4.460	2.832	4.082	4.756	10.730
CD (0.05)		2005	0.512	NS	NS	NS	NS	NS	NS	0.361	2.653	NS
		2006	1.500	4.718	NS	NS	0.800	1.105	0.627	NS	1.141	NS

Legend: *1. Days to 50% flowering; 2. Plant height (cm); 3. Primary branches per plant (no.); 4. Clusters per plant (no.); 5. Pods per cluster (no.); 6. Seeds per pod (no.); 7. 100-seed weight (g); 8. Pod length (cm); 9. Peduncle length (cm); 10. Pods per plant (no.).*

Table 2. Comparison of photosensitive blackgram germplasm with released varieties

Trait	Photosensitive lines		Released varieties (local checks)			Released variety (photosensitive)
	IC343880	IC426765	T-9	PU-19	LBG-20	Krishnayya (LBG-17)
Plant habit	Indeterminate	Indeterminate	Determinate	Determinate	Determinate	Determinate
Primary leaf shape	Lanceolate	Ovate lanceolate	Deltoid	Lanceolate	Ovate	Ovate
Pod pubescence	Dense	Dense	Puberulant	Moderate	Puberulant	Moderate
Leaf pubescence	Moderate	Dense	Sparse	Sparse	Dense	Moderate
Leaf colour	Dark green	Dark green	Dark green	Green	Green	Light green
Primary leaf shape	Deltoid	Cuneate	Ovate lanceolate	Ovate	Ovate	Ovate
Seed colour	Black	Black	Dull black	Black brown	Shiny Black	Greyish shiny black

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