

GENETIC EVALUATION OF COWPEA (*VIGNA UNGUICULATA* (L.) WALP.) LINES FOR MULTIPLE PEST RESISTANCE

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ABSTRACT

Forty nine germplasm lines of cowpea were evaluated in pot cultures for their multiple resistance against some economically important insects (galerucid beetle, semilooper) diseases (bacterial blight, cowpea mosaic virus), and a nematode (root-knot nematode), and also to relate them with some plant characters. None of the lines tested was resistant to all the five pests and diseases. However, line TVU-1591 was resistant to all except CPMV, line TVU-2337 exhibited moderately resistant reaction to all the pests and diseases. Moreover, significant positive or negative correlations between some of the plant characters and the pests were observed. The lines exhibiting resistant/moderately resistant reaction against multiple pests can be utilised in cowpea improvement programme.

Key words: Cowpea, multiple resistance, character correlations.

Cowpea, *Vigna unguiculata* (L.) Walp. (syn. *V. sinensis* (L.) Savi), is widely grown in India and elsewhere in the tropics and subtropics. It is consumed as grain, vegetable and fodder. Despite the release of many improved varieties, their full potential is not realised due to the considerable damage caused by the insects, disease and nematodes. The pest spectrum of cowpea is wide and practically every part of the plant has an adopted pest species. While the pest status may vary from one country or region to another, but the losses reported suggests that any one major pest can cause substantial economic loss if left uncontrolled [1].

Host plant resistance (HPR) is one of the major components of IPM strategies in many crops. Attempts have been made to identify and incorporate HPR into crop plants [2]. In cowpea, combined resistance to wilt and root-knot nematode was first reported in the cultivar Iron [3, 4]. The work on insect and disease resistance at this Institute have been reported earlier [5, 6].

At present, IITA identified several cowpea lines possessing multiple disease resistance [7]. The knowledge of associated resistance to one or more insect pests, diseases or

nematodes would be useful in selecting suitable parents for the hybridization programme leading to the development of improved varieties having multiple resistance. The present investigations are, therefore, an attempt to screen cowpea germplasm for resistance to major insects (galerucid beetle, *Madurasia obscurella*; semilooper, *Plusia nigrisigna*) and diseases (bacterial blight, *Xanthomonas compestris* pv *vignicola*; cowpea mosaic virus (CPMV), and root-knot nematode (*Meloidogyne incognita*).

MATERIALS AND METHODS

Forty nine lines of cowpea (Table 1) obtained from the National Bureau of Plant Genetic Resources, New Delhi, were surface sterilised and sown in 20 cm clay pots filled with naturally infested (2 *M. incognita* larvae/g) red sandy loam soil properly mixed with fertilizer. Fifteen days after germination, the plants were thinned to three per pot.

Table 1. List of cowpea lines used in study

Accession No.	Source	Variety	Accession No.	Source	Variety
EC4186	Australia	Brown Crowder	EC 244415	Philippines	TVU-352
EC8414	"	169 CP 15530	EC244416	"	TVU-423
EC98661	Nigeria	45578	EC244424	"	TVU-6373
EC24426	—	—	EC244427	"	83F-646-9
EC37614	Australia	P-6056 I	EC244430	"	EC-3
EC48543	—	—	EC244432	"	TVU-842-6
EC244123	Philippines	TVU-36	EC244438	"	TVU-3380-04
EC244125	"	TVU-379	IC6805	India	
EC244131	"	BG-2	IC19070	Orissa	
EC244209	"	F-937	IC19705	Ranchi	
EC244211	"	TVU-2337	IC20458	M.P.	
EC24426	"	IT-8380	IC20504	"	
EC244231	"	IT-83-5-329C	IC20504-2	"	
EC244241	"	TVU-2287	IC20533	"	
EC244242	"	TVU-3409	IC20688	"	
EC244243	"	TVU-2937	IC20737-A	"	
EC244249	"	TVU-909	IC28671	"	
EC244250	"	TVU-923	IC39354	Rajasthan	
EC244256	"	TVU-83F-824-8	IC42194	"	
EC244270	"	TVU-922	IC48720	"	
EC244310	"	TVU-908	PLL-133		
EC244317	"	TVU-4678-03E	PLL-362		
EC244320	"	TVU-1591	U-13-78		
EC244372	"	TVU-6594	N.P.-3		
EC244409	"	TVU-108			

Each variety was replicated four times. Sixty five days after sowing, the plants were carefully uprooted, washed free of soil, and data on various growth parameters were recorded. To assess the germplasm lines for their overall reaction to various pests and disease, a multiple resistance score was obtained for each line). The data were subjected to statistical analysis as per standard procedures.

RESULTS

The various cowpea lines identified, having high resistance or negligible reaction to the disease/pests studied are presented in Table 2. Among the 49 lines tested, the galerucid beetle damage was maximum in P 6056-I and minimum in TVU 908. The semilooper inflicted no visual damage in IC-20533 from M.P. and caused maximum damage (5% of the leaf lamina consumed) in IC-19070 from Orissa. Maximum viral infection along with severe

Table 2. Cowpea lines/varieties showing resistance to pests

Pest	Line/variety
Galerucid beetle	Resistant: F-937, IT-8380, TVU-2287, TVU-908, TVU-909, TVU-3409, TVU-1591, IC-19070, IC-20737-A Moderately resistant: Brown Crowder, EC-24426, TVU-36, TVU-379, TVU-2337, IT-83-5-329C, TVU-2937, TVU-922, TVU-4678-03E, TVU-6594, TVU-352, 83F-646-9, EC-3, TVU-842-6
Semilooper	Resistant: EC-24426, BG-2, TVU-2287, TVU-2937, TVU-909, TVU-83, F-824-8, TVU-908, TVU-4678-03E, TVU-1591, TVU-108, TVU-423, 83-F-646-9, EC-3, TVU-842-6, IC-20533, IC-206888 Moderately resistant: Brown Crowder, 169CPI-155301, TVU-36, F-937, TVU-2337, TVU-2937, TVU-922, TVU-6594, TVU-352, TVU-3673, IC-19705, IC-20458, IC-20737-A
CPMV	Resistant: Brown Crowder, P-60561, TVU-842-6, IC-20504, IC-39354, IC-42194, IC-48720, PLL-133, PLL-362 Moderately resistant: 169CPI-15530, TVU-36, TVU-379, F-397, TVU-337, TVU-2937, TVU-922, TVU-908, TVU-4678-03E, IC-20688, IC-20737A, IC-28671
Bacterial blight	Resistant: Brown Crowder, F-937, IT-8380, TVU-923, TVU-83F824-8, TVU-908, TVU-1591, TVU-423, TVU-6373, 83F-646-9, EC-3, TVU-3380-042E, PLL-362 Moderately resistant: 169CPI-15530, TVU-36, TVU-2337, IT-83-5-329C, TVU-2287, TVU-3409, TVU-2937, TVU-909, TVU-4678-03E, TVU-108, TVU-358, TVU-3380-042E, IC-6805, IC-19070, IC-19075, IC-20533, IC-20688, IC-28671, IC-42194, IC-48720, 45578, PLL-133, U-13-78
Root-knot nematode	Resistant: TVU-83F-824-8, TVU-1591, TVU-108, 83F-646-9, 455778 Moderately resistant: F-937, TVU-2337, TVU-2287, TVU-923, TVU-842-6, TVU-3380-042E, IC-6805

leaf puckering was observed in IC-19705 from Ranchi, whereas IT-8380, IC-28671, IC-39354, IC-42194, IC-48720, PLL-133 and PLL-362 were free from any visible viral symptoms. Maximum bacterial blight infection (more than 10% of the actual leaf area occupied by the bacterial pustules) was observed in P6056-I, however, it was almost negligible in Brown Crowder, TVU-923, TVU-83 F 824-8, TVU-908, TVU-423, TVU-6056-I, 83 F-646-9, EC-3, TVU-842-6 and PLL-133. In addition, the root-knot index was maximum in PLL-136, and minimum in TVU-83 F 824-8, TVU-1591, TVU-108, 83 F-646-9 and IC-45578.

The study of various plant growth parameters and pest incidence (Table 3) in combination indicated a significant positive correlation between stem length and flea beetle damage, bacterial blight incidence and root-knot index; and also between leaf weight and

Table 3. Coefficients of correlation between plant characteristics and response to diseases and pests in cowpea

Characters	Root weight	Nodules per root	Stem length	Leaf weight	Dry matter %	Galerucid beetle damage	Semilooper damage	Bacterial blight score	Virus damage	Root-knot index
Plant weight	0.56**	0.17	-0.00	0.10	-0.02	0.08	-0.14	-0.01	0.37*	0.37*
Root weight		0.64**	0.03	0.15	-0.08	0.13	0.21	0.16	0.01	-0.37*
Nodules/root			-0.31*	-0.24	0.04	0.00	-0.16	-0.14	0.00	-0.37*
Stem length				0.34*	0.07	0.37*	0.19	0.33*	-0.22	0.73**
Leaf weight					0.90**	0.36*	0.51**	0.05	0.10	0.02
Dry matter %						0.08	0.04	-0.34*	0.06	-0.03
Galerucid beetle damage							0.12	0.24	-0.15	0.21
Semilooper damage								0.25	-0.25	0.41
Bacterial blight score									-0.09	-0.26
Virus damage										0.02

flea beetle and semilooper damage. Negative correlations were found between root weight and root-knot index; number of nodules and root-knot index; and dry matter percentage and bacterial blight incidence.

DISCUSSION

From the foregoing it appears that although a considerable number of cowpea lines exhibit resistance against one or more insects, diseases and nematodes, none of them was had multiple resistance against all the five pests and diseases. However, TVU-1591 was

resistant against four of them, while TVU-2337 exhibited moderately resistant reaction to all the five pests and diseases tested. Cases of resistance against one or more pests and diseases individually or together in cowpea have been reported recently [6, 8, 9].

Positive correlation between galerucid beetle of semilooper damage and stem length and leaf weight per unit area indicates that varieties with thicker leaves are preferred by these insects. Similarly negative correlation between bacterial blight with dry matter content is attributed to higher susceptibility of the succulent plant types. Further, CPMV and root-knot seem to be more prevalent in the high yielding genotypes. Inhibition in the nodule number and size by root-knot nematode number and size was reported earlier [10].

The cowpea lines having multiple pest and disease resistance or moderate resistance are also good in forage yield. Such lines can be used in further cowpea improvement programme.

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