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Short Communication

Screening of cowpea germplasm for field tolerance against biotic and abiotic stresses

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The experimental materials comprising 1100 germplasm accessions of indigenous and exotic origin were systematically evaluated during 1996-2003 at the Division of Genetics, Indian Agricultural Research Institute, New Delhi. The exotic materials were received primarily from the International Institute of Tropical Agriculture, Kano Station, Nigeria. These materials were also grown in phased manner at hot spots and screened against diseases such as web blight, *Cercospora* leaf spot at H.P.K.V.V., Regional Station, Dhaula Kuan, H.P., powdery mildew, YMV at IARI Regional Station, Dharwad and YMV at GBPUA&T, Pantnagar. Each entry was grown in a single now plot of 2.5 m length following augmented plot design. Two checks viz., C 152 and V 240 were repeated after every 20th entry. The row to row distance was maintained at one meter while distance between the plants within the row was kept at 10-15 cm. Most of the lines were also evaluated during summer (April to June) 2003-05 at IARI, New Delhi for their response to high temperature. However, the varieties Pusa Komal and V 130 were used as checks in these experiments. The average survival under field conditions was considered as criteria for high temperature tolerance. The observations on various yield contributing traits including yield per plant and disease reaction were recorded and analyzed as per standard procedures.

A wide range of diversity was observed in major economic traits under consideration (Table 1). It was interesting to note that some of the accessions (C 480, C 705, C 722) flowered in less than 40 days whereas some of the accessions like C 577 took 119 days for flowering (Table 1). The early maturing lines can be of considerable importance in dry land farming. Likewise some of the accession (C 653) having dwarf, compact and non-trailing (determinate) growth habit identified in the present investigation has an excellent breeding value in cowpea improvement specially for restructuring the plant type [2]. A perusal of data presented in Table 1 revealed that the germplasm accessions under study had a wide range of diversity for almost all the characters of economic importance. It is worthwhile to mention that some of the accessions (especially exotic) could not flower and dried till the time of harvest, therefore, observations on some of the parameters could not be recorded in those accessions. A wide range of variation for different traits in cowpea has also been reported by other workers [2,3].

Diseases are one of the major production constraints in cowpea. A variety of pathogenic groups (bacteria, fungi, viruses, nematodes and parasitic flowering plant) has been identified to induce diseases in cowpea in different agro-ecological zones [4]. The yellow mosaic virus (YMV), leaf curl virus (LCV), bacterial leaf blight (BLB), *Cercospora* leaf spot (CLS), rust, powdery mildew, anthracnose etc. are the main diseases affecting cowpea crop especially in India. Among these probably YMV and powdery mildew disease are of international imporatnace. Therefore, the large scale evaluation of diverse germplasm regarding

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Table 1. Range for important agronomic traits in cowpea germplasm under investigation

Character	Range	
	Minimum	Maximum
Days of flowering	37(C 480)	119(C 577)
Days of maturity	62(C 62)	152(C 577)
Plant height (cm)	30(C 653)	421(C 579)
Pod length (cm)	7(C 102)	53(C 626)
Number of pods/peduncle	1(C 565)	4(C 421)
Number of pods/plant	10(C 42)	130(C 482)
Number of seeds/pod	5.6(C 504)	20.7(C 589)
100-seed weight (g)	4.3(C 619)	24.42(C 607)
Seed yield/plant (g)	8(C 625)	110(C 440)

their response to disease assumes special importance. The materials under present investigation were grown at hot sports for different diseases and the data were compiled. As can be seen from the data presented in Table 2, many promising accessions have been identified as resistant to prevalent diseases indicating the presence of wide range of diversity with respect reaction pattern against diseases in the material studied. However, small proportion of accessions were highly resistant against diseases. The stable sources of resistance to disease have also been reported by few workers [5, 7]. Some of the lines like C 380, C 453, C 568, C 614 showed multiple disease resistance which

Table 2. Selected promising lines resistant against diseases and tolerant to high temperature

Disease/stress Temperature	Promising resistant and lolerant lines
YMV	C 38, C 44, C 159, C 180, C 182, C 222, C 249, C 355, C 385, C 422, C 463, C 480, C 483, C 492, C 533, C 566, C 568, C 685, C 687, V 130
Powdery mildew	C 7, C 200, C 265, C 347, C 402
Web blight	C 380, C 453, C 505, C 568, C 578, C 614, C 851
Cercospora leaf spot	C 380, C 405, C 406, C 443, C 453, C 476, C 569, C 614, C 620
Rust	C 240, C 12, C 28, C 33, C 46, C 52, C 104, C 181, C 238, C 252, C 277, C 347, C 402
High tempe-rature	Pusa Komal, C 359, C 360, C 361, EC 472250, EC 472267, EC 472285, EC 472286, EC 472289

Table 3. Superior lines combining multiple desirable features in cowpea germplasm

Desirable features	Promising accessions
Semi-erect, YMV resistance, white bold seeds	C 19, C 27, C 159, C 181, C 182, C 249, C 355, C 385, C 522, C 472, C 491, C 509, C 685
Erect, YMV resistance, white bold seeds	C 39, C 447
Early flowering (37 days), YMV resistance	C 480
Early maturing (<75 days), YMV resistance)	C 463, C 480, C 483, C 538, C 503, C 566
Long pod (>22cm), YMV resistance	C 22, C 573
Seed/pod (>15), YMV resistance	C 538, C 589, C 599, C 600
Bold seeds (> 20g), YMV resistance	C 447, C 525, C 605, C 607, C 636
Resistance to web-blight and Cercospora leaf spot	C 380

can be used in resistance breeding as well as for genetic studies.

Cowpea is generally grown in the arid and semi-arid regions of the tropics and sub-tropics where drought coupled with high temperatures is a common phenomenon hampering the cowpea production. In many subtropical zones, cowpea is also grown during spring-season. Traditionally, in India also, cowpea has been grown during spring summer season. However, due to back of suitable varieties, the summer cultivation of cowpea is restricted to a very small area. The observations on seedling/plant survival showed a wide range of variation among the germplasm accessions studied under present investigation. Most of the germplasm accessions could not survive and all the plants were dried within 30-35 days after sowing during summer. There were some intergenotypic variations initially in few germplasm accessions, but later all the plants were defoliated and subsequently dried. It is interesting to note that there were several accessions which could not enter into reproductive phase due to prolonged vegetative growth. Some of such accessions included C 152, C 358, V 240, EC 472267 etc. On the other hand there were many accessions like C 359, C 360, C 361, EC 472250, EC 472267, EC 472285, EC 472286, EC 472289, V 578 etc. which showed fairly high level of tolerance against high temperature. The

maturity duration of these materials ranged from 75-90 days. These accessions can be used for summer cultivation after detailed evaluation in larger plots. Variable performance of cowpea genotypes under different temperature regimes has also been reported earlier [8, 9]. Some of the lines which showed luxuriant vegetative growth can be used as fodder crop during summer either as sole crop or in intercropping system.

An effort has also been made to identify promising accessions combining desirable features for multiple characters. A perusal of data presented in Table 3 showed that several germplasm accessions were having YMV resistance coupled with desirable agronomic traits like erect/semi-erect growth habit, early flowering, early maturity, long pods, bold and white seeds. These genotypes can be used directly as variety after detailed evaluation or exploited in the cowpea breeding programmes. The seeds of majority of the germplasm accessions evaluated in the present investigation have been deposited in the National Gene Bank, NBPGR, New Delhi for long term conservation and future use. The most promising accessions are also being maintained in the Division of Genetics, IARI, New Delhi.

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