Short Communications

Evaluation of Chickpea Accessions Against Root-knot Nematode, *Meloidogyne incognita*

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Chickpea (*Cicer arietinum*) is an excellent source of high quality protein. During last three decades chickpea cultivation area has decreased progressively in the country, various pests and diseases including nematodes being some of the factors for reducing yield of this crop. About ten species of plant parasitic nematodes have been found associated with this crop. Among them, the root-knot nematode, *Meloidogyne incognita* is most predominant and causes 25-60% yield loss (Ali, 1997). Keeping this fact in view, a green house experiment was conducted to identify resistant genotypes, which could be exploited in breeding programme for development of resistant commercial cultivars.

Advanced breeder's seed material entries for multilocational testing under All India Co-ordinated Research Project on Improvement of Chickpea were included in this study as these entries are high yielding. Promising seeds were surface sterilized in 0.2% mercuric chloride solution and were sown separately in 15 cm diam. clay pots, containing 1 kg of steam sterilized soil. Three replications were maintained for each germplasm accessions. Thinning was done at 2-3 leaf stage, leaving one healthy seedling in each pot. Fifteen hundred freshly hatched (12 hr after hatching) second stage juveniles of *M. Incognita* were inoculated around each plant. After 45 days of inoculation, the plants were uprooted and roots were gently washed. Galls developed on the roots are indexed on 0-5 scale (Taylor and Sasser, 1978), where 1 = 0 or no galls (highly resistant), 2 = 1-10 galls (Resistant), 3 = 11-30 galls (moderately resistant), 4 = 31-100 galls (susceptible) and 5 = above 101 galls (highly susceptible).

It is evident from the Table 1 that out of 120 germplasm accessions of chickpea tested, RSG 902, RSG 974, BGD 109, RSG 931, BGM 532, BGM 534, BGD 72 were found to be highly resistant, RSG 895, CSJD 901, RSG 906, BGD 11, GPF 2, H 95-30, GNG 1331, GNG 1293 were resistant whereas, PG 95-27, Phule G 94601, BG 267, BG 1075, BG 1095, GNG 1340 were highly susceptible against this nematode. Four

Table 1. Host reaction of various chickpea accessions to *M. incognita* under green house condition

Accessions	No. of galls	Host reaction	Total
RSG 902, RSG 97, BGD 109, RSG 931, BGM 532, BGM 534, BGD 72	0	HR	7
RSG 895, CSJD 901, RSG 906, BGD 11, GPG 2, H 95-30, GNG 1331, GNG 1293	1-10	R	8
IPC 97-1, FG 664, RSG 888, RSG 865, RSG 965, BGD 98, RSG 959, FG 703, Phule G 95311, BGM 535, BGM 528, H 95-123, H 208, C 235, BG 1078, BG 256, BG 1063, BG 1065, BG 1096, BG 1079, BG 372, BG 1080, GNG 1296	11-31	MR	23
CSJG 869, CSJD 884, RSG 807, FG 559, FG 711, CSJD 916, RSG 823, BGD 110, GPF 133, RSG 945, GL 96004, PBG 1, GL 90236, PBG 127, PBG 68, PBG 34, L 550, Phule G 96126, Phule G 93009, Phule G 96022, Phule G 96108, VIJAYA, Phule G 5, Phule G 96104, BGM 531, BGM 519, BGM 524, BGM 536, HK 94-134, H 95-122, BG 362, BG 1097, BG 256, BG 391, BG 1o66, BG 1062, BG 256, BG 1003, BG 1089, BG 256, BG 372, BG 1084, BGD 108, BG 256, BG 1081, BG 1067, BG 256, BG 1003, BG 1088, BG 362, BG 1094, BG 267, BGD 112, GNG 1323, GNG 1308, GNG 1320, GNG 1174, GNG 469, GNG 1250, GNG 1345, GNG 1329, GNG 1237, GNG 1350, GNG 1275, GNG 1292, GNG 1192, GNG 1271, GNG 1178, GNG 1336, GNG 663, CSG 9391, CSG 9388, CSG 9428, CSG 9401, CSG 9505	31-100	S	76
PG 95-27, Phule G 96401, BG 267, BG 1075, BG 1095, GNG 1340	Above 101	HS	6

cultivars/lines namely BG 369, BGM 481, GL 88341 and GMS 815 have been reported to possess resistance against *M. javanica* (Ali, 1997). These sources of resistance could be utilized in breeding programme for developing commercial varieties possessing resistance against root-knot nematode.

References

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Genetic Divergence for Physico-Chemical Characteristics of Lemon Fruits Grown in Himachal Pradesh

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Key Words: Cluster Analysis, Germplasm Genetic Divergence, Lemon, Physico-Chemical Characteristics

Lemon (*Citrus limon* Burm.) is one of the important fruits of citrus family. In India, it is cultivated in Uttar Pradesh, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Assam, West Bengal, Bihar, Rajathan, Orissa, Punjab and Himachal Pradesh (Singh, 1995; Mankand, 1994). Lemon trees are prolific bearers and have very high productivity as compared to other citrus fruits (Sharma *et al.*, 2001). One of the important characteristics of this fruit crop is that its fruits are available during December-February when the Kagzi lime is either not available or is rather scarce (Singh, 1995). Very little attention has been given to improve this fruit crop though it is almost at par with lime. A wide range of diversity in lemon germplasm exists in India which can form a basis for any crop improvement programme. Therefore, an attempt was made to evaluate the genetic diversity among 52 accessions collected from various lemon growing regions of Himachal Pradesh.

The experimental material consisted of 52 accessions of lemon collected from various lemon growing regions of HP such as Nurpur, Kangra, Una and Hamirpur. All the 52 accessions are planted in the experimental Orchard of Regional Horticultural Research Station, Jachh, (Nurpur) Distt. Kangra (HP) except one *i.e.* IL-1 (Italian lemon) which was procured from Kangra. All the accessions were evaluated for various physico-chemical characteristics of fruits harvested at their optimum maturity. The fruit length, diameter and flavedo thickness were measured using digital vernier calliper. Total soluble solids (TSS) were recorded by using hand refractometer and acidity of juice by the method detailed by Ranganna (1997). The juice was extracted through screw type juice extractor. The data on various physical and chemical fruit characteristics were analysed using Non-hierarchical Euclidean Cluster Analysis method (Beale, 1969; Spark, 1973).

Data presented in Table 1 show that the fruit weight of lemon ranged between 125-525 g with a mean weight of 332.71 g. The size parameters viz., fruit length varied between 9.00-13.50 cm (mean 11.27 cm) and fruit diameter varied between 5.27-9.68 cm (Mean 8.14 cm). The average flavedo thickness was observed to be 3.17 mm. The juice yield ranged between 16.0-51.2

Table 1. Mean, range, standard deviation and coefficient of variation for physico-chemical characteristics of lemon

Parameter	Mean	Range	Standard deviation	Coefficient of variation
Fruit weight (g)	332.71	125-525	88.10	26.48
Fruit length (cm)	11.27	9-13.5	1.36	12.07
Fruit dia (cm)	8.14	5.27-9.68	0.95	11.67
Total peel (%)	19.88	8.3.-42.8	6.91	34.76
Flavedo thickness (mm)	3.17	1.58-5.33	0.79	24.92
Juice (%)	31.29	16.0-51.2	7.64	24.42
Residue/Pomace(%)	48.95	25.0-64.9	9.51	19.43
No. of segments	9.92	8-12	1.22	12.30
No. of seeds	23.12	0-40	9.38	40.57
TSS of juices	8.10	7.1-9.5	0.65	8.02
Acidity of juice	5.43	4.9-5.9	0.33	6.08

* Total peel includes flavedo and albedo