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Research Article

Screening chilli (*Capsicum annuum* L.) genotypes for resistance to broad mite (*Polyphagotarsonemus latus* Banks) and analysing the geographic distribution of resistance

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Abstract
Field screening of indigenous chilli germplasm wascarried out to identify sources of resistance to the mite, Polyphagotarsonemus latus Banks. Among the 71 accessions screened, four (IC342390, IC572492, IC337281 and IC344366) were identified as resistant; 12 were found to be moderately resistant; 39 were susceptible and 16 were highly susceptible to P. latus. The GIS mapping and diversity analysis showed that the genotypes sourced from Sonipat (Haryana) and Kullu (Himachal Pradesh) were found to be having the highest range of Shannon diversity index while the genotypes collected from Nainital (Uttarakhand), Kullu and Lajaul&Spiti districts (Himachal Pradesh) and Kasaragod (Kerala) recorded the highest co-efficient of variation for their reaction tomite infestation in chilli.

Key words
Chilli, GIS, Host plant resistsnce, mite, Polyphagotarsonemus latus

Introduction

Chilli (*Capsicum annuum* L.) is a widely cultivated commercial crop in India in an area of 7.74 lakh ha with 14.92lakh MT production (NHB, 2015). The country commands a share of 25 per cent in global chilli trade and earns 375 million USD by exporting about 20 per cent of its production (Pednekar, 2015).However, the average productivity (1,925 kg ha^{-1}) is very low due to a multiplicity of factors, among which the leaf curl due to broad mite, *Polyphagotarsonemus latus* Banks is one of the major limiting reasons. The economic yield loss due to the pest was estimated to be around 11 to 75% quantitatively and 60 to 80% qualitatively in the event of serious infestation (Ghosh *et al*.,2009). Leaves damaged by *P. latus* curl downward and the flowers become distorted and fail to open normally. Both the nymphs and adults suck cell sap and devitalize the plant and as a result curling of leaves and petiole elongations of older leaves occur. Severely infested plants show deserted leaves with brownish patches leading to drying up of entire foliage. *P.latus* is difficult to control due to their polyphagous nature, cryptic habitat and high reproduction rate, resulting in preventive or excessive use of pesticides.Farmers take up nearly 18 to 26 rounds of pesticide sprays for the management of sucking pests in irrigated chilli, which in turn tremendously increases the cost of cultivation (Hosamani, 2007). Besides, the concern over indiscriminate use of chemical pesticides and the adverse effect on environment warrant eco-friendly approaches in pest management programs.

Host plant resistance plays a key role in formulating alternative pest management strategies. Over 700 chilli accessions were evaluated for their reaction to*P. Latus* (Mallapur, 2000; Tatagar*et al*., 2000; Ahmed *et al*., 2001; Sarath Babu *et al*., 2002; Yadwad, 2005; Desai *et al*., 2006; and Kulkarni *et al*., 2011)in severalfield screening studiesin India. The national gene bank at NBPGR holds over 4,480 chilli germplasm (NBPGR, 2015)and a wider scope exists for the identification of unexploitedresistance sources against the mites in chilli. Apart from the routine preliminary screening, a systematic study on diversity anddistribution of resistance sources was never attempted earlier. Geographical information system (GIS) tools may provide vital information for a targeted exploration of chilli genotypes for the screening against major biotic stresses. In this context, the present investigation was undertaken to screen indigenous chilli germplasm against the broad miteand to appraise the diversity and distribution of resistant genotypes utilising GIS analysis.

Materials and methods

Supervised field experiments were conducted to screen chilli genotypes for their reaction to mite, *Polyphagotarsonemus latus* at the research farm of ICAR - National Bureau of Plant Genetic Resources (NBPGR), Regional station, Rajendranagar, Hyderabad during *kharif* seasons of 2012-13 and 2013-14. A total of 71 chilli genotypes from the National Seed Gene Bank of the NBPGR was utilised for the field screening. The genotypes were sourced from 24 districts belonging to 11 states (Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Sikkim, Telangana, Uttar Pradesh and Uttarakhand) (Table. 1) through the exploration missions of NBPGR. Chilli seedlings were raised in pots under glasshouse conditions and transplanted after 40 days of sowing. Plants were spaced 60 cm between rows and 50 cm between plats. Each accession was sown in four rows with 10 plants per row in an augmented block deign with five check verities(*ArkaLohit* and *Pusa Jwala* as resistant check; *Arka Suphal* and LCA353 as moderately resistant and CA960as susceptible check). The checks were repeated after every 12 test genotypes in each block. Recommended agronomic package of practices were adopted for raising the crop excluding the plant protection measures.

The accessions werevisually rated for mite infestation based on the 'downward leaf curl' damage symptom on five randomly selected plantsat fortnightly intervals at 45,60 and75 days after transplantation (DAT). Scoring was done in the scale 0-4 as described by Niles (1980) and per cent leaf curl index (PLI) was calculated as described by Hosamani (2007).

Score	***Symptoms***
0	No leaf curl incidence (Healthy plant)
1	< 25 % leaves showing downward curling
2	26 to 50 % leaves showing downward curling
3	50 to 75 % leaves showing downward curling
4	> 75 % leaves showing downward curling

$$PLI = \frac{\text{Sum of scores of all plants}}{\text{Total no. of plants x No. of score category}} \times 100$$

The resistance reactions of chilli genotypes were classified in to four categories based on the PLI value, where, 0-10 = resistant; 11-25 = moderately resistant; 26-50 = susceptible and 51-100 = highly susceptible.The data obtained from field experiments were analysed using the analysis of variance for augmented block design (Gomez and Gomez, 1984). The PLI values were subjected arcsine transformationand the treatment means were compared using least significant difference test at P=0.05.The data was subjected to GIS analysis (DIVA-GIS version 7.5) (Hijmans *et al*., 2012) by plotting the mean PLI value of individual accessions corresponding to their geo-referenced points. Grid maps on chilli diversity with respect to the mean PLI value generated on the basis of Shannon diversity index and coefficient of variation for the genotypes.

Results and Discussion

The chilli genotypes exhibited a wider scalereaction to the infestation of *P. latus* in both the *kharif* seasons of 2012-13 and 2013-14 (Table 2) .The PLI value ranged from 4.00in the genotype IC342390 (sourced from Mathura, Uttar Pradesh) to68.33 in IC537662(from Kullu, Himachal Pradesh)at 45 DAT during 2012-13.The local *checks Arka Lohit, Arka Suphal*, CA960, LCA353 and *Pusa Jwala* recorded a leaf curl index of 21.33, 22.67, 45.00, 28.00 and 5.33 per cent, respectively. The accessions IC342390, IC337281(sourced from Pauri, Uttarakhand), IC572492 (from Gadag, Karnataka),IC344366&IC344385 (both from Kasaragod, Kerala) IC537657(Kullu, Himachal Pradesh) and IC537599 (Dehradun, Uttarakhand) recorded a PLI value of less than 10 per cent at 45 DAT. A similar trend were noticed during the observations recorded at 60 and 75 DAT. In the field experiment during *kharif* 2013-14 four genotypes viz., IC572492, IC342390, IC344366 and IC344385 were found to be recording a PLI of less than 10 at 45 DAT. Similarly five genotypes (IC342390, IC572492, IC344366, IC537657 and IC337281) at 60 DAT and three genotypes (IC342390, IC337281 and IC344366) at 75 DAT were showing a lower PLI value in response to the infestation of *P. latus.*

Based on the pooled mean PLI data of both the seasons, the genotypes were classified in to four categories of resistance. Among the 71 accessions screened, four (IC342390, IC572492, IC337281 and IC344366) were identified as resistant; 12 were found to be moderately resistant; 39 were susceptible and 16 were highly susceptible to the infestation of *P. latus*. Among the 12 moderately resistant accessions, three each were sourced from Kerala (IC344385, IC344367 and IC344364) and Himachal Pradesh (IC537657, IC537658, and IC537661); two each from Haryana (IC342449 and IC342464) and Uttarakhand (IC537599 and IC537583) and one each from Gujarat (IC330969) and Karnataka (IC572454).

In a field screening of 58 chilli genotypes against*P. latus,* Borah (1987) found, IHR-243-1-1-15 and *Musalwadi* selection were promising against the miteinfestation. Naitam *et al.* (1990) reported that the cultivars Jwala, G-5, and Past C1 had lesspopulation of mites and showed moderate resistance to leaf curl. Mallapur (2000) screened 62 chilli genotypes against both thrips and mites and found that 13genotypes recorded minimum per cent leaf curl index as compared to local checks. Twogenotypes *viz*., PMR-21 and KDSC-210 recorded a lower PLI with higher yield.Among the 77 chilli genotypes screened for their resistance *P. latus* on the basis of mite incidence, their injury grade and damage index, Ahmed *et al*. (2001)

reported that only nine entries were found resistant against mite, while the remaining entries were categorized as either susceptible (31) or highly susceptible (37).In ananalogous field screening with 308 chilli germplasm, Sarath Babu*et al.*, (2002) identified five resistant accessions (EC378630, EC378633, EC391082, IC214991 & NIC23897) to *P. latus*. The present study also resulted in identification of good number of resistant and moderately resistant genotypes for the broad mite infestations in chilli.

The GIS grid map generated by plotting the PLI values of chilli genotypes is furnished in Fig.1. The accessions sourced from Sonipat (Haryana) and Kullu (Himachal Pradesh) were found to be having the highest range of Shannon diversity index (1.92 - 3.00) and the accessions sourced from Kasaragod (Kerala) and Naintal (Uttarakhand) were reported to be having a high range of diversity (1.44 - 1.92). A medium level in diversity index (0.96 - 1.44) was observed for the accessions sourced from Dehradun (Uttarakhand); Lajaul &Spiti (Himachal Pradesh), Narmada (Gujarat) and Warangal (Telangana). The GIS map plotted on the basis of the coefficient of variation (based on the PLI values due to mite infestation in chilli genotypes) revealed that the genotypes collected from Nainital (Uttarakhand);Kullu and Lajaul&Spitidistricts (Himachal Pradesh) and Kasaragod (Kerala) recorded the highest (46-58) value (Fig.2). Accessions sourced from and Dehradun (Uttarakhand); Narmada (Gujarat) andSonipat (Haryana) showed a high coefficient of variation (34-46); while the collections from and Warangal (Telangana) and Champawat (Uttarakhand) recorded a medium (11-23) variation.

Geographical information system is a tool for the analysis of crop diversity and it enables us to comprehend the distribution of diversity on the geographical scale and also helps in planning targeted exploration trips to collect germplasm with preferred characters. GIS mapping may be effectively used for documentation, diversity analysis, identifying gaps in collection, assessment of loss of diversity, developing new strategies for conservation, and sustainable utilization, particularly in the wake of recent international developments related to food and nutritional security. Ganeshaiah *et al*., (2003) successfully used DIVA-GIS in predicting the potential distribution of sugarcane wooly aphid, *Ceratovacuna manigera* Zehntner in South India. GIS mapping has been successfully used in assessing biodiversity and in identifying *Canavalia* genotypes with high fatty acid content (Sivaraj *et al*., 2010); categorising areas of high diversity of *Phaseolus* bean (Jones *et al*., 1997); wild potatoes (Hijmans and Spooner, 2001); horse gram (Sunil *et al*., 2008); Piper (Parthasarathy*et al*., 2006); linseed (Sivaraj*et al*., 2009); and medicinal plants Southeast Coastal Zone (Varaprasad*et al*., 2007). The current study on GIS mapping identified the areas with greater diversity in chilli genotypes possessing a wider range of reaction to *P. latus* infestation.

The present study on indigenous collections of chilli germplasm had resulted in identification many resistant(IC342390, IC572492, IC337281 and IC344366) and moderately resistant sourcesto the broad mite, *P. latus* infestation. The identified source of resistance would be of immense use in the breeding programmes for the development of mite resistance verities in chilli.The GIS mapping and diversity analysis showed that the genotypes sourced from Sonipat (Haryana) and Kullu (Himachal Pradesh) were found to be having the highest range of Shannon diversity index while the genotypes collected from Nainital (Uttarakhand), Kullu and Lajaul&Spiti districts (Himachal Pradesh) and Kasaragod (Kerala) recorded the highest co-efficient of variation for the mite infestation in chilli.Further exploration could be targeted in the recognised areas for identifying good sources of resistance in chilli for *P.latus*.

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Table1: Collection sites of chilli genotypes screened for their reaction to P. latus

State	District	Chilli Accessions*
Chhattisgarh	Bastar	IC561354 (19.2, 82.87)
Gujarat	Bhoruch	IC344636 (21.81, 74.14)
	Narmada	IC344650 (21.82, 73.63), IC344706 (21.5, 73.94), IC344727 (21.81, 73.51), IC330969 (21.8, 73.7)
Haryana	Rohtak	IC342410 (29.03, 76.32)
	Panipat	IC342420 (29.32, 76.97), IC342426 (29.34, 76.68)
	Karnal	IC342438 (29.7, 76.92)
	Jind	IC342442 (29.66, 76.11), IC342449 (29.31, 76.47)
	Sonipat	IC342457 (29.14, 76.56), IC342458 (29.16, 76.86), IC342461 (28.9, 77.15), IC342463 (29.2, 76.97), IC342464 (29.2, 76.97), IC342465 (29.05, 76.87)
	Saharanpur	IC342480 (29.8, 77.18)
Himachal Pradesh	Kullu	IC537623 (31.61, 77.35), IC537632 (32.09, 77.15), IC537645 (31.95, 77.18), IC537646 (31.95, 77.18), IC537650 (31.99, 77.23), IC537656 (32.09, 77.15), IC537657 (32.09, 77.15), IC537658 (31.61, 77.35), IC537659 (31.61, 77.35), IC537661 (31.94, 77.11), IC537662 (31.94, 77.11), IC537664 (31.97, 77.21)
	Lajaul&Spiti	IC537634 (32.7, 76.69)
Karnataka	Haveri	IC572454 (14.36, 75.3)
	Belgaum	IC572479 (16.27, 74.48)
	Gadag	IC572492 (15.25, 75.35)
Kerala	Kasaragod	IC344324 (12.29, 75.19), IC344325 (12.29, 75.19), IC344350 (11.84, 75.86), IC344364 (12.5, 75.27), IC344366 (12.5, 75.27), IC344367 (12.5, 75.27), IC344368 (12.5, 75.27), IC344370 (12.5, 75.27), IC344381 (12.4, 75.05), IC344383 (12.51, 74.98), IC344385 (12.51, 74.98), IC344386 (12.51, 74.98), IC344387 (12.51, 74.98)
Madhya Pradesh	Dhar	IC336754 (22.6, 75.3)
Sikkim	Namchi	IC274340 (27.23, 88.38)
Telangana	Warangal	IC344563 (17.97, 79.88), IC344575 (17.39, 79.89), IC344597 (17.39, 9.89)
Uttar Pradesh	Mathura	IC342390 (27.44, 77.73)
	Agra	IC342394 (27.25, 78.04), IC342400 (27.12, 78.02)
Uttarakhand	Pauri	IC337281 (29.28, 79.97)
	Champawat	IC338772 (29.43, 79.9), IC338775 (29.42, 80.08), IC338777 (29.31, 80.05), IC338778 (29.31, 80.05), IC338782 (29.22, 80.12), IC338786 (29.22, 80.12)
	Naintal	IC537578 (29.39, 79.53), IC537579 (29.39, 79.53), IC537581 (29.5, 79.48), IC537583 (29.22, 79.53)
	Dehradun	IC537595 (30.3, 78.01), IC537596 (30.3, 78.01), IC537599 (30.33, 78.01), IC537601 (30.33, 78.01)

*Figures in parentheses are the geographic co-ordinates of collection site designated as latitude and longitude

Table 2: Reaction of chilli genotypes in terms of the percent leaf curl index (PLI) to infestation of mites, P. latus(mean of three observations)

Accession	Kharif 2012-13			Kharif 2013-14			Pooled mean for two seasons	Resistance Category*
	45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT		
IC274340	40.67 (39.56)	49.67 (44.49)	54.00 (47.42)	60.33 (51.2)	61.67 (52.24)	42.33 (40.75)	51.45 (45.81)	HS
IC336754	56.00 (48.21)	41.67 (39.87)	58.33 (49.72)	40.67 (39.66)	49.67 (45.33)	42.67 (40.75)	48.11 (43.93)	S
IC337281	4.33 (11.31)	1.33 (0.65)	10.67 (17.71)	12.67 (20.71)	9.67 (17.92)	6.33 (17.17)	7.53 (15.89)	R
IC338772	56.67 (48.21)	53.67 (46.78)	42.33 (40.5)	52.00 (46.58)	45.67 (43.03)	46.33 (43.04)	49.45 (44.66)	S
IC338775	52.33 (45.91)	49.00 (44.49)	46.33 (42.83)	44.67 (41.99)	49.67 (45.33)	42.33 (40.75)	47.39 (43.49)	S
IC338777	40.67 (39.21)	41.33 (39.87)	38.33 (38.14)	40.33 (39.66)	49.67 (45.33)	38.33 (38.45)	41.44 (40.06)	S
IC338778	48.67 (43.62)	57.67 (49.08)	54.33 (47.42)	44.67 (41.99)	45.67 (43.03)	42.33 (40.75)	48.89 (44.35)	S
IC338782	20.33 (26.33)	25.33 (29.98)	26.67 (30.61)	24.67 (29.77)	21.33 (28.05)	38.00 (38.45)	26.11 (30.72)	S
IC338786	44.67 (41.32)	49.67 (44.49)	46.33 (42.83)	56.00 (48.88)	41.33 (40.71)	46.33 (43.04)	47.39 (43.49)	S
IC342390	4.00 (11.31)	5.33 (12.19)	2.33 (1.29)	4.67 (11.98)	1.33 (1.52)	2.33 (13.33)	3.33 (10.51)	R
IC342394	44.67 (41.32)	53.67 (46.78)	46.33 (42.83)	56.67 (48.88)	53.67 (47.62)	46.67 (43.04)	50.22 (45.11)	HS
IC342400	56.33 (48.21)	53.33 (46.78)	54.67 (47.42)	44.00 (41.99)	41.67 (40.71)	46.33 (43.04)	49.39 (44.63)	S
IC342410	25.33 (30.2)	30.67 (33.03)	30.67 (33.38)	37.67 (37.64)	31.67 (34.04)	45.33 (42.47)	33.56 (35.39)	S
IC342420	33.67 (35.12)	30.67 (33.03)	42.33 (40.48)	37.33 (37.64)	35.33 (36.46)	41.33 (40.15)	36.78 (37.32)	S
IC342426	25.33 (30.2)	22.67 (27.91)	18.33 (25.5)	29.67 (32.72)	31.00 (34.04)	45.00 (42.47)	28.72 (32.39)	S
IC342438	41.33 (39.8)	42.67 (40.13)	38.33 (38.16)	41.67 (40.17)	47.67 (43.44)	45.33 (42.47)	42.83 (40.86)	S
IC342442	65.33 (53.79)	62.67 (51.7)	70.33 (56.97)	69.00 (56.32)	67.67 (55.14)	73.00 (58.96)	68.06 (55.56)	HS
IC342449	21.33 (27.59)	22.67 (27.91)	22.67 (28.26)	21.33 (27.34)	15.00 (23.18)	33.33 (35.37)	22.72 (28.46)	MR
IC342457	21.00 (27.54)	30.67 (33.03)	22.67 (28.26)	33.00 (35.22)	19.00 (26.16)	53.67 (47.06)	29.95 (33.16)	S
IC342458	37.33 (37.48)	38.67 (37.81)	46.33 (42.78)	45.67 (42.33)	51.00 (45.74)	41.33 (40.15)	43.39 (41.18)	S
IC342461	53.33 (46.69)	54.67 (47.02)	50.33 (45.67)	57.33 (49.21)	43.33 (41.15)	57.33 (49.36)	52.72 (46.54)	HS
IC342463	57.33 (49.01)	58.67 (49.34)	54.67 (47.37)	45.67 (42.33)	39.33 (38.82)	41.33 (40.15)	49.50 (44.72)	S
IC342464	17.33 (24.82)	22.00 (27.91)	22.67 (28.26)	17.00 (24.36)	23.00 (28.93)	29.00 (32.87)	21.89 (27.88)	MR
IC342465	45.33 (42.1)	38.67 (37.81)	58.33 (49.69)	49.67 (44.62)	47.67 (43.44)	37.33 (37.79)	46.17 (42.78)	S
IC342480	30.33 (33.4)	28.00 (33.76)	24.33 (29.76)	24.00 (29.48)	32.67 (34.58)	47.00 (43.54)	31.06 (33.85)	S
IC344324	26.33 (30.9)	20.67 (28.38)	24.67 (29.76)	16.33 (23.73)	24.33 (29.47)	39.00 (38.92)	25.22 (30.13)	S
IC344325	50.33	48.33	52.67	48.00	48.33	43.00	48.44	**S**

Table continued….

	(45.09)	(45.66)	(46.56)	(44.21)	(43.98)	(41.24)	(44.09)	
IC344350	46.33	60.33	52.33	48.33	40.33	47.00	49.11	S
	(42.8)	(52.57)	(46.56)	(44.27)	(39.36)	(43.54)	(44.47)	
IC344364	18.33	16.33	12.67	12.67	16.33	23.67	16.67	MR
	(25.52)	(25.39)	(20.7)	(20.42)	(23.71)	(29.03)	(24.09)	
IC344366	6.33	12.67	8.33	8.00	4.67	7.00	7.83	R
	(15.39)	(22.08)	(16.86)	(16.58)	(11.68)	(16.13)	(16.25)	
IC344367	14.33	20.00	12.33	16.33	16.33	11.33	15.11	MR
	(22.33)	(28.38)	(20.7)	(23.73)	(23.71)	(19.96)	(22.86)	
IC344368	58.67	52.33	48.33	48.33	47.00	47.33	50.32	HS
	(49.71)	(47.95)	(44.27)	(44.24)	(41.68)	(43.54)	(45.17)	
IC344370	34.33	40.33	40.33	36.67	56.33	47.67	42.61	S
	(35.82)	(41.04)	(39.65)	(37.01)	(48.57)	(43.54)	(40.73)	
IC344381	50.33	52.33	44.33	52.00	44.33	47.33	48.44	S
	(45.09)	(47.95)	(41.97)	(46.29)	(41.68)	(43.54)	(44.09)	
IC344383	54.33	56.33	52.67	48.67	52.33	51.00	52.56	HS
	(47.39)	(50.25)	(46.56)	(44.13)	(46.27)	(45.83)	(46.45)	
IC344385	6.33	12.33	12.67	8.33	12.33	11.67	10.61	MR
	(15.39)	(22.08)	(20.7)	(16.58)	(20.4)	(19.96)	(19.21)	
IC344386	61.00	52.33	45.33	48.00	44.33	52.00	50.50	HS
	(53.29)	(46.22)	(42.01)	(44.55)	(41.64)	(46.57)	(45.27)	
IC344387	21.33	28.33	13.33	24.67	28.00	44.33	26.67	S
	(29.1)	(32.03)	(21.74)	(30.04)	(32.04)	(41.98)	(31.08)	
IC344563	49.33	52.33	49.33	52.67	52.33	52.33	51.39	HS
	(46.38)	(46.22)	(44.3)	(46.84)	(46.24)	(46.57)	(45.78)	
IC344575	45.33	60.33	45.33	44.67	48.00	48.33	48.67	S
	(44.08)	(50.84)	(42.01)	(42.25)	(43.94)	(44.28)	(44.22)	
IC344597	37.33	32.67	37.33	36.00	32.33	48.33	37.33	S
	(39.4)	(34.33)	(37.39)	(37.57)	(34.54)	(44.28)	(37.65)	
IC344636	45.33	48.33	45.33	48.67	52.33	52.67	48.78	S
	(44.08)	(43.93)	(42.01)	(44.55)	(46.24)	(46.57)	(44.28)	
IC344650	61.00	52.33	65.33	52.67	52.33	52.33	56.00	HS
	(53.29)	(46.22)	(53.7)	(46.84)	(46.24)	(46.57)	(48.42)	
IC344706	57.67	56.33	49.33	48.67	56.67	68.00	56.11	HS
	(50.97)	(48.52)	(44.3)	(44.55)	(48.33)	(55.97)	(48.49)	
IC344727	37.33	48.67	41.33	40.67	48.67	52.33	44.83	S
	(39.4)	(43.93)	(39.71)	(39.93)	(43.94)	(46.57)	(42.02)	
IC537578	49.33	48.33	45.33	44.00	40.33	48.00	45.89	S
	(46.38)	(43.93)	(42.01)	(42.25)	(39.32)	(44.28)	(42.62)	
IC537579	61.33	60.33	45.33	44.67	48.00	52.33	52.13	HS
	(53.29)	(50.84)	(42.01)	(42.25)	(43.94)	(46.57)	(46.13)	
IC537581	65.67	44.67	49.33	44.33	44.67	52.33	50.17	HS
	(55.65)	(41.63)	(44.3)	(42.25)	(41.64)	(46.57)	(45.08)	
IC537583	25.33	17.67	10.33	18.00	14.67	16.33	17.16	MR
	(29.57)	(23.78)	(19.59)	(25.67)	(22.56)	(23.67)	(24.46)	
IC537595	25.33	29.67	18.33	26.00	30.67	44.33	29.06	S
	(29.57)	(32.15)	(25.88)	(31.05)	(33.43)	(41.64)	(32.67)	
IC537596	33.67	45.33	38.00	42.67	50.67	48.00	43.06	S
	(34.68)	(41.75)	(38.55)	(40.65)	(45.12)	(43.94)	(40.99)	
IC537599	9.33	9.67	10.33	14.00	10.67	12.33	11.06	MR
	(16.67)	(16.63)	(19.59)	(22.68)	(19.25)	(20.36)	(19.41)	
IC537601	41.33	37.67	38.33	46.00	46.00	44.33	42.28	S
	(39.46)	(37.33)	(38.55)	(42.95)	(42.83)	(41.64)	(40.54)	
IC537623	49.33	53.67	46.33	42.33	50.67	52.33	49.11	S
	(44.08)	(46.34)	(43.17)	(40.65)	(45.12)	(46.23)	(44.47)	
IC537632	53.33	49.67	46.67	50.33	46.33	48.33	49.15	S
	(46.37)	(44.05)	(43.17)	(45.24)	(42.83)	(43.94)	(44.51)	
IC537634	57.33	57.00	62.33	54.33	66.67	56.33	59.12	HS
	(48.67)	(48.64)	(52.44)	(47.54)	(54.52)	(48.53)	(50.16)	

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Table continued….

IC537645	49.33 (44.08)	53.67 (46.34)	54.33 (47.76)	54.00 (47.54)	50.67 (45.12)	52.33 (46.23)	52.49 (46.41)	HS
IC537646	57.33 (48.67)	45.33 (41.75)	38.33 (38.55)	46.67 (42.95)	54.67 (47.42)	52.00 (46.23)	49.0 (44.44)	
IC537650	57.00 (48.67)	49.67 (44.05)	54.67 (47.76)	46.00 (42.95)	42.67 (40.33)	52.33 (46.23)	50.43 (45.23)	HS
IC537656	49.33 (44.08)	45.33 (41.75)	42.33 (40.87)	54.33 (47.54)	50.67 (45.12)	48.33 (43.94)	48.39 (44.06)	S
IC537657	8.33 (16.63)	14.67 (22.2)	18.33 (25.4)	10.33 (19.04)	7.00 (16.08)	22.67 (28.47)	13.56 (21.59)	MR
IC537658	16.33 (23.77)	18.67 (25.18)	18.33 (25.4)	14.33 (22.34)	23.00 (28.97)	18.33 (25.48)	18.17 (25.22)	MR
IC537659	24.33 (29.53)	26.67 (30.57)	30.33 (33.77)	18.00 (25.33)	23.33 (28.97)	42.33 (41.13)	27.52 (31.61)	S
IC537661	20.67 (26.76)	18.67 (25.18)	22.33 (28.38)	18.67 (25.33)	15.00 (23.22)	26.33 (31.23)	20.26 (26.74)	MR
IC537662	68.33 (55.73)	50.67 (44.76)	50.33 (45.67)	66.33 (54.3)	51.67 (45.78)	70.67 (57.44)	59.76 (50.57)	HS
IC537664	52.00 (46.33)	42.67 (40.17)	54.33 (47.96)	50.00 (44.9)	43.33 (41.19)	50.33 (45.75)	48.78 (44.28)	S
IC561354	24.33 (29.53)	18.67 (25.18)	34.33 (36.27)	26.67 (30.71)	23.33 (28.97)	46.33 (43.45)	28.94 (32.53)	S
IC572454	24.67 (29.53)	14.67 (22.2)	18.33 (25.4)	22.00 (28.1)	19.00 (26.21)	26.33 (31.23)	20.83 (27.15)	MR
IC572479	24.33 (29.53)	22.67 (27.95)	34.33 (36.27)	22.67 (28.18)	31.00 (34.09)	50.33 (45.75)	30.89 (33.75)	S
IC572492	4.33 (11.74)	6.67 (15.05)	6.33 (13.36)	2.33 (10.31)	3.67 (11.19)	10.33 (18.34)	5.61 (13.72)	R
IC330969	24.67 (29.53)	22.67 (27.95)	22.33 (28.38)	14.33 (22.34)	23.47 (28.97)	26.33 (31.23)	22.30 (28.17)	MR
ArkaLohit	21.33 (27.44)	23.33 (28.77)	20.67 (26.98)	22.67 (28.37)	24.00 (29.3)	24.00 (29.27)	22.67 (28.42)	MR
ArkaSuphal	22.67 (28.43)	22.67 (28.37)	24.00 (29.25)	22.00 (27.88)	24.00 (29.27)	24.67 (29.69)	23.34 (28.87)	MR
CA960	45.00 (42.32)	44.67 (41.92)	48.00 (43.83)	44.67 (41.91)	46.67 (43.06)	47.33 (43.45)	46.06 (42.72)	S
LCA353	28.00 (31.87)	29.33 (32.72)	28.67 (32.22)	24.67 (29.76)	26.00 (30.58)	29.33 (32.61)	27.67 (31.72)	S
PusaJwala	5.33 (12.06)	5.67 (12.06)	9.33 (17.7)	10.00 (18.34)	12.67 (20.72)	9.33 (17.7)	8.72 (17.17)	R
CV (%)	8.51	4.26	11.22	6.91	12.22	8.73	7.11	
CDat 5%	10.76	11.49	8.40	7.03	7.43	9.53	3.23	

Figures in parentheses are arc sine transformed values; * R - Resistant (PLI: 0-10); MR - Moderately resistant (PLI: 11-25): S- Susceptible (PLI: 26-50): HS - Highly susceptible (PLI: 51-100)

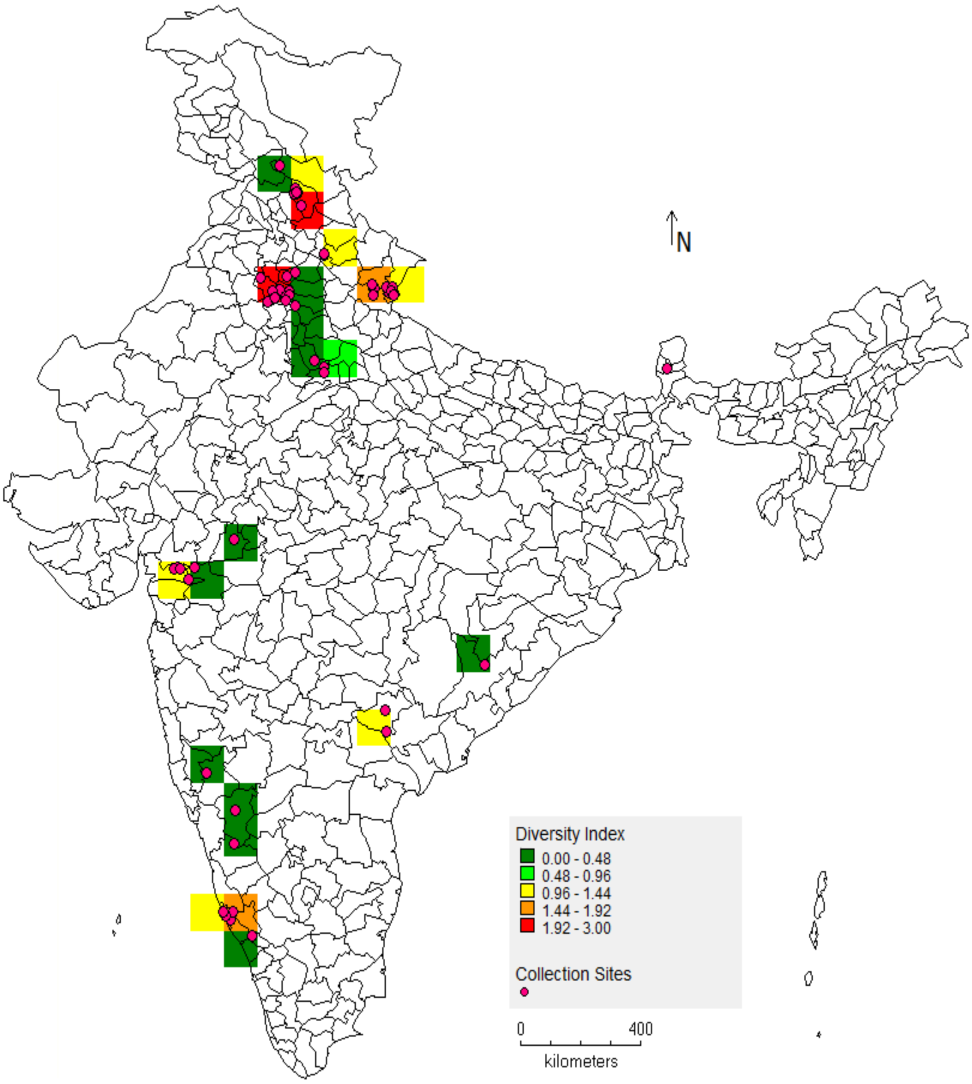

Fig. 1: GIS grid map for diversity index in chilli genotypes with respect to infestation of *P. latus*

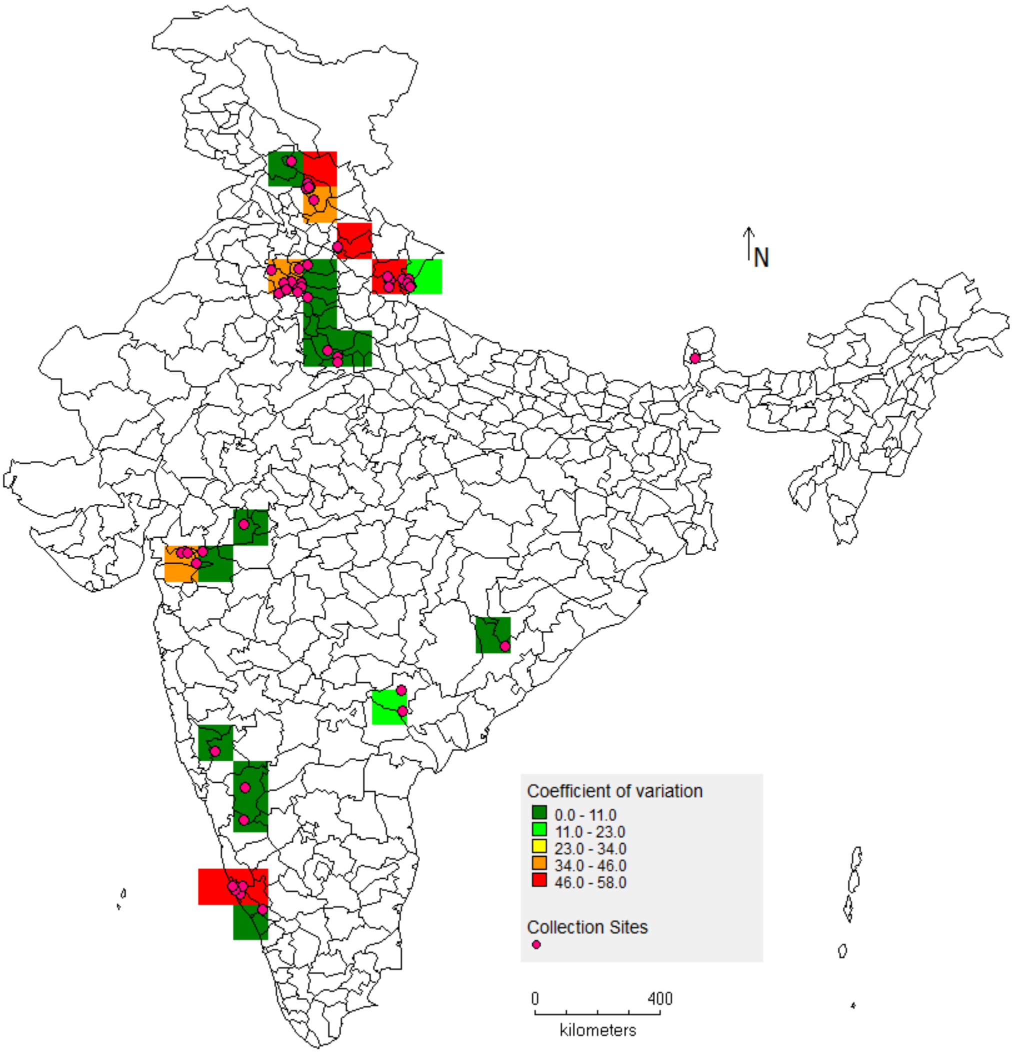

Fig. 2: GIS grid map for coefficient of variation in chilli genotypes with respect to infestation of *P. latus*