Environment & Ecology 27 (1A) : 367—370, 2009
 ISSN 0970-0420

Biochemical and Nutritional Parameters in Characterization of Green Gram Germplasm *Vigna radiata* (L.) Wilczek

H. K. SARKAR, MOLOY ROY, S.P. SINHAMAHAPATRA[1]
KRISHNENDU CHATTOPADHYAY AND SOMNATH BHATTACHARYYA

Department of Genetics, Bidhan Chandra Krishi Viswavidyalaya
[1]Department of Plant Breeding, Bidhan Chandra Krishi Viswavidyalaya
Mohanpur 741252, India
E-mail : hemensarkar@rediffmail.com

Abstract

A group of 34 genotypes of green gram *Vignata radiata* (L.) Wilczek were used in the present study to assess the biochemical diversity in respect of nutritional and antinutritional parameters. T-44 was identified as the highest protein containing genotype (24.58%) while B-27 had the highest seed yield/plant (5.7 g) associated with highest protein content/plant (1.29 g). The genotype, Set-4 was having lowest seed protein (16.1%) but highest albumin fraction (19.32%) that confirms the presence of more sulfur containing amino acids. T-44, being the highest seed protein containing genotype exhibited lower globulin fraction than Sonamung. It is suggested that the higher seed protein content need not indicate higher globulin and albumin fraction. No correlation existed between total protein content and anti-nutritional factor, like trypsin inhibitor. The genotypes, BI and T-44, were having higher protein but with remarkably low amount of trypsin inhibitor.

Key words : Antinutritional factor, Trypsin inhibitor, Seed protein, Sulfur containing amino acid, Characterization.

Protein content in mungbean, like other pulses, is important on nutritional point of view. One of the main constraints in improvement of this crop is unavailability of high yielding protein rich genotypes. Priority should be given on screening of germplasm for high seed protein content along with high seed yield. The genotypic variation of protein content in mungbean has been reported earlier. significant association with early flowering, pod length, pod number, seed number and yield /plant was found in respect of seed protein content (1). Ali (2) and Chattopadhyay (3). have studied the nutritional aspects of black gram and green gram respectively. From the quality point of view, another constraint of this crop is its low amount of sulfur containing amino acids. Amounts of different seed protein fractions give us an over all idea about the presence of various types of amino acids. Isoleucine, leucine, phenylalanine, tyrosine and valine were present in high amounts in the globulin protein, whereas lysine, methionine, threonine and tryptophan were abundant in the albumin protein. The major storage globulin in mungbean is vicilin (4).Vicilin is rich in acidic amino acid and deficient in sulfur containing amino acids. Legumin, another storage globulin, is present only in small amounts (5). High protein rich genotypes may be associated with some anti-nutritional factors like trypsin inhibitor. Trypsin is a proteolytic enzyme of the pancreatic juice capable of converting proteins into peptone. When trypsin is inhibited, proteins are not digested adequately. So while screening for protein rich germplasm, the level of trypsin inhibitor should be adequately taken into consideration. The content of trypsin inhibitor in mungbean was found to be low as compared to other pulses (6). But a wide range of variation was found for trypsin inhibitor content. Numerous lines were selected with high protein content and low trypsin inhibitor level by Fillipeetti and Azadegan (7). Thirty four genotypes of green gram comprised the experimental materials of the present study for estimating biochemical diversity under two seasons. The present investigation also aimed at screening and identifying desirable genotypes with higher yield, protein content and sulfur containing

Table 1. Performance of 34 germplasms of mungbean in respect of protein content, seed yield/plant and protein yield/plant in summer and *kharif* seasons.

Genotypes	Protein content (%)		Per plant seed yield (g)		Per plant protein yield (g)	
	Summer	*kharif*	Summer	*kharif*	Summer	*kharif*
Tripurasonamung	20.20	20.23	2.54	2.20	0.514	0.445
PS-16	22.10	22.13	4.20	3.89	0.928	0.861
Radiata-5	23.13	23.20	3.40	3.20	0.786	0.742
Malda-95-13	21.50	21.40	3.17	3.67	0.798	0.785
SML-264	21.93	22.10	3.92	2.27	0.860	0.502
SML-32	22.30	22.30	2.80	2.63	0.622	0.586
MM-6	18.97	18.93	2.97	2.35	0.634	0.445
74-6/2	21.93	21.23	4.20	3.38	0.892	0.717
BL × 444-2D-1	21.93	21.77	2.78	2.27	0.610	0.494
T-44	24.43	24.73	3.72	3.29	0.909	0.814
Sonamung	22.17	22.30	3.79	3.05	0.840	0.680
B-1	23.47	23.63	3.86	3.47	0.906	0.820
Midnapurlocal	19.23	19.63	3.17	2.96	0.609	0.581
SML-286	21.77	21.93	3.31	2.73	0.720	0.599
Dantanchaitali	18.13	18.70	2.34	1.95	0.424	0.365
B-27	22.77	23.00	5.70	4.63	1.298	0.065
HUM-6	20.53	20.63	4.77	3.93	0.979	0.811
PDM-19-257	18.60	18.67	2.66	2.21	0.494	0.413
Local	19.50	19.80	2.91	2.48	0.567	0.491
SML-175	20.30	20.77	2.19	1.16	0.445	0.334
MM-25-Selection	22.27	22.30	2.51	2.03	0.566	0.453
Mash × Mung	20.47	20.80	3.18	2.75	0.650	0.572
Kgp × BR-3	22.77	22.77	3.54	2.75	0.806	0.626
83-M-Selection	20.77	20.73	2.80	1.77	0.581	0.325
LM-23	21.60	21.67	2.08	1.62	0.449	0.351
NP-28	22.40	22.50	3.05	2.77	0.683	0.623
444-2D1	19.50	19.40	2.02	1.90	0.394	0.369
BM-18	20.27	20.30	2.75	2.20	0.557	0.447
Kopargaon	19.33	19.17	2.58	2.07	0.498	0.397
Datansonamung	19.83	19.87	2.43	2.37	0.482	0.171
Set-4	16.10	16.10	1.65	1.40	0.266	0.225
Sub-14	17.00	16.83	2.57	1.53	0.437	0.257
Orissa-2	17.60	17.60	2.60	2.13	0.457	0.375
Sub-2	17.07	16.90	3.34	2.23	0.568	0.378

amino acids but low amount of trypsin inhibitor.

Methods

Sonamung, PS-16, Radiata-5, Malda-95-13, SML-264, SML-32, MM-6, 74-6/2, BL × 444-2Dl, T-44, Sonamung, B-1, Midnapur local, SML-286, Dantanchaitali, B-27, HUM-6, PDM-19-257, Local, SML-175, MM-25, Selection, Mush × Mung, Kgp × BR3, 83-M-Selection, LM-23, NP-28, 444-2D1, BM-18, Kopargaon, Datansonamung, Set-4, Sub-14, Orissa-2 and Sub-2 constituted the experimental materials for the present study.

These 34 genotypes were sown in *kharif* and summer seasons following randomized block design in three replications in the university farm, situated at Kalyani, Nadia (West Bengal, India).

The three nutritive characters were studied for the characterization of the mungbean germplasm. Total seed protein content was estimated following the procedure suggested by Lowry et al. (8). For fractionation of seed protein the procedure suggested by Shewry and Band Kasarda (9) was followed. Analysis of trypsin inhibitor was done following the method of Kakade et al. (10).

Results and Discussion

Percent Protein Content

No seasonal variation was observed regarding

Table 2. Seed protein fractions (%) of six selected genotypes of mungbean.

	Protein fractions			
Genotypes	Globulin	Albumin	Glutelin	Prolamine
B-27	65.26	18.37	16.05	0.315
T-44	69.48	17.29	12.89	0.382
B-1	66.45	16.51	16.61	0.429
SML-175	66.92	17.21	15.51	0.357
Sonamung	71.39	16.53	12.07	0.308
Set-4	64.81	19.32	15.48	0.392

total protein content. The total protein content ranged from 16.1—24.43% during summer season and 16.1—24.57% during *kharif* season, with the mean value of 20.62 and 20.70 %, respectively. The genotypes having high protein percentage were PS-16, Radiata-5, SML-264, SML-32, T-44, Sonamung, B-1, B-27, MM-25-Selection, Kgp × BR-3 and NP-28. Some low protein containing genotypes were MM-6, PDM-19-257, 444-2D1, Kapargaon, Set-4, Sub-14, Orissa-2 and Sub-2.

Per Plant Protein Harvest

Per plant protein harvest was most desirable quality for the improvement of pulse crops. This was calculated by multiplying the value of plant yield with protein content (%). B-27 was identified as highest yielding genotype whereas T-44 was identified as highest protein containing variety among the germplasm in both the seasons. It was observed that B-27, the highest yielding genotype, produced highest protein per plant in both the seasons. Performance of 34 germplasms with regard to protein content, per plant seed yield and per plant protein yield in summer and *kharif* season are presented in the Table 1. It was found that protein content per plant was comparatively better for all the genotypes in summer season than in the *kharif* season.

Fractionation of Seed Protein

Four protein fractions, namely globulin, albumin, glutelin and prolamine were estimated and the data are presented in Table 2. Globulin fraction was recorded to be the highest and prolamine was the lowest whereas albumin ranked next to globulion. This by and large confirmed earlier observations made by Bera and Bera (11) and Roy et al. (12) in green gram and black gram. It was estimated that globulin, albumin, glutelin and prolamine contents of the total protein ranged from 64.81 to 71.39%, 16.51 to 19.32%, 12.07 to 16.16% and 0.308 to 0.429%, respectively. The genotype, Sonamung contained highest globulin (71%) whereas the wild genotype Set-4 contained highest albumin fraction. Most significant result was that of Set-4 having lowest seed protein content recorded highest albumin fraction. Similarly T-44 having the highest seed protein content recorded lower globulin fraction than Sonamung. This would therefore, suggest that higher seed protein content need not guarantee higher globulin and albumin fractions. Set-4 and B-27 with high albumin fractions could be a potential source of sulfur containing amino acids.

Estimation of Trypsin Inhibitor

Trypsin inhibitor content in some selected genotypes are presented in Table 3. The genotypes contained trypsin inhibitor with an average of 1372 TIU/g dry matter. Rosario et al. the genotypes contained trypsin inhibitor with an average of 1372 TIU/g dry matter. Rosario et al. (6) reported an average trypsin inhibitor activity of 1500 TIU/g for 17 cultivars. B 1 recorded the lowest amount of trypsin inhibitor activity and the genotype SML-175 exhibited the highest. Significantly B-1 being the second highest in respect of total protein content among the six selected genotypes recorded the lowest amount of trypsin inhibitor activity whereas SML-175 having lowest pro-

Table 3. Trypsin inhibitor content (TIU/g) of six selected genotypes of mungbean.

	Genotypes					
	B-27	T-44	B-1	SML-175	Sonamung	Set-4
Trypsin inhibitor (TIU/g)	1410	1381	1295	1460	1352	1335
Protein content (%)	22.80	24.58	23.55	20.53	22.23	16.10

tein content recorded highest trypsin inhibitor activity. No correlation could be drawn between total protein content and trypsin inhibitor activity. This corroborated the studies of Fillipeetti and Azadegan (7). High protein and low trypsin inhibitor activity should be one of the criteria for identification of the desirable genotypes with good qualities.

In the present study, genotypes B-1 and T-44 having high protein and remarkably low amount of trypsin inhibitor may therefore, be regarded as ideal green gram genotypes which can be used directly as nutritionally superior green gram and also be used for breeding better quality mungbean varieties from nutritional point of view.

References

1. Naik B. S., S. K. Pattanayak and C. Kole. 2000. Selection of protein rich genotypes in mung bean. Indian J. Gen. and Pl. Breed. 60 : 321—326.
2. Ali Md. Nasim. 2006. Study of genetic variability in black gram [*Vigna mungo* (L.) Hepper] through morphological, biochemical and molecular characterization. Doctoral thesis, BCKV, Mohanpur, India.
3. Chattopadhyay K. 2006. Study of genetic variability of some germplasm of mungbean [*Vigna radiata* (L.) Wilczek] through morphological, biochemical and molecular parameters. Doctoral thesis, BCKV, Mohanpur, India.
4. Norton G., F. A. Bliss and R. Bressani. 1985. Biochemical and nutritional attributes of grain legumes. Pages 73—114 *in* R. J. Summerfield and E. H. Roberts, editors. Grain Legume Crops, Collins, London, UK.
5. Ericson M. C. and M. J. Chrispeels. 1973. Isolation and characterization of glucasamine-containing storage glycoproteins from the cotyledons of *Phaseolus aurens.* Pl. Physiol. 52 : 98—104.
6. Rosario R. R. D., Y. Lozano and M. G. Noel. 1980. The chemical and biochemical composition of legume seeds I. Mungbean. Philippine Agriculturist 63 : 267—274.
7. Fillipeetti A. and G. H. Azadegan. 1994. Protein content and trypsin inhibitor in raw fababean seeds. FABIS Newsl. 34—35 : 48—51.
8. Lowry O. H., N. J. Rosenbought, A. L. Ferr and R. J. Randall. 1951. Protein measurement with the folin phenol reagent. J. Biol. Chem. 193 : 265—275.
9. Shewry P. R. and D. D. Band Kasarda. 1984. The structural and evolutionary relationship of the prolamine storage proteins of barley, rye and wheat. Phil. Trans. R. Soc. Lon (Biol.) 304 : 297—308.
10. Kakade M. L., J. J. Rackis., J. E. Mc Ghee and G. Puski. 1974. Determination of trypsin inhibitor activity of soy products : A collaborative analysis of an improved procedure. Cereal Chem. 51 : 376—382.
11. Bera A. K. and A. Bera. 1990. Patterns of total and fractional protein content in developing seeds on mungbean and urdbean. Leg. Res. 13 : 69—72.
12. Roy M., N. Mandal and P. K. Das. 2003. Some nutritional attributes of black gram and grasspea genotypes. Leg. Res. 26 : 48—50.