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Screening of elite genotypes of chilli (Cv. Byadgi Kaddi) against pest complex

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Abstract
In order to explore the possibility of sources of resistance and relative tolerance of the cultivars a total of 48 germplasms consisting of diverse phenotypic and genetic makeup were evaluated against chilli thrips, *Scirtothrips dorsalis* Hood, mites *Polyphagotarsonemus latus* Banks, damages under open field condition. Among these, based on the observation on percent leaf curl index, four genotypes (BK-14, BK-16, BK- 21, BK-36) were found to be moderately resistant against thrips infestation and four genotypes were categorised under moderately resistant (BK-16, BK-26, BK-31, BK-47, BK-48).

Keywords: Chilli, insect pests, *Polyphagotarsonemus latus*

1. Introduction
Chilli (*Capsicum annuum* L.) is one of the major vegetable and spice crop grown in the country. It is a important versatile spice as well as vegetable crop. Chilli is mainly used in culinary adding flavour, colour, pungency and rich source of vitamins like A, C and E having medicinal properties. India is the largest consumer and exporter of chilli in the world with a production of 14.92 lakhs tonnes from an area of 7.75 lakh hectares. In Karnataka, chilli occupies an area of 2.74 lakhs ha with a production of 1.44 lakhs tonne with the productivity of 4.85 quintals ha^{-1}. Byadgi chilli cultivars are known for their acceptable pungency and bright red colour value and considered as promising export varieties. India being the largest chilli producer, the number of limiting factors have been identified for the low productivity. A major bottle neck in the production is the pest complex of chilli with more than 293 insects and mite species debilitating the crop in the field as well as in storage. The major insect pests that attack chilli are aphids (*Myzus persicae* Sulzer and *Aphis gossypii* Glover), mites (*Polyphagotarsonemus latus* Banks) and thrips (*Scirtothrips dorsalis* Hood). In Karnataka, thrips, mites and white flies have been identified as key sucking pests of chilli of which leaf curl caused by mite and thrips is serious. In addition to these, pod borers also cause maximum damage to the crop both during vegetative and fruit formation stages. The crop loss by three major pests, where, 30-50% by thrips (*S. dorsalis*), 30-70% by mites (*P. latus*). These pests cause serious damage to the chilli crop by direct feeding and transmitting deadly disease called "leaf curl disease" or "Murda complex". Keeping this in back drop, an attempt was made to evaluate the 48 elite genotypes against chilli insect pests.

2. Materials and Methods
The present investigation was carried out during kharif 2017-18 at Havelli farm College of Horticulture Bagalkot and screened under field conditions during *kharif* 2017. 48 genotypes (Byadagi kaddi) of chilli in a randomized block design with two replications. All the agronomic practices were followed except plant protection according to the package of practices. Five plants were randomly selected in each genotype and visually rated for thrips infestation based on upward leaf curl damage. The rating was used for recording the thrips infestation done at 30 days intervals with symptoms severity on a 0-4 scale as per the standard procedure given below. Similarly for mites, five plants were randomly selected and visually rated for mites infestation based on downward leaf curl damage. The rating was done at 30 days intervals as per the standard procedure from Table 1. Two observations were made during the peak activity of population at 13 and 15 Weeks after transplanting. Adopting one way ANOVA statistical analysis. The data recorded from all the observations was pooled and analyzed with the help of MSTAT-C statistical software, a preliminary classification of the

genotypes was made against *S. dorsalis* and *P. latus* incidence and the genotypes were classified as resistant, moderately resistant, susceptible and highly susceptible. The entries falling in each category were represented in the form of histograms.

Table 1: Scoring procedure for thrips and mites

Scoring	Category	Symptoms
0	1	No leaf curling (healthy plant)
1	< 25%	(1-25%) low curling
2	26-50%	(26-50%) moderate curling
3	51- 75%	(51-75%) heavy curling
4	75%	(>75%) very high curling

(Niles, 1980)

3. Results and Discussion

Present investigation on screening of seventy chilli genotypes (Cv. Byadagi kaddi) against thrips and mites were classified in to four categories of resistance based on the LCI (Leaf Curl Index). The findings of the experiments are presented here under.

The reaction of genotypes for thrips, among 48 different genotypes screened, the genotypes *viz.*, (BK-14, BK-16, BK-21, BK-36) recorded relatively lowest LCI (Leaf Curl Index) respectively, hence categorised under moderately resistant group (Table 3). On the other hand 18 were slightly resistant genotypes, 22 were categorized into less susceptible genotypes and 5 were registered consistantly higher leaf curl damage hence were grouped into highly susceptible genotypes (Table 3). This may be attributed to a phytophagous insect faces purely mechanical problem such as gaining a firm attachment on the plant surface and penetrating the hard tissue. The problem of obtaining secured anchorage on the smooth surface of plant organ exposed to wind and rain presents formidable difficulties. A smooth cuticle which was hard in nature was quite resistant to sucking pests. The plant height has positive association with thrips damage, the increase in plant height results in more young flesh which attracts the thrips population. Further, hybrid Tejaswini performed better with respect to yield and showed resistance to murda complex due to its rough leaf and higher phenol with moderate potassium content might have repelled the thrips population and resulted less thrips infestation. Similarly, Guntur-4, Pusa Jwala and hybrid Tejaswini recorded less population of mites, thrips and the lowest leaf curl index and proved tolerant to pest damage which has thick leaf, low sugar content, high chlorophyll and phenol content might have favored the tolerance. Any leaf character that interferes with the thrips life-cycle is a potential resistance factor which may contribute to the mechanism of defence against thrips.

Similarly the reaction of genotypes for mites, the mean data clearly indicated that, the same 48 chilli germplasm lines exhibited wide differences in causing damage indices of yellow mite, however, none of them was found immune to this pest (Table 4). On the basis of symptoms caused by mite, four genotypes were identified as moderately resistant such as BK-16, BK-26, BK-31, BK-47, BK-48showing leaf curl indices of respectively. Data on LCI showed no statistical difference among many genotypes. However, based on the percentage of plants infested, 33 genotypes were categorized into slightly resistant. The 8 genotypes were grouped under less susceptible category *viz.*, respectively and no genotypes were found highly susceptible to this pest from (Table 4). The resistant BK-5, BK-6, BK-7, BK-20, BK-24, BK-29, BK-32.Nature of the genotypes can be attributed to higher leaf thickness. Similar opinion was expressed by screening of 58 genotypes against *P. latus* and found IHR- that 243-1-1-15 and *Musalwadi* selection were promising against the mite infestation. Total sugars and proteins content were high in susceptible entries which might support mite infestation compared to the resistant entries. Five resistant accessions to *P. latus* were identified. The negative non significant correlation with plant height and population may be due to lack of dispersal behaviour through wind in mite perhaps led to a failure in interception by the taller genotypes as was noticed. The present study also resulted in identification of good number of moderately resistant genotypes for the broad mite infestation in chilli.

Table 2: *Per se* performance of elite genotypes of chilli (Cv. Byadgi kaddi) for entomological and yield parameters

Sl. No.	Genotypes	LCI due to thrips		LCI due to mites		Mean			
		13 WAT	15 WAT	13 WAT	15 WAT	LCI due to thrips	LCI due to mites	Fruit yield per plant(g)	Fruit yield per ha(q)
1	BK-01	2.25	2.50	1.70	1.85	2.40	1.78	31.70	8.75
2	BK-02	1.95	3.00	1.85	2.35	2.23	2.10	43.37	12.04
3	BK-03	1.40	1.55	1.40	1.60	1.48	1.50	36.44	10.11
4	BK-04	2.15	1.20	1.10	1.60	2.08	1.35	40.42	11.15
5	BK-05	3.35	2.40	2.25	2.05	3.43	2.15	28.50	7.85
6	BK-06	1.80	2.50	1.80	2.30	2.15	2.05	38.60	10.65
7	BK-07	3.10	3.00	2.90	1.70	3.05	2.30	30.93	8.55
8	BK-08	1.10	3.00	1.95	1.40	1.35	1.68	34.65	9.55
9	BK-09	1.90	1.65	1.45	1.20	1.88	1.33	55.40	15.30
10	BK-10	1.80	1.30	1.80	1.20	1.65	1.50	30.99	8.55
11	BK-11	2.00	1.20	1.50	1.50	2.02	1.50	22.28	6.10
12	BK-12	1.60	2.00	1.60	1.80	1.80	1.70	31.09	8.60
13	BK-13	2.30	1.05	1.90	1.70	1.95	1.80	34.80	9.60
14	BK-14	1.70	1.32	1.70	1.05	0.66	1.38	40.37	11.19
15	BK-15	2.25	1.80	1.95	1.50	2.40	1.73	34.57	9.55
16	BK-16	2.00	1.10	1.05	0.80	0.55	0.93	56.69	15.70
17	BK-17	1.40	1.90	1.40	1.40	1.04	1.40	25.65	7.10
18	BK-18	1.45	2.50	1.70	1.50	1.98	1.60	32.54	8.95
19	BK-19	1.40	2.40	1.40	0.90	1.90	1.15	44.02	12.15
20	BK-20	3.00	2.30	1.90	2.45	2.65	2.18	32.65	9.06
21	BK-21	1.80	1.80	1.55	1.00	0.80	1.28	47.53	13.15

22	BK-22	3.00	2.40	1.60	2.70	2.70	3.15	29.91	8.29
23	BK-23	2.00	2.50	1.40	1.20	2.25	1.30	33.51	9.25
24	BK-24	2.80	2.75	2.50	2.25	2.78	2.38	33.59	9.30
25	BK-25	2.62	2.00	1.40	1.60	2.31	1.50	30.15	8.30
26	BK-26	1.90	1.68	1.00	0.94	1.79	0.97	40.60	11.25
27	BK-27	1.30	2.30	1.00	0.83	1.95	1.91	55.65	15.42
28	BK-28	1.7	2.70	1.60	1.55	1.73	1.58	35.41	9.80
29	BK-29	1.90	2.10	2.55	1.80	2.00	2.18	37.99	10.50
30	BK-30	1.50	2.20	1.50	1.60	1.85	1.55	33.18	9.19
31	BK-31	1.40	2.40	1.00	0.85	1.90	0.93	35.64	9.85
32	BK-32	3.45	2.60	2.80	2.30	3.03	2.55	34.56	9.55
33	BK-33	1.70	1.32	1.70	1.05	1.66	1.38	49.86	13.80
34	BK-34	2.30	2.60	1.40	1.30	2.45	1.35	38.42	10.65
35	BK-35	1.30	2.50	1.30	1.10	1.90	1.20	45.34	12.50
36	BK-36	1.40	2.40	1.00	0.85	0.90	1.68	50.07	13.86
37	BK-37	1.40	2.90	1.40	1.70	2.15	1.55	42.87	11.85
38	BK-38	1.60	2.80	1.60	1.10	1.80	1.35	38.09	10.50
39	BK-39	1.10	1.10	1.20	0.74	1.80	1.97	43.75	12.10
40	BK-40	1.20	2.50	1.20	1.10	1.85	1.15	43.76	12.10
41	BK-41	1.80	2.40	1.80	1.35	2.10	1.38	40.50	11.20
42	BK-42	1.70	2.30	1.70	1.35	2.00	1.53	40.49	11.20
43	BK-43	1.60	3.20	1.60	1.10	3.10	1.35	34.16	9.40
44	BK-44	1.70	2.50	1.70	1.30	2.70	1.50	48.66	13.45
45	BK-45	1.70	1.70	1.70	1.05	2.30	1.38	45.79	12.65
46	BK-46	3.90	2.10	3.50	3.10	3.00	3.30	20.25	5.60
47	BK-47	1.90	1.68	1.00	0.94	1.79	0.97	29.70	8.20
48	BK-48	1.40	2.80	1	0.96	2.10	0.98	30.92	8.55
Mean		1.97	2.16	1.75	1.61	2.17	1.68	37.83	10.45
S.Em ±		0.34	0.32	0.22	0.25	0.35	0.22	3.97	1.10
C.D. at 5%		0.95	0.90	0.63	0.72	1.00	0.62	11.31	3.13

WAT- Weeks After Transplanting LCI - Leaf Curl Index WAT- Weeks After Transplanting.

Table 3: Indexing of chilli genotypes into different grades on the basis of leaf curling due to thrips damage

Leaf Curl Index (LCI)	Reaction	No. of genotypes	Genotype
0	Resistant	0	-
0.01 - 1.0	Moderately resistant	4	BK-14, BK-16, BK- 21, BK-36
1.01 - 2.0	Slightly resistant	18	BK-3, BK-8, BK-9, BK-10, BK-12,BK-13, BK-17, BK-18, BK-19, BK-26, BK-27,BK-28, BK-29, BK-30, BK-33, BK-38, BK-39 BK-40, BK-47
2.01 - 3.0	Less Susceptible	22	BK-1, BK-2, BK-4, BK-6 BK-11, BK-15, BK-20, BK-22, BK-23, BK-24, BK-25, BK-29, BK-34, BK-37, BK-39, BK-41, BK-42, BK-44, BK-45 BK-46, BK-48
3.01 - 4.0	Highly susceptible	4	BK-5, BK-7, BK-32, BK-43

Table 4: Indexing of chilli genotypes into different grades on the basis of leaf curling due to mites damage

Leaf Curl Index (LCI)	Reaction	No. of genotypes	Genotype
0	Resistant	-	-
0.01 - 1.0	Moderately resistant	5	BK-16, BK-26,BK-31, BK-47, BK-48
1.01 - 2.0	Slightly resistant	33	BK-1,BK-3, BK-4, BK-8, BK-9, BK-10, BK-11, BK-12, BK-13, BK-14, BK-15, BK-17, BK-18, BK-19, BK-21, BK-23, BK-25, BK-27, BK-28,BK-30, BK-33, BK-34, BK-35, BK-36, BK-37, BK-38 BK-39 BK-40,BK -41,BK -42,BK-43, BK-44, BK-45
2.01 - 3.0	Less Susceptible	8	BK-2, BK-5, BK-6, BK-7, BK-20, BK-24, BK-29, BK-32,
4.0	Highly susceptible	2	BK-22, BK-46

4. Conclusion

Among 48 different genotypes screened, the genotypes *viz.*, BK-14, BK-16, BK- 21, BK-36 recorded relatively lowest LCI (Leaf Curl Index) against thrips, respectively and they were categorised under moderately resistant group. Whereas, four genotypes were identified as moderately resistant such as (BK-16, BK-26, BK-31, BK-47, BK-48) showing leaf curl against mites, respectively. With respect to the yield performance, highest dry chilli of 15.70 q ha^{-1} was harvested from BK-16 followed by BK-27 (15.42@ ha^{-1}) and BK - 9 (15.30 @ ha^{-1}).

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