

Screening for a Low Molecular Weight Protein in Mungbeans

K. Kalaiselvi¹, A. Manickam² and R. Rathinasamy³

Tamil Nadu Agricultural University,
Coimbatore - 641 003, India.

ABSTRACT. *Thirty five green gram accessions were screened to investigate the grain and axis characteristics to further characterize a low molecular weight (12 kD) water soluble protein found to occur in mungbean embryonic axis. Embryonic axes were dissected out of the cotyledons, and protein was extracted and estimated by the method of Bradford (1976). SDS-PAGE was run to examine the occurrence of the protein. All the accessions analyzed contained the protein. The percentage of axis to grain ratio of the accessions ranged from 2.1 to 6.45 by weight. The protein content varied from 110 to 450 µg/mg axis. Among the analyzed accessions, the highest protein content of 450 µg/mg axis was recorded by the accession CO 3 of which the percentage axis to grain ratio was 3.52. Based on these data and the ease with which the embryonic axis could be manually dissected, the variety CO 3 was identified to be suitable to further study the low molecular weight axis protein of mungbean.*

INTRODUCTION

Legume storage proteins, apart from being a source of nitrogen for the germinating seedling, form an important source of dietary protein for humans. Globulins and albumins form the major storage proteins of legumes. Globulins have been studied in great detail for their storage property. Albumins form the second major storage proteins in legumes. A group of low molecular weight water soluble albumins are found to occur in diverse plant species, including castor bean, cotton seed, brazil nut, sunflower, grain,

¹ SRF, CPMB, Tamil Nadu Agricultural University, Coimbatore - 641 003.

² CPMB, Tamil Nadu Agricultural University, Coimbatore - 641 003.

³ Department of Pulses, School of Genetics, Tamil Nadu Agricultural University, Coimbatore - 641 003.

amaranth, pea, arabidopsis and rapeseed. Manickam and Carlier (1980) reported the occurrence of a low molecular weight water-soluble protein rich in basic amino acids in mungbean embryonic axis. To further study this protein it became necessary that the characteristics of the grain and axis be studied in detail. Hence, the present work was undertaken to investigate the grain and axis characteristics, including total protein content.

MATERIALS AND METHODS

Thirty-five mung bean accessions were obtained from the Department of Pulses, School of Genetics, Tamil Nadu Agricultural University, Coimbatore. The embryonic axis from each grain was dissected out manually and weighed. The individual grain weight was also recorded. Total water soluble protein from the axis was extracted in sterile distilled water in the presence of 0.05% phenyl methyl sulphonyl fluoride, centrifuged and supernatant was stored. Protein content was estimated according to the method of Bradford (1976). The extract was also subjected to SDS-PAGE electrophoresis (Laemmli, 1970).

RESULTS AND DISCUSSION

The values of axis to grain ratio and the protein content of the mungbean accessions are given in Table 1. Analysis of variance for protein content and percentage of axis to grain ratio showed significant differences among different accessions. The percentage of axis to grain ratio varied from a minimum of 2.18 to a maximum of 6.45. The axis to grain ratio of the genotype PLS 308 recorded the highest value of 6.45, significantly differing from that of the other accessions. The axis to grain ratio is useful to identify the genotype that has bold axis. Moreover, the grain weight is directly related to yield of the plant (Parida and Singh, 1984). Some accessions had bold grains, but a very small axis. On the other hand, in some cases, although the grains were small the axis was of a remarkable size leading to increased axis to grain ratio. The accessions that recorded the highest percentage value of axis to grain ratio were chosen for further study, which in turn reflected on the recovery of axis.

Apart from axis to grain ratio, the water-soluble protein contents of the axes were determined to identify the genotypes having high protein

Table 1. Protein, axis/grain, ratio in different accessions of mungbean.

Accessions	Protein $\mu\text{g}/\text{mg}$ axis	% axis/ grain
CO 2	360	2.58
CO 3	450	3.52
CO 4	400	2.78
CO 5	300	2.70
CO GB 2	288	3.12
CRS 55	346	2.18
K 851	293	2.59
LM 14	300	2.78
LM 66	398	4.20
MH 85	301	2.61
PS 16	326	2.43
PY 1	359	2.61
VGG 4	388	3.63
V5200	395	2.62
89047	298	2.43
PLS 168	230	5.83
PLS 261	195	5.89
PLS 262	133	4.11
OLS 264	180	3.64
PLS 266	179	4.68
PLS 267	181	4.40
PLS 272	198	3.30
PLS 274	200	5.30
PLS 225	220	4.07
PLS 301	212	4.44
PLS 302	203	5.15
PLS 303	201	3.93
PLS 308	200	6.45
PLS 313	200	5.60
PLS 316	110	4.80
PLS 317	125	4.46
PLS 318	202	6.00
PLS 326	176	3.02
PLS 334	333	4.71
PLS 239	386	6.01
CV%	1.30	0.5
SED	1.98	0.01
Critical Difference at 1% level	5.59	0.03

content. The results on total water-soluble protein of the axis indicated that the total protein content varied through a wide range from 110 μg protein/mg axis up to 450 μg /mg axis. In most of the PLS accessions which had higher percentage axis to grain ratio, the axis protein content was found to be very low (Table 1). The maximum protein content of 450 μg /mg axis ($P < 0.01$) was recorded by the variety CO 3 of which the percentage axis to grain ratio was 3.52.

All the accessions were subjected to SDS-PAGE to further confirm the presence of the protein. In 12% SDS-PAGE the albumin band (12 kD) migrated to the same level of cytochrome C, which was used as a marker protein. Electrophoresis revealed that the low molecular weight protein of our interest was found in all accessions, and the genotype CO 3 showed a visually more significant albumin band than the other accessions (Figure 1).

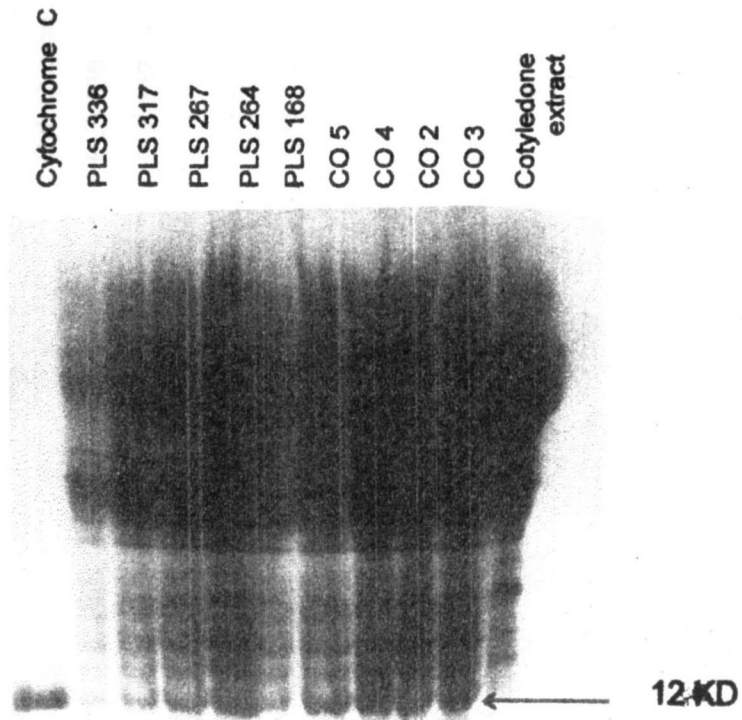


Figure 1. Electrophoretic Profile of Mungbean Embryonic Axis Protein.

CONCLUSIONS

Of the thirty five mungbean accessions studied, the genotype PLS 308 had the highest percentage of axis to grain ratio, but its protein content was only 200 $\mu\text{g}/\text{mg}$ axis. To study the low molecular weight protein in mungbean axis, the genotype CO 3 is best suited as it recorded the highest protein content of 450 $\mu\text{g}/\text{mg}$ axis, and also because the manual dissection of axis was easy when compared with the other genotypes.

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