INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 1 | APRIL, 2016 | 237-245

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.1/237-245

Development and genetic analysis of inter sub specific Recombinant Inbred Line population in blackgram (*Vigna mungo* (L.) Hepper)

■ R. VINOTH AND P. JAYAMANI*

Department of Pulses, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

ARITCLE INFO

Received : 02.02.2016
Revised : 05.03.2016
Accepted : 14.03.2016

KEY WORDS :
Blackgram, Mapping population, Frequency distribution, Biometrical traits, Transgressive segregation

ABSTRACT

Blackgram (*Vigna mungo*) is fourth important pulse crop of India. Major constraints in achieving higher yield of blackgram are absence of suitable ideotypes for different cropping systems, poor harvest index and susceptibility to pests and diseases. Genetic maps can be constructed based on mapping population. Among the mapping populations, Recombinant Inbred Lines (RIL) is more advantages than others. In the present study, an inter sub specific RIL population was developed by crossing VBN(Bg) 4 x *Vigna mungo* var. *silvestris* 22/2 by single seed decent method. A total of 195 RILs were evaluated for 11 biometrical traits. RIL 113 recorded the highest mean for single plant yield (9.90 g) along with more number of pods plant (42.84). RIL 125 recorded the maximum yield of 8.93g per plant along with more number of clusters per plant (17.50) and RIL 131 had single plant yield of 7.99 g along with more number of pods per plant (34.00). RILs with high yield and yield attributing traits can be used to develop high yielding varieties. RILs isolated with specific traits could be used as pre breeding material for the improvement of blackgram.

How to view point the article : Vinoth, R. and Jayamani, P. (2016). Development and genetic analysis of inter sub specific Recombinant Inbred Line population in blackgram (*Vigna mungo* (L.) Hepper). *Internat. J. Plant Protec.*, **9**(1) : 237-245.

***Corresponding author:**
Email: jayamani1108@gmail.com

INTRODUCTION

Pulses are the second most important group of crops grown worldwide. They are important in Indian agriculture, because they are more drought tolerant than cereals. India is the largest producer and consumer of pulses in the world accounting for 37 per cent of world area and 28 per cent of production. Blackgram [*Vigna mungo* (L.) Hepper] is popularly known as urdbean or mash, is a grain legume domesticated from *V. mungo* var. *silvestris*. It is highly prized pulse and having good source of protein, carbohydrates, calcium, phosphoric acid and popular for its fermenting action. It is the fourth important pulse crop in India, cultivated as a sole crop and intercrop covering an area of about 3.29 million

hectares with the production of 1.83 million tones and productivity is 555 kg/ha. (AICRP report, 2013). India is the largest producer and consumer of blackgram in the world and its total production is not able to fulfill its domestic consumption demand. The domestic demand of this pulse makes India the largest importer as well. In India, the major states that produce blackgram are Madhya Pradesh, Uttar Pradesh, Maharashtra, West Bengal, Andhra Pradesh, Odisha, Tamil Nadu and Karnataka. The major constraints in achieving higher yield of this crop are lack of genetic variability, absence of suitable ideotypes for different cropping systems, poor harvest index and susceptibility to pests and diseases. Despite blackgram being one of the most important pulses in India (Duke, 1981), genome level research on this crop has lagged behind that of cereals and other legumes.

The genetic maps can be constructed based on mapping population *viz*., F_2, backcross, Recombinant Inbred Lines (RILs), double haploids (DH) and Near Isogenic Lines (NILs) and have been employed in mapping of important traits (Semagn *et al*., 2006). Among the mapping populations, RILs having more advantages than the others because, RILs can be reproduced easily and favour the genetic analysis of quantitative traits because experiments can be replicated over years and environments. RILs developed by several generation of selfing to increase the probability of recombination between genes. In addition, single seed descent population gave a predominantly fixed genetic structure, which makes the population valuable for assessing the environmental impact on trait expression. Maps constructed with such materials could, therefore, facilitate fine mapping of region around genes of interest. Hence, the present study was undertaken to develop RIL population and to study the various biometrical traits for structural analysis of mapping population.

MATERIAL AND METHODS

Paried cross was made between [VBN(Bg) 4] and *Vigna mungo* var. *silvestris* 22/2, a wild progenitor of blackgram to generate mapping population. Single plant derived F_2 population was advanced to F_8 generation by SSD method. The RIL population was raised in homogenous block following Randomized Block Design (RBD) consisted of 197 rows (195 RILs along with parents) with two replications during *Rabi*, 2012 -13 at Research Farm of Department of Pulses, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. The RILs along with parents were planted in a single row of 4 meter in length with a spacing of 30 × 10 cm. Recommended cultural practices were followed throughout the crop season. Observations on 11 biometrical traits *viz*., days to 50 per cent flowering, days to maturity, plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, number pods per plant, pod length, number of seeds per pod, hundred seed weight and single plant yield were recorded in three randomly selected plants in the 195 lines of mapping population and its parents. The data was analyzed for simple statistics including mean, standard error, critical difference and frequency distribution for various biometrical traits.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Development of mapping population :

In the present study, out of 17 F_1's evaluated six F_1 plants were found to be true hybrid. These plants were harvested individually to produce their respective F_2 population. Single plant derived F_2 population was raised during *summer*, 2011 and seeds were collected in single plant basis. A total of 195 F_3 progenies were raised during *Kharif*, 2011, from individual F_2 plant and these progenies were advanced till F_8 generation by SSD method (Fig. 1). The RIL population was also developed by Chaitieng *et al*. (2006) and Gupta *et al*. (2008) by crossing a cultivated blackgram and *Vigna mungo* var. *silvestris*.

Evaluation RIL population for biometrical traits:

The lines with high mean performance for each character could be taken into consideration for the identification of good potential genotypes to a particular environment. Yet, exception exists in days to maturity where short duration lines of the crop were considered as the best, as it suits well in intercropping situation. Among 195 RILs studied, 79 RIL lines were earlier than the general mean for days to 50 per cent flowering in which RIL20 took minimum 41.5 days for 50 per cent flowering followed by 42 days in RIL 19 and RIL 28 whereas, late flowering was observed in RIL 180 (47

Table 1. Mean performance of RIL population derived from VBN (Bg) 4 x *Vigna mungo* var. *silvestris* 22/2

Sr. No.	Entries	Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Hundred seed weight (g)	Single plant yield (g)
1.	VBN (Bg)4	43.50	74.00	25.49	3.00	10.17	4.17	24.34	4.42	5.67	4.90	5.42
2.	*Vigna mungo* var. *silvestris* 22/2	45.00	76.50	22.67	2.00	11.33	2.17	16.17	3.74	5.50	2.95	1.57
3.	RIL 1	43.00	73.50	31.07	2.50	13.00	3.58	23.67	4.69	5.50	4.35	4.57
4.	RIL 2	44.00	76.00	36.35	2.84	13.00	2.67	24.00	4.34	5.67	4.65	4.44
5.	RIL 3	43.50	74.00	33.52	2.33	12.34	3.67	27.83	4.04	5.00	4.25	3.67
6.	RIL 4	44.00	74.00	34.87	3.70	18.17	3.83	33.00	4.72	6.00	4.35	5.45
7.	RIL 5	44.00	74.50	38.15	2.65	10.67	3.84	23.50	4.62	6.50	3.75	4.58
8.	RIL 6	42.50	75.00	31.52	3.17	10.33	3.67	21.00	4.55	6.25	4.45	2.73
9.	RIL 7	43.50	74.50	25.17	1.84	9.67	3.17	17.84	4.67	6.67	4.35	2.44
10.	RIL 8	42.50	74.50	41.17	3.00	13.50	3.50	24.17	4.42	5.67	5.10	4.67
11.	RIL 9	44.00	73.50	38.92	2.67	9.33	4.17	21.84	4.77	5.84	4.70	4.08
12.	RIL 10	42.50	73.50	38.08	2.50	11.17	4.00	23.33	4.40	5.67	4.95	3.57
13.	RIL 11	44.00	75.00	30.52	2.67	9.00	3.67	22.67	4.74	6.67	3.70	3.89
14.	RIL 12	44.50	75.50	28.17	2.17	8.34	3.50	17.67	4.13	5.84	3.90	2.37
15.	RIL 13	46.00	75.00	31.75	2.67	10.17	3.00	22.00	4.50	6.34	4.45	3.57
16.	RIL 14	45.00	77.00	27.90	2.34	12.34	3.17	24.33	5.00	6.99	4.00	4.94
17.	RIL 15	45.00	75.50	32.97	2.50	10.67	4.00	23.00	4.75	6.84	4.35	4.22
18.	RIL 16	43.50	75.00	35.49	2.00	8.84	2.67	14.00	4.72	6.34	4.30	2.22
19.	RIL 17	44.00	75.50	30.04	2.33	11.50	3.34	21.00	4.45	6.34	4.15	3.32
20.	RIL 18	44.50	75.50	33.08	2.50	11.00	4.00	25.00	5.27	6.50	5.25	4.99
21.	RIL 19	42.00	75.00	34.69	2.00	9.50	4.00	22.00	5.09	6.00	4.75	3.77
22.	RIL 20	41.50	74.00	25.87	1.50	9.33	3.34	19.34	4.57	6.50	4.90	3.94
23.	RIL 21	42.50	75.00	27.88	2.00	10.17	3.67	16.83	4.77	6.50	5.05	3.74
24.	RIL 22	43.50	74.00	33.75	2.85	13.67	3.67	28.34	4.57	6.33	4.95	6.02
25.	RIL 23	44.00	75.00	37.42	2.50	11.83	3.83	25.00	3.99	5.50	4.05	4.07
26.	RIL 24	44.00	77.00	31.75	2.50	11.83	3.00	19.33	3.97	5.17	3.95	2.27
27.	RIL 25	43.50	75.00	37.17	2.50	11.17	3.34	22.00	4.48	6.25	5.15	3.74
28.	RIL 26	44.50	74.50	37.84	2.17	10.34	3.67	22.00	4.68	6.67	3.80	3.52
29.	RIL 27	43.00	74.50	24.45	1.50	8.17	3.67	19.50	4.77	6.34	4.70	3.07
30.	RIL 28	42.00	75.00	28.85	2.35	10.00	3.00	22.34	4.87	6.33	4.20	4.22
31.	RIL 29	44.00	74.00	28.45	3.17	13.34	3.34	28.83	4.80	5.75	4.35	4.90
32.	RIL 30	44.50	75.50	29.59	3.33	11.17	3.17	24.00	4.85	6.67	5.15	4.49
33.	RIL 31	44.00	75.00	29.84	1.84	8.34	3.17	18.00	4.87	6.00	4.25	3.02
34.	RIL 32	43.00	75.00	28.07	2.00	9.00	4.17	20.50	4.90	6.67	6.00	4.52
35.	RIL 33	44.50	77.00	32.42	2.00	11.00	4.17	26.17	5.04	6.83	4.80	5.72
36.	RIL 34	42.00	74.00	27.43	2.00	9.33	3.50	20.00	4.75	6.17	4.65	3.74
37.	RIL 35	42.50	74.00	28.65	3.00	10.50	3.67	23.84	5.00	6.33	5.05	4.89
38.	RIL 36	44.00	75.00	29.90	2.50	9.67	2.83	18.50	4.67	6.83	4.45	3.37
39.	RIL 37	43.50	73.00	37.00	1.50	9.17	3.84	19.00	4.55	6.84	5.15	4.35
40.	RIL 38	44.00	75.50	40.60	2.50	12.50	4.00	30.67	4.88	7.00	4.75	5.20
41.	RIL 39	43.50	75.00	31.85	1.67	8.17	4.17	18.84	4.55	6.50	4.15	3.10

Contd... Table 1

Table 1 contd..

42.	RIL 40	44.00	75.00	39.75	2.50	9.50	4.00	17.50	4.82	6.67	5.00	4.00
43.	RIL 41	42.50	74.00	30.17	2.17	10.50	3.67	23.84	5.00	6.50	4.75	4.52
44.	RIL 42	43.00	74.00	30.17	3.34	10.50	4.17	24.00	4.62	5.92	4.45	3.80
45.	RIL 43	44.50	75.00	37.00	3.00	11.00	3.83	23.50	4.67	6.50	4.90	4.75
46.	RIL 44	44.00	73.50	33.90	2.50	11.84	3.67	27.17	4.45	6.34	4.05	3.24
47.	RIL 45	44.00	75.50	38.98	3.17	11.17	3.50	23.67	4.50	6.50	3.70	2.97
48.	RIL 46	44.00	75.50	31.50	2.17	10.17	3.50	22.17	4.60	6.84	3.95	3.42
49.	RIL 47	45.00	76.00	26.60	2.84	10.50	3.84	23.33	4.65	6.34	4.20	3.85
50.	RIL 48	43.00	75.50	26.59	2.50	11.17	3.84	28.84	4.60	5.67	4.20	3.65
51.	RIL 49	44.00	76.00	41.99	2.50	12.50	3.67	22.00	3.92	5.17	4.55	3.39
52.	RIL 50	42.00	74.50	33.87	1.84	10.17	4.17	23.34	5.10	7.50	4.55	5.35
53.	RIL 51	45.50	77.00	42.24	3.17	9.50	3.50	19.00	4.44	5.34	4.50	2.77
54.	RIL 52	43.00	74.00	36.29	2.17	11.17	4.00	25.00	4.57	6.25	4.35	4.35
55.	RIL 53	42.50	74.00	32.42	2.00	9.00	3.84	17.34	4.64	6.17	4.50	2.94
56.	RIL 54	42.50	72.00	27.00	2.85	8.67	3.34	15.17	5.02	6.50	4.65	3.53
57.	RIL 55	44.50	74.00	31.42	2.00	10.00	3.67	18.00	4.77	6.34	4.45	4.30
58.	RIL 56	44.00	75.00	27.25	2.50	8.50	3.50	19.17	4.75	6.00	4.20	2.92
59.	RIL 57	44.00	75.50	27.42	2.34	8.67	3.50	17.34	4.82	6.67	3.95	2.50
60.	RIL 58	45.00	75.50	29.00	2.83	11.83	4.50	29.34	4.87	6.50	4.85	4.75
61.	RIL 59	44.50	75.50	39.50	3.17	12.50	3.67	21.50	4.87	6.67	5.15	3.95
62.	RIL 60	44.00	75.00	30.60	2.34	9.84	4.00	23.34	5.52	6.33	4.40	4.33
63.	RIL 61	43.00	73.50	32.00	2.20	9.83	3.00	18.50	4.72	6.17	3.90	2.59
64.	RIL 62	44.00	74.00	28.67	1.50	8.17	3.50	17.17	4.77	6.34	4.40	3.08
65.	RIL 63	45.50	76.00	31.75	2.17	10.00	3.17	19.17	4.42	6.00	3.90	2.38
66.	RIL 64	42.00	74.00	32.20	2.50	10.83	5.33	29.34	4.67	6.33	5.80	6.45
67.	RIL 65	42.00	73.00	19.17	2.50	10.00	3.83	22.17	4.44	5.25	4.80	2.90
68.	RIL 66	46.00	77.00	25.42	2.67	10.84	3.50	21.67	4.70	6.67	3.80	3.10
69.	RIL 67	46.00	77.00	34.80	1.67	10.00	4.17	23.00	4.65	5.30	3.90	2.25
70.	RIL 68	43.00	74.00	36.08	2.83	13.17	3.67	30.84	4.67	6.67	4.40	4.80
71.	RIL 69	44.00	73.50	42.22	3.34	18.33	4.00	38.00	4.68	6.17	4.85	7.17
72.	RIL 70	43.50	73.50	36.32	2.34	9.84	3.83	17.84	4.65	6.00	4.60	3.54
73.	RIL 71	42.00	74.00	30.52	2.34	15.00	4.00	27.00	4.50	5.25	4.80	4.67
74.	RIL 72	43.50	75.00	33.50	2.00	11.00	3.00	19.67	4.17	5.67	5.10	2.52
75.	RIL 73	44.00	75.00	30.17	3.67	13.00	3.50	29.00	5.00	6.50	4.00	3.42
76.	RIL 74	44.50	75.50	42.20	2.83	14.34	3.50	29.00	4.65	6.50	5.15	5.59
77.	RIL 75	43.50	77.00	27.50	3.33	11.67	3.67	29.17	4.67	5.25	4.45	3.50
78.	RIL 76	44.00	77.00	30.55	2.17	9.67	3.67	19.84	4.05	4.67	4.35	2.80
79.	RIL 77	46.00	78.00	24.42	1.83	8.67	4.00	22.67	4.89	6.75	4.65	4.00
80.	RIL 78	45.00	77.00	28.67	2.17	10.83	3.50	22.00	4.30	6.17	4.25	2.58
81.	RIL 79	44.50	77.00	36.09	2.00	10.67	4.17	28.00	4.94	6.67	4.10	5.75
82.	RIL 80	44.00	75.00	32.40	3.50	14.50	3.50	26.17	4.22	5.33	4.35	2.87
83.	RIL 81	42.50	74.50	32.67	3.00	13.67	3.84	30.50	4.52	6.17	4.20	4.57
84.	RIL 82	44.00	75.00	32.33	2.17	10.67	3.67	23.50	5.09	7.00	4.45	3.97
85.	RIL 83	45.00	75.00	39.25	1.50	10.17	4.17	27.17	4.70	6.67	5.10	3.99
86.	RIL 84	44.50	75.50	24.22	3.00	10.67	3.50	22.67	4.12	5.33	4.65	3.89
87.	RIL 85	43.50	78.00	31.75	1.83	9.67	3.84	23.00	4.65	6.00	4.95	4.17
88.	RIL 86	44.50	76.50	30.67	3.00	13.67	3.67	26.00	4.40	5.84	4.80	3.88

Contd... Table 1

Table 1 contd...

89.	RIL 87	44.00	76.50	40.67	3.00	10.67	3.50	21.34	4.73	6.17	4.85	4.00
90.	RIL 88	43.00	73.50	30.17	3.00	12.17	3.50	26.00	4.44	5.75	4.60	4.87
91.	RIL 89	43.00	75.00	31.42	1.65	10.00	3.50	21.00	4.40	5.75	5.00	5.02
92.	RIL 90	42.50	75.00	31.25	1.85	10.37	4.84	23.50	4.60	6.17	5.25	4.54
93.	RIL 91	42.00	72.00	26.28	2.50	9.50	4.00	21.83	4.67	6.67	4.85	3.82
94.	RIL 92	44.00	74.50	28.83	2.67	12.34	3.84	23.17	4.45	6.00	4.45	4.05
95.	RIL 93	44.50	74.50	29.79	2.17	9.67	3.67	19.17	4.77	6.33	5.10	4.44
96.	RIL 94	45.50	75.50	21.75	2.50	10.83	3.33	20.83	3.97	5.34	3.65	2.28
97.	RIL 95	44.50	74.50	26.92	3.00	10.17	3.50	22.84	4.15	6.17	3.35	3.29
98.	RIL 96	45.00	76.00	32.92	1.84	9.00	3.50	19.00	5.69	6.50	5.20	4.82
99.	RIL 97	44.00	76.00	31.92	3.67	14.84	3.67	32.00	4.70	6.25	4.45	6.37
100.	RIL 98	45.50	76.50	33.25	3.34	12.83	3.67	28.84	4.82	6.25	3.25	3.65
101.	RIL 99	45.00	77.50	40.17	2.33	9.33	3.34	21.67	4.97	6.83	5.15	3.50
102.	RIL 100	45.00	75.50	30.70	3.33	13.67	4.17	30.17	5.34	6.67	3.90	5.49
103.	RIL 101	46.00	75.50	29.50	2.84	10.00	3.67	19.50	4.14	5.83	4.15	3.67
104.	RIL 102	46.50	77.00	34.17	2.34	10.33	3.34	21.67	4.32	6.17	4.55	4.40
105.	RIL 103	46.50	76.50	19.42	2.33	10.17	2.84	19.83	4.37	6.17	3.05	1.75
106.	RIL 104	45.00	77.00	29.37	2.00	10.67	3.34	25.84	3.85	5.34	3.45	2.83
107.	RIL 105	45.50	77.00	31.17	2.83	12.84	4.33	33.17	4.99	7.00	4.50	7.19
108.	RIL 106	46.00	76.50	23.25	3.17	10.34	3.84	30.00	4.70	6.67	3.55	4.89
109.	RIL 107	45.50	77.00	23.75	3.00	12.17	4.17	26.34	4.65	6.84	3.35	3.08
110.	RIL 108	44.50	76.50	33.08	3.00	12.17	3.67	25.17	4.40	6.33	3.60	3.15
111.	RIL 109	43.50	76.50	31.00	3.17	15.84	3.83	38.00	4.57	7.00	4.10	5.05
112.	RIL 110	43.00	74.50	25.83	2.17	12.17	3.34	25.50	3.82	5.75	3.30	2.88
113.	RIL 111	44.50	73.00	31.42	3.00	12.00	4.00	25.50	4.68	7.00	4.75	4.60
114.	RIL 112	45.00	75.00	35.58	2.50	13.17	3.83	30.84	4.88	6.34	4.80	5.82
115.	RIL 113	44.00	75.00	39.75	3.84	17.84	3.67	42.84	4.97	6.75	5.10	9.90
116.	RIL 114	43.50	75.00	17.02	3.67	10.83	3.50	23.17	3.92	5.34	3.85	3.60
117.	RIL 115	45.50	75.50	20.82	2.33	10.50	3.17	17.84	3.99	5.00	4.35	2.95
118.	RIL 116	44.50	75.50	37.84	3.17	14.00	3.17	25.50	4.73	6.84	3.75	3.98
119.	RIL 117	42.50	71.50	40.67	4.67	14.50	4.34	30.67	4.79	6.75	4.45	6.18
120.	RIL 118	43.50	77.00	35.33	2.34	13.00	4.34	26.17	4.12	6.67	3.65	3.50
121.	RIL 119	43.50	75.50	35.49	3.34	16.67	3.17	34.67	4.78	6.50	4.60	5.29
122.	RIL 120	43.50	75.50	35.42	4.00	15.67	3.34	32.17	4.82	7.00	3.70	4.54
123.	RIL 121	43.50	75.00	32.92	2.83	12.00	4.17	32.17	4.90	5.75	4.45	5.45
124.	RIL 122	45.50	75.50	23.50	3.50	12.84	3.34	26.50	4.69	7.00	3.70	3.84
125.	RIL 123	44.50	73.00	30.00	3.17	10.50	3.00	20.67	3.93	5.83	3.75	1.92
126.	RIL 124	43.00	75.00	34.34	3.83	16.50	3.50	34.83	5.05	7.00	4.20	6.39
127.	RIL 125	42.50	73.50	39.80	3.67	17.50	3.67	31.00	4.52	6.67	6.00	8.93
128.	RIL 126	43.50	74.50	31.67	2.67	14.50	3.50	26.00	4.35	5.84	4.00	3.47
129.	RIL 127	44.50	75.00	26.09	2.85	11.00	3.67	25.67	4.55	6.50	4.05	4.77
130.	RIL 128	46.00	74.50	25.30	4.00	11.33	3.67	24.34	4.69	6.25	4.10	4.92
131.	RIL 129	45.00	74.50	30.57	1.33	10.34	3.67	27.17	4.52	6.84	3.30	4.05
132.	RIL 130	43.50	75.50	33.00	2.50	10.84	3.50	28.00	4.17	5.84	5.05	5.17
133.	RIL 131	46.00	73.50	38.65	3.50	15.84	4.34	34.00	4.87	6.67	4.80	7.99
134.	RIL 132	43.50	75.00	39.35	3.00	11.00	3.67	21.34	4.24	6.34	4.35	3.49
135.	RIL 133	45.00	76.00	32.09	2.00	10.17	2.84	21.00	4.37	6.17	3.45	2.57

Contd... Table 1

Table 1 contd...

136.	RIL 134	44.00	75.00	31.00	2.67	9.50	3.34	15.50	4.68	7.00	4.05	2.15
137.	RIL 135	43.50	74.00	37.85	2.17	12.83	4.33	31.84	5.32	6.67	4.85	6.19
138.	RIL 136	43.50	75.50	32.54	2.50	9.17	3.83	20.00	3.60	5.75	5.15	4.08
139.	RIL 137	42.50	75.50	44.25	2.67	13.17	4.17	23.34	4.20	6.00	4.45	5.64
140.	RIL 138	42.00	73.50	42.08	1.83	10.50	3.83	19.83	4.34	6.50	4.55	3.59
141.	RIL 139	42.50	75.00	39.55	2.67	8.33	3.33	19.33	4.48	6.25	3.90	2.70
142.	RIL 140	42.00	73.00	26.18	2.00	8.50	2.67	15.50	4.30	6.34	4.45	2.37
143.	RIL 141	43.50	74.50	29.00	2.00	8.67	3.33	19.34	5.04	6.67	5.10	3.75
144.	RIL 142	43.50	73.00	32.59	1.84	8.67	3.67	15.84	5.05	6.67	3.80	2.55
145.	RIL 143	45.50	73.50	29.09	2.85	10.00	4.17	20.67	4.67	5.75	5.70	5.05
146.	RIL 144	43.00	73.50	24.79	2.67	8.50	3.17	20.00	4.55	5.84	5.00	2.40
147.	RIL 145	44.50	75.00	31.08	1.50	7.84	3.50	14.50	4.04	4.50	3.35	1.25
148.	RIL 146	43.00	74.00	33.92	1.50	8.00	4.17	18.00	4.85	6.25	3.90	2.80
149.	RIL 147	46.00	75.50	21.00	1.17	6.84	2.50	12.00	4.79	6.33	3.55	1.72
150.	RIL 148	45.50	76.00	30.85	1.00	7.34	3.00	11.50	4.39	5.75	4.60	2.04
151.	RIL 149	44.00	77.00	27.50	2.35	8.17	3.50	17.34	4.62	5.84	4.80	3.24
152.	RIL 150	43.50	76.50	29.34	2.00	11.00	2.67	21.00	4.45	6.50	4.00	3.87
153.	RIL 151	44.50	76.50	26.92	2.17	6.33	2.83	14.17	4.09	5.83	4.00	2.27
154.	RIL 152	43.00	76.50	28.17	3.00	11.17	3.00	21.17	4.45	6.50	3.80	2.79
155.	RIL 153	43.00	75.50	30.34	2.00	11.00	3.83	29.17	4.80	6.67	4.40	4.02
156.	RIL 154	44.50	75.50	23.90	2.17	8.33	3.50	17.67	4.29	5.75	4.35	3.05
157.	RIL 155	45.50	78.00	32.59	1.50	7.50	3.00	16.50	4.68	5.84	4.50	2.62
158.	RIL 156	44.00	77.00	36.12	2.60	13.34	4.67	27.00	5.00	6.67	4.65	6.17
159.	RIL 157	43.50	76.50	30.44	2.67	10.33	2.84	19.17	4.77	6.67	5.10	3.18
160.	RIL 158	44.00	77.00	27.90	3.17	9.67	3.17	21.84	3.60	5.84	3.80	2.48
161.	RIL 159	44.50	76.50	28.58	2.17	10.17	2.84	20.83	4.29	5.84	3.60	2.79
162.	RIL 160	43.00	75.50	39.09	2.67	12.00	3.34	22.00	5.00	6.50	3.85	4.65
163.	RIL 161	43.00	75.50	38.44	2.17	12.50	2.83	29.00	5.10	6.67	5.05	6.12
164.	RIL 162	43.50	75.00	32.84	2.50	12.17	3.67	24.84	4.47	6.34	3.90	3.62
165.	RIL 163	44.50	75.00	27.07	2.85	11.50	2.84	21.84	3.70	5.84	4.05	3.15
166.	RIL 164	45.50	75.50	42.00	3.00	14.67	4.34	29.67	5.13	6.67	4.00	4.49
167.	RIL 165	46.00	75.00	29.64	3.34	14.33	3.84	29.00	5.00	7.00	4.75	5.67
168.	RIL 166	46.00	75.00	32.93	2.50	9.33	3.50	19.83	4.75	7.00	3.95	3.12
169.	RIL 167	44.00	75.00	45.92	2.15	13.84	4.34	31.67	4.84	6.67	4.65	4.85
170.	RIL 168	45.00	75.00	39.84	2.17	10.34	3.17	22.17	4.57	6.25	4.50	3.25
171.	RIL 169	45.50	76.00	25.22	1.83	9.17	3.34	20.00	4.50	5.75	4.15	2.38
172.	RIL 170	43.00	71.00	28.59	3.00	10.84	3.67	24.67	4.92	8.00	4.15	4.02
173.	RIL 171	42.00	72.00	26.45	1.84	7.67	3.67	19.50	5.02	6.25	3.80	2.95
174.	RIL 172	43.50	73.00	41.17	2.17	12.00	3.50	24.17	4.53	6.17	4.25	3.54
175.	RIL 173	44.00	75.00	33.59	2.15	7.34	3.84	16.17	3.65	6.67	3.40	1.60
176.	RIL 174	43.50	75.00	40.34	1.67	7.50	2.33	12.33	4.70	6.50	4.35	2.30
177.	RIL 175	43.50	75.00	38.82	1.85	10.67	4.00	20.50	5.07	6.25	4.15	3.85
178.	RIL 176	44.00	75.50	41.00	2.30	10.50	3.83	23.34	4.88	6.50	4.60	5.38
179.	RIL 177	44.00	76.50	41.09	1.83	7.00	2.50	11.83	3.85	5.34	4.60	2.20
180.	RIL 178	42.50	75.50	37.25	2.33	11.17	2.67	23.25	5.05	6.50	3.45	4.10
181.	RIL 179	46.00	75.50	35.45	1.17	6.00	2.34	7.84	4.44	5.00	4.25	1.19
182.	RIL 180	47.00	76.50	15.47	1.50	6.34	2.00	6.20	3.40	5.84	3.90	1.15

Contd... Table 1

Table 1 contd...

183.	RIL 181	44.50	77.00	31.45	2.67	12.67	3.33	24.84	4.62	6.83	4.05	3.17
184.	RIL 182	45.00	76.50	34.87	2.17	11.17	3.34	22.50	5.12	6.34	3.95	3.12
185.	RIL 183	45.50	76.00	35.74	2.34	9.34	3.33	19.84	4.83	6.25	4.85	3.54
186.	RIL 184	45.50	77.00	35.25	3.17	10.00	3.00	19.00	5.09	6.34	4.80	2.80
187.	RIL 185	45.00	77.00	39.84	2.50	13.67	4.00	32.84	4.97	6.67	4.30	4.67
188.	RIL 186	44.50	77.00	38.32	3.50	10.67	3.17	20.50	4.74	6.50	4.15	2.38
189.	RIL187	44.00	76.00	34.00	3.67	12.50	2.84	23.50	4.95	6.34	4.00	3.13
190.	RIL 188	45.00	75.00	42.37	2.83	11.34	3.17	23.17	4.75	6.25	4.15	3.92
191.	RIL 189	44.00	75.00	35.50	2.67	9.83	3.34	21.17	5.07	6.50	4.70	3.87
192.	RIL 190	44.50	75.50	32.75	1.84	10.00	3.50	20.34	4.57	6.17	4.65	2.87
193.	RIL 191	44.00	76.00	39.57	2.67	12.34	3.67	33.17	4.64	6.25	5.15	4.67
194.	RIL 192	43.00	75.00	41.72	3.50	15.17	3.34	31.17	4.82	6.17	3.95	3.67
195.	RIL 193	45.00	73.50	34.13	1.17	9.34	4.17	24.83	4.65	6.50	4.80	3.43
196.	RIL 194	43.00	75.00	34.87	2.17	11.00	3.50	21.67	4.62	6.34	4.60	3.94
197.	RIL 195	42.50	74.00	27.42	1.17	8.34	3.34	14.67	4.74	6.50	5.05	3.32
	General mean	44.01	75.15	32.33	2.51	10.98	3.57	23.13	4.61	6.24	4.38	3.88
	Range among	41.50 –	71.00 –	15.47 –	1.00 –	6.00 –	2.00 –	6.20 –	3.40 –	4.50 –	3.05 –	1.15 –
	RILs	47.00	78.00	45.92	4.67	18.33	5.33	42.84	5.69	8.00	6.00	9.90
	S.E.±	0.487	0.524	2.070	0.341	1.168	0.301	2.397	0.219	0.316	0.129	0.466
	C.D. (P=0.05)	1.359	1.464	5.772	0.792	3.256	0.839	6.684	0.611	0.882	0.361	1.299

*Parental values was not taken for calculating general mean and range

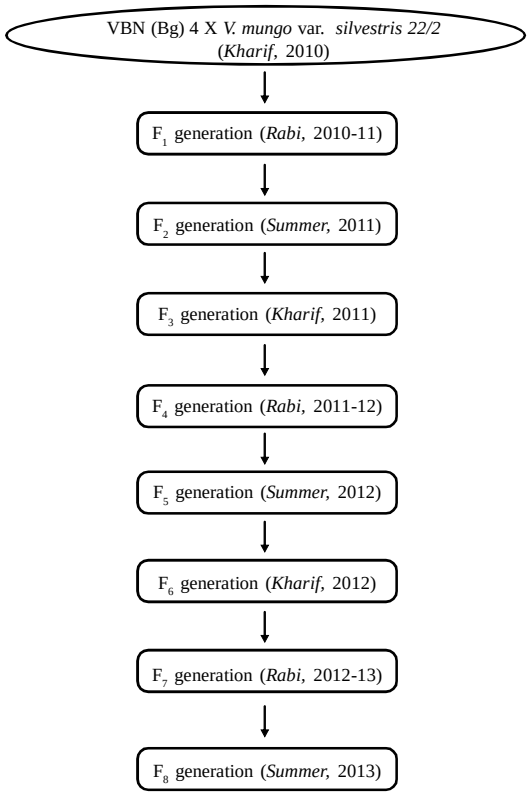

Fig. 1 : Development of mapping population (RILs)

days). A total of 60 RILs found to have earlier than the general mean value for days to maturity. RIL170 took minimum of 71 days for maturity followed by RIL 117 (71.5 days) and RIL 54, RIL 91(72 days) whereas, RIL 77 (78 days) was late for maturity.

For plant height, RIL180 was the shortest (15.47 cm) line whereas, RIL 167 was the tallest (45.92 cm) followed by RIL 137 (44.25 cm) and RIL 188 (42.37 cm). A total of 87 RILs found to have higher mean value than the general mean for plant height. Blackgram is a short duration crop and is being grown as sole and also as intercrop. Hence, the RILs with short duration and suitable plant height could be exploited either directly or include in the crossing programme to develop varieties suitable for intercropping situation.

Number of branches per plant ranged between 1.00 and 4.67. The highest number of branches per plant was recorded by RIL 117 (4.67) followed by RIL 120, RIL 128 (4.00) whereas, the lowest number of branches per plant was recorded by RIL 148 (1.00). Eighty two RILs exceeded the general mean value and RIL 117 out performed when compared to all other lines. Regarding number of clusters per plant, 85 RILs recorded higher mean value than the general mean where, RIL 69 possessed the highest number of clusters (18.33) per

plant followed by RIL 4 (18.17), RIL 113 (17.84) and RIL 125 (17.50) whereas, minimum number of clusters per plant was recorded by RIL 179 (6.00). More number of branches and more number of clusters per plant, respectively were selected and could be used as donors in crossing programme for the improvement of blackgram.

The mean performance for number of pods per cluster ranged from 2.00 to 5.33 with a general mean of 3.57. The highest number of pods per cluster was recorded by RIL 64 (5.33) followed by RIL 90 (4.84) and RIL 156 (4.67) whereas, the lowest number of pods per cluster was depicted by RIL 180 (2.00). One hundred RILs exceeded the general mean value and RIL 64 (5.33) out performed when compared to all other lines. Among the 195 RILs evaluated, RIL 113 had the highest number of pods per plant (42.84) followed by RIL 69, RIL 109 (38.00) and RIL 124 (34.83) whereas, minimum number of pods per plant was recorded by RIL 113 (6.20). The general mean was 23.13. Ninety two RILs had higher mean value than the general mean. Since number of pods per plant is the primary yield contributing trait, RIL 113 may be further tested for yield and released as variety, besides using it as donors for further crop improvement.

Regarding pod length, 115 RILs recorded higher mean value than the general mean where, RIL 96 possessed the maximum pod length (5.69 cm) followed by RIL 60 (5.52 cm) and RIL 50 (5.10 cm) whereas, the minimum pod length was recorded by RIL 180 (3.40 cm). The number of seeds per pod ranged from 4.50 to 8.00 and the general mean was 6.24. A total of 120 RILs showed higher mean value than the general mean. The highest number of seeds per pod was recorded by RIL 170 (8.00) followed by RIL 50 (7.50) and RIL 82, RIL 105 (7.00). The lowest number of seeds per pod was recorded by RIL 145 (4.50). Thus, the RILs with more number of seeds per pod and increased pod length could be selected as pre breeding materials for the improvement of blackgram.

Ninety nine RILs exceeded the general mean value (4.88 g) for hundred seed weight. RIL 32 exhibited maximum hundred seed weight (6.00 g) followed by RIL 64 (5.80 g) and RIL 143 (5.70 g) whereas, the lowest hundred seed weight was depicted by RIL 103 (3.05 g). RILs with bold seed could be used as pre breeding material for blackgram improvement. Single plant yield is economically important character, 88 RILs recorded higher mean value than general mean (3.88 g) where, RIL 113 recorded the highest single plant yield (9.90 g) followed by RIL 125 (8.93 g) and RIL 131 (7.99 g) whereas, the lowest single plant yield was recorded by RIL 180 (1.15 g) (Table 1). The highest single plant yield could be exploited to improve the productivity of blackgram. Similar results were observed in blackgram by Sowmini and Jayamani (2013) for days to maturity, plant height, number of branches per plant and 100 seed weight.

On the whole, RIL 113 recorded the highest mean for single plant yield (9.90 g) along with more number of pods per plant (42.84). RIL 125 recorded the single plant yield of 8.93 g along with more number of clusters per plant (17.50) and RIL 131 possessed single plant yield of 7.99 g along with more number of pods per plant (34.00). The above RILs were found to be resistant to yellow mosaic disease (YMD) and could be exploited further for commercial cultivation.

Conclusion :

The RIL population derived from inter sub specific cross and also segregating for YMD resistance. Normal frequency distribution and mesokurtic nature was observed in most biometrical traits indicated that, genetic nature of population is normal and could be used in the mapping of YMD resistance gene and other economic traits. In addition, the RILs with better mean values for yield and its attributing traits will be helpful to develop high yielding varieties. The RILs isolated with specific traits could be used as pre breeding material for further improvement of blackgram.

Acknowledgement :

The authors are grateful to the Department of Biotechnology, Government of India for providing financial assistance to carry out this research work (BT/PR13464/AGR/02/698/2010 dt.01.12. 2010).

REFERENCES

AICRP Report (2013). All India Coordinated Research Project report on pulses. Indian Institute of pulse research, Kanpur. pp 31.

Chaitieng, B., Kaga, A., Tomooka, N., Iseumara, T., Kuroda, Y. and Vaughan, D.A. (2006). Development of blackgram [*Vigna mungo* (L.) Hepper] linkage map and its comparison with an azukibean (*Vigna angularis* (wild.) Ohwi & Ohashi)

map. *Theor. Appl. Genet*., **113**: 1261-1269.

Duke, J.A. (1981). *Handbook of legumes of world economic importance*. Plenum Press, New York.

Gupta, S.K., Souframanien, J. and Gopalakrishna, T. (2008). Construction of a genetic linkage map of blackgram [*Vigna mungo* (L.) Hepper] based on molecular markers and comparative studies. *Genome*, **51**: 628-637.

Roy, D. (2000). *Plant Breeding - analysis and exploitation of variation*. Narosa Publishing House, New Delhi, pp. 300- 304.

Semagn, K., Bjornstad, A. and Ndjiondjop, M.N. (2006). Principles, requirements and prospects of genetic mapping in plants. *African J. Biotechnol*., **5**: 2569-2589.

Sowmini, K. and Jayamani, P. (2013). Genetic variability studies for yield and its component traits in RIL population of blackgram [*Vigna mungo* (L.) Hepper]. *Electron. J. Plant Breed*., **4** (1): 1050- 1055.