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Evaluation of chilli (*Capsicum annuum* L.) genotypes for Murda complex and fruit borer

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Abstract
To explore the possibility of sources of resistance and relative tolerance of the genotypes a total of 16 chilli genotypes were evaluated at Regional Horticultural Research and Extension Centre (RHREC), Kumbapur, Dharwad, University of Horticultural Sciences (UHS), Bagalkote during *kharif* season 2020-2021. The experiment was outlaid in randomized complete block design (RCBD) with 3 replications. Among the genotypes studied four genotypes (DCA-218, DCA-154, DCA-67 and BKNO-10) were noticed to be resistant against murda complex and for fruit borer DCA-218, DCA-154, GCS-946, SRS-02, GLP-28 were found resistant. None of the genotypes were noticed immune to pest and diseases.

Keywords: Chilli, pest and disease, murda complex, fruit borer

Introduction
Chilli (*Capsicum annuum* L.) associated to the genus capsicum under the solanaceae family with chromosome number 2n = 24 (Jyoti *et al*. 2008). It is the most essential spice and commercial vegetable of India because of its pungency, taste, appealing colour and flavour (Yatagiri *et al*. 2017) [10]. Chilli is domesticated in Peru and Mexico. Portuguese were the pioneer to introduce chilli in India. The pungency is because of alkaloid capsaicin. It is also used for industrial purpose for extraction of oleoresin. Green fruit of chilli is one of the richest sources of anti-oxidant. Pungency in chilli is present in placenta and pericarp of fruit. The pungency and heating properties of capsaicin is utilized in cosmetic and pharmaceutical industries in lowering cholesterol and also used in pain balms. Green chilli is rich source of vitamin-C. India is the world's largest producer, consumer and exporter of chilli contributing almost one fourth of the world production (Maurya *et al*. 2016) [14]. India is the world leader in chilli production followed by China, Thailand, Ethiopia and Indonesia. Cultivation spans over an area of 364 million hectare, with a production of 3720 million tonnes (Anon, 2019) [1]. In India, major chilli producing states are Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Madhya Pradesh. Major chilli growing districts in Karnataka are Haveri, Dharwad, Belgaum and Shivamogga. The number of limiting factors have been noticed for the low productivity. A major constraint in the production is the pest complex of chilli with more than 293 insects and mite species infecting the crop in the field as well as in storage. In Karnataka, thrips, mites and white flies have been noticed as key sucking pests of chilli of which leaf curl caused by mite and thrips is serious. In addition to these, fruit borers also cause maximum infection to the crop both during vegetative and fruit formation stages. The crop loss by three major pests, where, 30-50% by thrips (*Scirtothrips dorsalis*), 30-70% by mites (*Polyphagotarsonemus latus*) (Datta and Chakravarthy 2013) [15] and 30-40% by fruit borers *Helicoverpa armigera*. These sucking pests cause serious damage to the chilli crop by direct feeding and *Bemicia tabaci* transmits deadly disease called "leaf curl disease" or "Murda complex" (Kumar *et al*. 2009) [16] and (Kumar *et al*. 2011) [11]. With this in back drop, an attempt was made to evaluate the 16 elite genotypes against chilli murda complex and fruit borer.

Material and Methods
The current study was conducted at Regional Horticultural Research and Extension Centre (RHREC), Kumbapur, Dharwad, University of Horticultural Sciences (UHS), Bagalkote during *kharif* season 2020-2021. The soil is red sandy loam soil (Alfisol) with a uniform fertility. It is located at an altitude of 678 meters above mean MSL at 15°16'N latitude and 75°07' E longitude in the Northern Transition Zone of Karnataka (Zone-II). The experimental

design was Randomized Complete Block Design (RCBD) with three replications. The experimental material consisted of 16 chilli genotypes. The plot size was 3×3 m^2. The spacing followed was 70 cm x 45 cm. 5 randomly selected plants were tagged in the replication without any pesticide spray exclusively maintained for the study for the reaction of genotypes to pest and diseases. The scoring was given on 95th day after transplanting for pest like fruit borer by using the scale adopted by Shivaramu and Kulkarni (2008) [7]. Scoring for leaf curl virus as given by Sawant *et al.* (1986) [6] was utilized for grouping the accessions into different categories. The data collected from all the observations was pooled and analyzed with the help of MSTAT-C statistical software.

$$\text{Per cent fruit damage} = \frac{\text{Number of fruits damaged}}{\text{Total number of fruits}} \times 100$$

$$\text{PDI} = \frac{\text{Sum of numerical values grades}}{\text{Number of plants observed}} \times \frac{100}{\text{Maximum disease rating}}$$

Table 1: Scales used for scoring fruit borer damage (Shivaramu and Kulkarni, 2008)

Category (%)	Reaction
0-5	Resistant (R)
5-10	Less Susceptible (LS)
10-20	Susceptible (S)
>20	Highly Susceptible (HS)

Table 2: Scales used for scoring murda complex (Savant *et al*, 1986)

Grade	Scale (%)	Reaction
1	0.0-0.0	Immune (I)
2	0.10-25.00	Resistant (R)
3	25.10-50.00	Moderately Resistant(MR)
4	50.10-75.00	Susceptible (S)
5	75.10-100.00	Highly Susceptible (HS)

Results and Discussion

A field inspection was undertaken to screen 16 chilli genotypes against murda complex and fruit borer under natural field condition, where control measures were taken. High degrees of yield loss because of infestation of chilli crop by insect pest and diseases have been detailed by Dhandapani and Kumar swami (1983) [2]. Fruit borers are the major pests on chilli and white flies are components of murda complex (leaf curl) in chilli. The range of per cent murda complex disease is 9 (DCA-218) to 66 (GLP-51) and the range of per cent fruit borer infestation is 3.5 (DCA-218) to 17 (GLP-18) (Table 1). Based on murda complex and fruit borer damage, the genotypes were divided into immune, resistant, moderately resistant, susceptible and highly susceptible by adopting the method of Niles (1980) [4] (Table 2 and 3). Among 16 chilli genotypes, no immune genotypes were found for murda complex whereas, four genotypes were recorded as resistant (DCA-218, DCA-154, DCA-67, BKNO-10), 8 moderately resistant (DCA-118, DCA-268, GCS-946, SRS-02, GLP-32, GLP-28, GLP-43, GLP-48) and 4 were susceptible (DCA-07, GLP-18, GPM-1205, GLP-51) (Table 2). The potential genotypes with resistant reaction against fruit borer damage were (DCA-218, DCA-154, GCS-946, SRS-02, GLP-28), 7 were less susceptible (DCA-67, BKNO-10, DCA-118, DCA-268, GLP-32, GLP-43, DCA-67) and 4 were highly susceptible (GLP-51, GPM-1205, GLP-18, GLP-48) (Table 3). This type of wide variation in chilli genotypes for reaction to pest and disease have also been recorded by Puttarudraiah (1959) [12], Shivaramu (1999) [19], Sarath Babu *et al.* (2002) [5], Gayatridevi and Giraddi (2006) [17], Shivaramu and Kulkarni (2008) [7], Nagaraj *et al.* (2012), Asif *et al.* (2016) [9], Kurbett *et al.* (2018) [3] and Latha and Hunumanthraya (2018) [11]

Table 1: Reaction of chilli genotypes to pest and disease

Sl. No.	Genotypes	Codes	Murda complex (%)	Reaction	Fruit borer (%)	Reaction	Yield per hectare (q/ha)
1	SRS-02	T-1	34 (35.66*)	MR	4.43 (12.15)	R	198.66
2	DCA-218	T-2	9 (17.46)	R	3.5 (10.78)	R	188.41
3	DCA-118	T-3	33 (35.06)	MR	8.06 (16.49)	LS	35.00
4	DCA-154	T-4	20.3 (26.78)	R	4.83 (12.69)	R	232.66
5	BKN0-10	T-5	12 (20.27)	R	8.46 (16.91)	LS	96.66
6	GPM-1205	T-6	62 (51.94)	S	14.53 (22.38)	S	28.00
7	DCA-268	T-7	32 (34.45)	MR	7 (15.34)	LS	252.66
8	GCS-946	T-8	40 (39.23)	MR	3.8 (11.24)	R	176.09
9	DCA-07	T-9	48 (43.85)	S	10 (18.43)	LS	71.00
10	DCA-67	T-10	19 (26.49)	R	10.3 (18.72)	LS	44.56
11	GLP-18	T-11	47 (43.27)	S	17 (24.35)	S	99.16
12	GLP-28	T-12	31 (33.83)	MR	4.5 (12.25)	R	51.85
13	GLP-32	T-13	35 (36.63)	MR	9.63 (18.08)	LS	16.83
14	GLP-43	T-14	42 (40.39)	MR	8.5 (16.95)	LS	62.33
15	GLP-51	T-15	66 (54.32)	S	12 (20.27)	S	84.95
16	GLP-48	T-16	31 (33.83)	MR	13.6 (21.70)	S	106.00
	Mean		34.71		8.76		109.05
	S.Em ±		1.44		0.42		3.25
	C.D (0.05)		4.15		1.23		9.40
	CV (%)		7.18		8.47		5.17

* Figures in the parenthesis are arc sign transformed value

R – Resistant LS – Less susceptible

MR - Moderately resistant S – Susceptible

Table 2: Reaction of chilli genotypes to murda complex under field condition

Reaction	Number of lines	Genotypes
Immune (0.0%)	-	Nil
Resistant (0.1025.00%)	4	DCA-218, DCA-154, DCA-67,BKNO-10
Moderately resistant (25.10-50.00%)	8	DCA-118, DCA-268, GCS-946, SRS-02, GLP-32, GLP-28, GLP-43, GLP-48
Susceptible (50.10-75.00%)	4	DCA-07, GLP-18, GPM-1205, GLP-51

Table 3: Reaction of chilli genotypes to fruit borer (*Helicoverpa armigera*) infestation under field condition

Reaction	Number of lines	Genotypes
Resistant (0.5%)	5	DCA-218, DCA-154, GCS-946, SRS-02, GLP-28,
Less susceptible (5-10%)	7	DCA-67, BKNO-10, DCA-118, DCA-268, GLP-32, GLP-43, DCA-67
Susceptible (10-20%)	4	GLP-51, GPM-1205, GLP-18, GLP-48,

Conclusion

The current investigation was undertaken screening of chilli genotypes against murda complex and fruit borer, none of them was found completely free from the attack of pest and disease. The genotypes, The DCA-218, DCA-154, DCA-67 and BKNO-10 were resistant to murda complex and DCA-218, DCA-154, GCS-946, SRS-02 and GLP-28 were resistant to fruit borer damage. The highest fruit yield of chilli was also obtained in the DCA-268, DCA-154 followed by SRS-02. Many chemical management of these pests have been reported, the most economical and eco-friendly option is to develop and use a resistant source (Jogi 2012) [20].

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