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Survey for the severity of chilli anthracnose in northern parts of Karnataka

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Abstract

Chilli, *Capsicum annum* (L.) is an important spice and vegetable crop throughout the world, which is renowned to enhance the taste and aroma, it is an annual cash crop. The sustainability of chilli is affected by various biotic and abiotic stresses, major fungal foliar pathogen causing havoc in production, export and marketing is fruit rot or anthracnose of chilli. It is known to cause by major *Colletotrichum* species viz., *Colletotrichum capsici*, *Colletotrichum gloeosporioides*, *Colletotrichum acutatum* and *Colletotrichum coccodes*. Thus, conducting survey in major chilli growing belts helps in knowing disease intensity, suitable management measures and collection of isolates. Roving survey was conducted during *kharif* 2020 and *kharif* 2021 in Belagavi, Dharwad, Gadag and Haveri districts of northern Karnataka. Mean highest per cent disease index (PDI) was recorded in Dharwad district (36.95) whereas, lowest PDI of 32.93 in Belagavi district during both *kharif* seasons. Among the taluks surveyed, Annigeri taluk of Dharwad district recorded highest PDI of 43.65 during *kharif* 2020 and lowest PDI in Kundgol taluk (21.96). During *kharif* 2021, Kundgol taluk showed highest PDI of 50.35 and Ramdurg taluk (36.22) of Belagavi district recorded lowest PDI. Morphological examination of samples from the surveyed region revealed that *Colletotrichum capsici* and *C. acutatum* were the major species infecting chilli.

Keywords: Chilli, anthracnose, *Colletotrichum*, survey, northern Karnataka

Introduction

Chilli, *Capsicum annum* (L.) is an important spice and vegetable crop throughout the world. India is bestowed with wide variety of peppers where it is a leading producer, exporter with a major share in economy. Chilli belonging to *Solanaceae* family is enriched with minerals, vitamins and red coloured chillies with enhanced capsanthin have more vitamin A whereas, green chillies with vitamin C (Kumar and Kerketta, 2018) [3].

Chilli is also a rich source of red pigments namely capsanthin, capsorubin, cryptoxanthin and related carotenoids which are esters of capsanthin. Apart from this oleoresin can also be extracted from chillies and is extensively used in western countries in beverage industries, food preparations, cosmetics and medicines. Chilli extracts are used in wide range of medicines against tonsillitis, loss of appetite, intermittent fever, rheumatism, sore throat, diphtheria and hardened tumors.

The major chilli growing countries are India, Thailand, Pakistan, China, and Africa. India is the largest producer of chilli grown mainly in Tamil Nadu, Maharashtra, Karnataka, Nagaland, Telangana, Andhra Pradesh, West Bengal and parts of Madhya Pradesh. Indian chillies are famous for its colour, pungency and it is exported to countries like China, Sri Lanka, Malaysia, Singapore, Bangladesh, Thailand and UAE (Katediya *et al.*, 2019) [2].

India's area, production and productivity of green chillies are 364 thousand hectares, 3851 thousand metric tonnes (MT) and 10.58 MT/ ha respectively. Dry chillies are with an area of 683 000' hectares, 1702 000' MT and productivity of 10.58 MT/ ha. Among the states, Karnataka with 673.81 000' MT occupies prime position in green chillies production followed by Madhya Pradesh (669.16 000' MT) and Bihar with 451.19 000' MT (Anon., 2019) [8].

Chilli suffers from various fruit rot disease viz., Alternaria fruit rot by *Alternaria alternata* (Fr.) Keissler, *Alternaria solani* (Ellis and Martin) Jones and Grout, Aspergillus rot by *Aspergillus niger* (van Tieghem), Grey mold rot by *Botrytis cinerea* (De Bary), Phytophthora rot by *Phytophthora capsici* Leonian and *P. parasitica* Dastur (Mridha and Siddiqui, 1989) [7] affecting economic part. Other major diseases are powdery mildew (*Leveillula taurica*), bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*), chilli leaf curl virus (Choudhary *et al.*, 2013) [1]. Among all these, major fungal foliar pathogen affecting production, export and marketing is fruit rot or anthracnose of chilli (*Colletotrichum capsici*) (Syd.) Butler and Bisby,

which has emerged in both tropical and subtropical regions in impairing production. However, four *Colletotrichum* species viz., *Colletotrichum capsici*, *Colletotrichum gloeosporioides*, *Colletotrichum acutatum* and *Colletotrichum coccodes* have been reported as causal agents of chilli anthracnose and the major species are *C. capsici* and *C. gloeosporioides* (Rahman et al., 2011) [9]. In India anthracnose was first reported by Sydow during 1928 from Coimbatore (Mishra et al., 2018) [6]. The disease occurs on all the above parts of plant i.e. leaves, fruits and stem in three phases viz., (i) prevalent in the nursery (seedling blight or damping off stage), (ii) die back stage where the tips of branches defoliates and dry (iii) fruit rot stage in which red ripe fruits are infected. The last phase causes extensive damage to the fruits in lowering the fruit quality and marketability.

Material and Methods

Disease severity survey

A roving survey was conducted during *kharif* 2020 and *kharif* 2021 in major four chilli growing districts of Northern Karnataka viz., Belagavi, Dharwad, Gadag and Haveri. Per cent disease index was calculated by recording the disease severity based on 0-9 scale given by Mayee and Datar (1986) [5],

Disease severity survey

Grade	Description
0	No symptoms on the leaf or branch or fruit.
1	1-10% or less infection of the leaf or branch or fruit.
3	11-25% infection on the leaf or branch or fruit.
5	26-50% infection of leaf or branch or fruit.
7	51-75% infection of leaf or branch or fruit.
9	75% and above area of leaf or branch or fruit.

PDI was calculated by using the formula of Wheeler (1969)

[11] as given below;

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of individual rating}}{\text{Total number of samples examined} \times \text{Maximum disease rating}} \times 100$$

Morphological examination of surveyed samples

The samples collected were sectioned and observed under the microscope (40x) for spore characteristics and based on spore morphology the species were recorded.

Results

Symptoms

Symptoms of fruit rot of chilli include initiation of sunken water-soaked lesions followed by production of black dots of acervuli in concentric rings, which covers the entire fruit and such fruits fall off. Similarly, some fruits show sunken water-soaked lesions covered with orange sporulation as represented in Figure 1.

Severity of anthracnose

Roving survey results during *kharif* 2020 revealed that among the taluks, highest PDI of 43.65 was recorded in Annigeri taluk and lowest PDI of 21.96 in Kundgol taluk of Dharwad district. The highest PDI of 50.35 was recorded in Kundgol taluk of Dharwad district and least PDI of 36.22 in Ramdurg taluk of Belagavi district during *kharif* 2021. Among the districts surveyed during *kharif* 2020 and 2021, the average highest PDI was observed in Dharwad district (36.95) and least PDI was observed in Belagavi district (32.93).

Samples collected from surveyed locations (Figure 1) after morphological examination, showed two types of spore morphology among which *C. capsici* forms falcate or fusiform shaped conidia with central oil globule. *C. acutatum* spores were straight, cylindrical to clavate as shown in Figure 2.

Table 1: Severity of anthracnose in different taluks and districts of northern Karnataka

District	Taluk	<i>Colletotrichum</i> sp. recorded	Per cent disease index		Mean
			<i>Kharif</i> 2020	<i>Kharif</i> 2021	
Belagavi	Bailhongal	<i>C. acutatum</i> , <i>C. capsici</i>	22.56	46.48	34.52
	Ramdurg	<i>C. capsici</i>	26.49	36.22	31.35
	District mean				32.93
Dharwad	Annigeri	<i>C. capsici</i>	43.65	38.64	41.14
	Dharwad	<i>C. capsici</i>	27.19	42.82	35.00
	Hubballi	<i>C. acutatum</i> , <i>C. capsici</i>	25.34	40.58	32.96
	Kundgol	<i>C. acutatum</i> , <i>C. capsici</i>	21.96	50.35	36.15
	Navalgund	<i>C. capsici</i>	32.85	46.17	39.51
District mean				36.95	
Gadag	Gadag	<i>C. capsici</i>	36.17	40.46	38.31
	Shiratti	<i>C. capsici</i>	26.03	39.92	32.97
	Lakshmeshwar	<i>C. capsici</i>	24.54	42.28	33.41
District mean				34.89	
Haveri	Byadgi	<i>C. acutatum</i> , <i>C. capsici</i>	30.37	42.14	36.25
	Haveri	<i>C. capsici</i>	-	40.38	40.38
	Hirekerur	<i>C. acutatum</i> , <i>C. capsici</i>	-	43.08	43.08
	Ranebennur	<i>C. capsici</i>	30.14	45.56	37.85
	Savanuru	<i>C. capsici</i>	27.18	-	27.18
District mean				36.94	



Fig 1: Severity and symptoms of fruit rot of chilli in farmer's field



C. capsici

C. acutatum

Fig 2: Spore morphology of *C. capsici* and *C. acutatum*

Discussion

The highest PDI of 43.65 was recorded in Annigeri taluk and lowest PDI of 21.96 in Kundgol taluk of Dharwad district during *kharif* 2020. The highest PDI of 50.35 was recorded in kundgol taluk of Dharwad district and least PDI of 36.22 in Ramdurg taluk of Belagavi district during *kharif* 2021. Among the districts surveyed the average maximum PDI was observed in Dharwad district (36.95) and least PDI was observed in Belagavi district (32.93) during *kharif* 2020 and 2021. The increase in disease severity during *kharif* 2021 in Kundgol is mainly due to increase in rainfall during the fruiting period which favoured the pathogen dispersal and disease development.

These results are in accordance with Rajput, 2010^[10] who reported that the highest severity of anthracnose was noticed in Nalvadi (46.35) of Dharwad district followed by Saunshi (42.85) of Kundgol taluk. Among the three surveyed districts Dharwad showed highest PDI of 48.02 followed by Gadag district (36.75). Machenahalli, 2014^[4] conducted survey in Bellary, Belagavi, Dharwad, Gadag, Haveri, Koppal and Raichur districts of Karnataka during 2013-2014 where Bellary recorded highest fruit rot PDI of 14.51 followed by Gadag (13.62) and Haveri (11.65) whereas, Dharwad recorded 11.36 (PDI).

Conclusion

As discussed above, among the survey districts Dharwad is more prone to anthracnose of chilli because of wider cultivation, favourable environmental conditions and continuous growing of the same varieties. Intensive roving survey helps in knowing the losses caused by this disease, emergence of new species. Involvement of multiple species is making breeding for anthracnose resistance a challenging one.

Thus, integrated management approach is required to mitigate this major fungal pathogen in chilli.

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