



Management of anthracnose (*Colletotrichum capsici*) in chilli (*Capsicum annum* L.) through fungicides, bioagents and hand picking methods

K K Pandey & R C Gupta^{*1}

Division of Crop Protection, ICAR-Indian Institute of Vegetable Research,
PO-Jakhini (Shahanshahpur), Varanasi, Uttar Pradesh.

^{*}E-mail: rcg_9730@rediffmail.com

Received 28 March 2014; Revised 26 May 2014; Accepted 11 July 2014

Abstract

Field trials were conducted on chilli variety LCA-355 for management of anthracnose (*Colletotrichum capsici*) through fungicides, bioagents and hand picking of initial set of green fruits. The pooled data of two year trials revealed that, minimum percent disease index (PDI) of anthracnose (13.33%) on red chilli fruits was recorded in thrice hand picking of initial set of green chilli fruits. The data also indicated that foliar spray of bioagent *Aspergillus niger*-V @0.5% with sticker @0.1% resulted in 29.83 PDI which proved to be the second effective treatment. However, highest total yield (1947.95 g plot⁻¹) as well as healthy red chilli fruits (1286.66 g plot⁻¹) was recorded in foliar sprays with Mancozeb @0.3% followed by Azoxystrobin @0.1% (1125.00 g plot⁻¹) and lowest yield in control (550 g plot⁻¹). The highest PDI (59%) of anthracnose on dry red chilli fruits with lowest total yield (1068.97 g plot⁻¹) was recorded in control. The pooled data of field trials revealed that, the thrice hand picking of initial set of green chilli fruits performed better with lowest PDI and proved that hand picking is an effective method for management of anthracnose.

Keywords: anthracnose, bioagent, *Colletotrichum capsici*, fungicide, hand picking, management, red chilli fruits

Anthracnose is one of the most important disease incited by *Colletotrichum capsici* (Syd.) Butler & Bisby and is the major constraint in chilli production worldwide, especially in tropical and subtropical regions which resulted in more than 50% losses in yield (Ekbote *et al.* 2002; Ramchandran *et al.* 2007). India is the largest producer of chilli with an annual production of 12.28 lakh tone from an area of 7.70 lakh ha. India exported 2,41,000 metric tons

of chilli, approximately 10% of the total production and topped in the list of 52 spices as per the report of the Spices Board in terms of volume (Saideswara *et al.* 2013). Anthracnose is mainly a problem on mature chilli fruits. Infection many times reduces the market quality of intact red chilli fruits as well as chilli powder and paste in spices industry. There are four species of *Colletotrichum* involved in anthracnose throughout the world (Than *et al.*

¹National Horticultural Research and Development Foundation, Chitegaonphata, Post-Darnasangvi, Taluka-Niphad, Nashik-422 003, Maharashtra.

2008). Anthracnose is caused mainly by *Colletotrichum capsici* but, *C. gloeosporioides* is also an emerging problem in chilli. Earlier *C. gloeosporioides* was reported to be present only in Karnataka on chilli, however, during 2004, *C. gloeosporioides* appeared as leaf spot disease in Bilaspur region of Chattishgarh (Pandey & Pandey 2006). The pathogen is seed transmitted in chilli in the form of acervuli and microsclerotia as well as survives in plant debris and rotten chilli fruits in the field (Pring *et al.* 1995; Perenzny *et al.* 2003). The minimum incidence of anthracnose in chilli was noticed several times following the harvesting of initial set of green chilli fruits, due to reduction in inoculum of pathogen (Observation not published). The chilli fruits at red ripe stage are more susceptible to *C. capsici* than green chilli fruits (Rajapakse & Ranasinghe 2002). Realizing importance of the above facts, the present study was carried out with the objective of managing anthracnose in chilli through fungicides, bioagents and picking of initial set of green chilli fruits on variety LCA-355 during 2006–07 and 2007–08.

The field trials were conducted on chilli variety LCA-355 at Research Farm, Indian Institute of Vegetable Research, Varanasi for two consecutive years (2006–07 and 2007–08). The 14 treatments comprised of T₁-Mancozeb @0.3%, T₂-Propineb @0.3%, T₃-Myclobutanil @0.1%, T₄-Hexaconazole @0.1%, T₅-Triadimefon @0.1%, T₆-Azoxystrobin @0.3%, T₇-Carbendazim @0.1%, T₈-*A. niger* -V@0.5% + sticker @0.1%, T₉-Cymoxanil + Mancozeb @0.3%, T₁₀-Flusilazole @0.1%, T₁₁-*T. viride* @0.5%, T₁₂-Kasugamycin @0.3%, T₁₃-Thrice hand picking of initial set of green chilli fruits and T₁₄-Control were laid out in the Randomized Block Design. The bed size was kept as 3.0 m (length) × 2.7 m (width) and maintained the spacing as 45 cm (row to row) and 30 cm (plant to plant). Four weeks old seedlings were transplanted. The trial was conducted under natural epiphytotic condition and the standard agronomical practices were followed uniformly for all the treatments. Foliar spray of selected fungicides, bioagents and periodical green chilli fruit picking was carried out thrice to manage anthracnose disease. The

sprays were started after 30 days of transplanting and subsequently repeated at 10 days interval. A total of three sprays were given as per treatments. Three pickings of initial set of green chilli fruits were done as the treatments of hand picking. Imidachloprid @0.1% was sprayed at 10 days intervals to manage the vector and check the infection of leaf curl virus in chilli. Both *T. viride* and *A. niger* used in the trial were talc based formulations. The disease was scored on a 0-9 scale (Than *et al.* 2008) after 15 days of last spray. The Percent Disease Index (PDI) of anthracnose, yield of infected, healthy and total red chilli fruits per plot was recorded. The data of two years trial were pooled, statistically analyzed and presented in Table 1.

The data presented in Table 1 revealed that all the treatments performed superior than control. The findings clearly indicated that among the 14 treatments, thrice hand picking (T₁₃) of initial set of green chilli fruits was significantly superior with the lowest PDI (13.33%) (Table 1). However, the highest PDI (59.0%) in red chilli fruits was recorded in control. Further, data revealed that foliar sprays of *Aspergillus niger* -V @0.5% along with sticker @0.1% (T₈) at 10 days interval resulted in 29.83% PDI which was found to be the second best treatment (Table 1) followed by spray of combined fungicide Cymoxanil (8%) + Mancozeb (64%) @0.3% (T₉) with 30% PDI. The PDI of anthracnose on red chilli fruits were recorded as 35%, 35.83% and 36% with the spray of Azoxystrobin @0.1%, Mancozeb @0.3% and Triadimefon @0.1%, respectively. The PDI on red chilli fruits ranged from 38.16-43.50% in the treatment with foliar spray of *T. viride* @0.5%. The other tested fungicides included in the study such as Propineb, Carbendazim, Hexaconazole, Myclobutanil, Flusilazole and Kasugamycin showed less effectiveness after three sprays. Tanwar & Bunker (2013) conducted studies for the control of anthracnose and reported that two fungicides namely Tebuconazole and Propiconazole significantly reduced anthracnose in chilli. Goswami *et al.* (2013) reported that sprays with chemical fungicides including Mancozeb 75WP

Table 1. Percent disease index (PDI) of anthracnose (*Colletotrichum capsici*), total, healthy and infected yield of red chilli fruits

Treatments	PDI	Yield of red chilli fruits (g plot ⁻¹)		
		Infected	Healthy	Total
T ₁ -Mancozeb @0.3%	35.83	661.29	1286.66	1947.95
T ₂ -Propineb @0.3%	38.16	576.98	875.00	1451.98
T ₃ -Myclobutanil @0.1%	43.50	905.50	633.33	1538.83
T ₄ -Hexaconazole @0.1%	41.66	1000.75	550.00	1550.75
T ₅ -Triademefon @0.1%	36.00	670.10	500.00	1170.10
T ₆ -Azoxystrobin @0.3%	35.00	606.30	1125.00	1731.30
T ₇ -Carbendazim @0.1%	39.30	835.62	691.66	1527.28
T ₈ - <i>A. niger</i> -V @0.5% + sticker @0.1%	29.83	785.29	470.00	1255.29
T ₉ -Cymoxanil + mancozeb @0.3%	30.33	763.37	410.00	1173.37
T ₁₀ -Flusilazole @0.1%	40.83	551.58	975.00	1526.58
T ₁₁ - <i>T. viride</i> @0.5%	41.16	1006.89	841.66	1848.55
T ₁₂ -Kasugamycin @0.3%	41.33	718.68	455.00	1173.68
T ₁₃ -Hand picking	13.33	863.43	741.66	1605.09
T ₁₄ -Control	59.00	1066.97	102.00	1168.97
CD (P<0.05)	3.59	18.40	21.41	25.21

@0.3% effectively controlled anthracnose in chilli.

The yield of red chilli fruits were higher in all the treatments as compared to control while, significantly highest healthy red chilli fruits yield (1286.66 g plot⁻¹) was recorded in T₁ (Mancozeb @0.3%) followed by T₆ (Azoxystrobin @0.1%) and lowest yield was recorded in control (550 g plot⁻¹). However, significantly highest total yield (1947.95 g plot⁻¹) of red chilli fruits was recorded in T₁ (Mancozeb @0.3%) followed by total yield (1848.55 g plot⁻¹) in T₁₁ (*T. viride* @0.5%), T₆ (Azoxystrobin @0.1%) and T₁₃ (hand picking) while, lowest yield was recorded in control (1168.97 g plot⁻¹). Significantly lowest yield of infected chilli fruits (551.58 g plot⁻¹) was recorded in T₁₀ (Flusilazole @0.1%) followed by yield in T₂ (Propineb @0.3%), T₆ (Azoxystrobin @0.1%) and T₁ (Mancozeb @0.3%). However,

maximum yield of infected red chilli fruits (1066.97 g plot⁻¹) was recorded in the control (Table 1). Maximum total yield of red chilli fruits was observed in Mancozeb followed by *T. viride*, Hexaconazole and Azoxystrobin. While some of the molecules like Triademefon, Cymoxanil + Mancozeb and Kasugamycin had negative effect on total fruit yield, which might be due to less number fruit sets or higher flower drop or inhibition of flower buds formation. It is also clear that among tested fungicides, Mancozeb and Azoxystrobin are better molecules in relation to total yield and reduction in infected red chilli fruits. Present findings clearly indicated that three pickings of initial set of green chilli fruits was very effective in minimizing the incidence of anthracnose caused by *C. capsici* in chilli. Hand picking is an important practice and could be practiced in large scale for the production of anthracnose free chilli fruits.

References

- Ekbote S D, Jagadeesha R C & Patil M S 2002 Survey of chilli diseases in Haveri district. Karnataka J. Agri. Sci. 15: 726–728.
- Goswami S, Thind T S & Dipak N T 2013 Efficacy of new fungicides against anthracnose of chilli (*Capsicum annum*) caused by *Colletotrichum capsici*. Indian Phytopath. 66: 207–208.
- Pandey K K & Pandey P K 2006 *Colletotrichum gloeosporioides*: a new leaf spot pathogen on chilli from Chhattisgarh and its molecular characterization. Indian Phytopath. 59: 127–129.
- Perenzny K, Roberts P D, Murphy J F & Goldberg N P 2003 Compendium of pepper diseases. APS Press, St. Paul, Minnesota, UAS, pp.73.
- Pring R J, Nash C, Zakaria M & Bailey J A 1995 Infection process and host range of *Colletotrichum capsici*. Physiol. Mol. Plant Pathol. 46: 137–152.
- Rajapakse R G A S & Ranasinghe J A D A R 2002 Development of variety screening method for anthracnose disease of chilli under field conditions. Trop. Agril. Res. Ext. 5: 7–11.
- Ramchandran N, Madhavi R K & Rathnamma K 2007 Current status of chilli anthracnose in India. The First International Symposium on Chilli Anthracnose held on September 17–19, 2007, Hoam Faculty House, Seoul National University, Korea, pp.26.
- Saideswara R, Y Sasidharan Swapna & Mathew Mary K 2013 Problems encountered in chilli production in Guntur district of Andhra Pradesh. Indian J. Arec. Spices Med. Plants 15: 16–22.
- Tanwar N S & Bunker R N 2013 Efficacy of fungicides and botanicals for suppression of anthracnose of chilli caused by *Colletotrichum capsici*. J. Mycol. Plant Pathol. 43: 198–200.
- Than P P, Jeewon R, Hyde K D, Pongsupasamit S, Mongkolporn O & Taylor P W J 2008 Characterization and pathogenicity of *Colletotrichum* species associated with anthracnose on chilli (*Capsicum annum*) in Thailand. Plant Path. 56: 562–572.