International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2020; 8(1): 1240-1243

Received: 16-11-2019
Accepted: 18-12-2019

Sanika Joshi
Department of Plant Pathology, DBSKKV, Dapoli, Maharashtra, India

PG Borkar
Department of Plant Pathology, DBSKKV, Dapoli, Maharashtra, India

MS Joshi
Department of Plant Pathology, DBSKKV, Dapoli, Maharashtra, India

Corresponding Author:
Sanika Joshi
Department of Plant Pathology, DBSKKV, Dapoli, Maharashtra, India

Integrated management of anthracnose disease of bottle gourd

Sanika Joshi, PG Borkar and MS Joshi

DOI: https://doi.org/10.22271/chemi.2020.v8.i1q.8421

Abstract
The anthracnose of bottle gourd incited by *Colletotrichum lagenarium* (Syn.*C. orbiculare*) is emerging as a major disease of bottle gourd in Konkan region. The fungal growth on solid medium was robust, compact with distinct zonation at specific distance. Initially the growth was olivaceous grey to green which gradually turned black with a pinkish tinge at maturity. Mycelium was septate, hyaline and branched about 2-5 µm in diameter. Conidia were hyaline, single celled measuring about 12 - 14 X 4 - 4.5 µm and guttulate with single oil globule. The disease appeared in the form minute, irregular yellow spots on leaves. These spots enlarged into brown necrotic lesions surrounded by yellow halo. Under field conditions, Benomyl (0.25%) was found to be the most effective fungicide with PDI of 28.00 per cent. The highest yield 19.43t/ha was recorded from Propiconazole (0.1%) with highest ICBR of 0.63. in case of integrated management of the disease, seed treatment with *T. viride* + three sprays with Propiconazole (0.1%) was the best treatment in integrated management with the lowest disease intensity (24.35%). The maximum yield (20.71t/ha) was recorded from seed treatment with *T. viride* + three sprays of Propiconazole (0.1%) with ICBR of 0.80.

Keywords: Bottlegourd, *Colletotrichum lagenarium*, robust, anthracnose

Introduction
Bottle gourd [*Lagenaria siceraria* (Mol.) Standal.], belonging to family Cucurbitaceae is fruit vegetable. The crop is considered to be a native of tropical Africa. Its cultivation dates back to at least 4000 years by the Egyptians. It is one of the chief culinary vegetables in many tropical and temperate regions around the world. Bottle gourd is also known as calabash, white flowered gourd, long melon, New Guinea bean and Tasmania bean in different parts of world. It is called as *doodhi*, *ghiya* or *lauki* in India. *L. siceraria* is cultivated in India, Japan, Sri Lanka, China and Thailand for its kitchen use. It has high medicinal value and hence used in some ayurvedic medicines. Being low in fat and cholesterol, and high in dietary fiber, it is recommended by dieticians.

Bottle gourd is a good source of vitamin- B- complex and ascorbic acid. It is rich in pectin and also contains various saponins, fatty oils and alcohols. It has a cooling effect on the human body and is also useful in prevention of constipation (Jemima and Prasadini, 2011) [6]. Bottle gourd fruit contains 96.3 per cent water, 2.8 per cent carbohydrate, 0.2 per cent protein, 0.5 per cent fat, 0.5 per cent mineral matter (Ca-0.02%, P-0.01% and Fe-0.0007%), vitamin A in traces and vitamin B- 10 I.U. per 100g (Chauhan,2002). It is one of the low calorie vegetables (14 calories per 100g). Fresh gourds contains about 6µg/100g of folic acid that helps in reducing the defects in newborns.

Major bottle gourd growing states of India are U.P., Punjab, Gujarat, Assam, Meghalaya and Rajasthan. In India about 153 thousand ha area is under the cultivation of bottle gourd with an annual production of 2529 thousand MT and productivity of 16.52 tons per ha. Production wise, Bihar is the leading state (631.60 thousand tones) with a share of 25.70 per cent followed by Uttar Pradesh and Haryana (Anonymous, 2017) [1].

In Konkan region this crop is basically grown on large scale in Raigad and Thane districts. Bottle gourd is one of the kitchen garden crops in Ratnagiri district.

Among fungal diseases, downy mildew, powdery mildew anthracnose, and *Cercospora* leaf spot are more prevalent in different bottle gourd growing areas. Among all these, anthracnose caused by *Colletotrichum lagenarium* (Pass) Ellis and Halsted is of major economic importance.

This disease was also recorded as one of the important diseases of bottle gourd in *Konkan* region of Maharashtra (Shinde, 1993) [8]. Hot and humid climate of the region is highly congenial for disease development. As the bottle gourd crop is commercially cultivated in North *Konkan* region for local and metropolitan markets, it is necessary to reduce the qualitative and quantitative losses due to anthracnose in strategic manner.

Material and Methods

The field experiments during *Kharif* 2018 were conducted at Central Experiment Station, Wakawali, Tal. Dapoli, Dist. Ratnagiri. During *Rabi* 2018-19, the experiments were conducted at the field of Department of Agronomy, College of Agriculture, Dapoli. The field experiment was conducted on variety *Samrat* during both the trials. The experiment was laid in randomized block design (RBD). The crop was observed carefully for initiation of disease. Three sprays of bio-agents, plant extract and fungicides were applied at an interval of 15 days starting from initiation of disease symptoms. A field trial was conducted to evaluate the effect of combination of treatments. The treatments included, T1- Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%), T2- Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%), T3- Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%), T4- Three sprays of Propiconazole (0.1%), T5- Three sprays of Thiophanate Methyl (0.1%), T6- Three sprays of *Sapindus trifoliatus* (30%) and T7-untreated (control).

Per cent Disease Index (PDI) was calculated by the formula:

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{No. of observations assessed X Maximum rating}} X100$$

The per cent disease control was calculated by using the formula given below:

$$PDC = \frac{\text{PDI in control} - \text{PDI in treatment}}{\text{PDI in control}} X\ 100$$

Yield

Fruits were harvested at maturity and yields of net plot were recorded as kg per plot and later expressed in tonnes per ha.

The per cent increase in yield over control was calculated by using formula given below:

$$\text{Yield increase over control (\%)} = \frac{\text{Yield in treatment plot} - \text{Yield in control plot}}{\text{Yield in control plot}} X\ 100$$

To find out the most effective and economical treatment, the incremental cost: benefit ratio (ICBR) was worked out. Total monetary gain per treatment was worked out on the basis of selling rates of bottle gourd in the local market. The data obtained in all the experiments were statistically analyzed using SAS software.

Results and Discussion

An *in vivo* trial for management of bottle gourd anthracnose was conducted in Kharif and rabi seasons. The results from Kharif, 2018 (Table1) revealed that, 30 DAS i.e. one day before first spraying the intensity ranged between 17.33 to 18.00 per cent. The PDI for plot with seed treated of *T. viride* (@25g/kg) ranged from 15.06 to 15.60 per cent. The lowest (terminal) disease intensity (23.22%) was recorded in the treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.1%)] which was statistically superior over all treatments. This was followed treatment T_2 [Seed treatment with *T. viride* + three sprays with Thiophenate methyl (0.1%)] with disease intensity of 24.26 per cent and T_3 [Seed treatment with *T. viride* + three sprays with *Sapindus trifoliatus* (30%)] with 25 per cent. The sole treatments comprising three sprays of Propiconazole, Thiphanate Methyl and plant extract were statistically significant with each other and superior to control but less effective than combination treatments. The highest per cent disease control (60.88%) was observed in treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.1%)].

In Rabi, 2018-19 (Table 2), the lowest disease intensity (25.47%) was recorded in the treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.1%)] which was statistically superior over all treatments. This was followed treatment T_2 [Seed treatment with *T. viride* + three sprays with Thiophenate methyl (0.1%)] with disease intensity of 26.37 per cent and T_3 [Seed treatment with *T. viride* + three sprays with *Sapindus trifoliatus* (30%)] with disease intensity of 27.38 per cent. Among rest of the treatments, sole sprays of Propiconazole and Thiphanate methyl were at par with each other and statistically significant with three sprays of *Sapindus trifoliatus*. The highest percentage disease control over control by 50.55% was observed in treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.1%)].

Pooled analysis (Table3) revealed that, the lowest disease intensity (24.35%) was recorded in the treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.1%)] which was statistically superior over all treatments. This was followed treatment T_2 [Seed treatment with *T. viride* + three sprays with Thiophenate methyl (0.1%)] with disease intensity of 25.32 per cent and T_3 [Seed treatment with *T. viride* + three sprays with *Sapindus trifoliatus* (30%)] with disease intensity of 26.19 per cent. In pooled analysis also, the treatments T4 and T5 were at par and significantly superior to T6 and T7. The highest percentage disease control over control by 56.07% was observed in treatment T_1 [Seed treatment with *T. viride* + three sprays with Propiconazole (0.25%)]. It was noticed that, seed treatment (Thiram -3g/kg of seed), green manuring (glyricidia leaves -1.5t/ha) and foliar sprays of Propiconazole (0.1%) was most effective against bitter gourd anthracnose (Jadhav *et al*., 2010) [5]. Propiconazole (0.1%) caused a dramatic reduction in disease incidence of chilli anthracnose by 70% (Gopinath *et al*., 2006) [4]. Dubale (2018) [3] reported that, minimum disease severity of turmeric anthracnose (11.88%) was observed in plot sprayed with Propiconazole 25%EC (0.1%).

The pooled analysis from table 4 revealed that, the maximum yield (20.71t/ha) was recorded from T_1 [Seed treatment with *T. viride* + three sprays of Propiconazole (0.1%)] with 40.22% increase over control. It was followed by T_2 [seed treatment with *T. viride* + 3 sprays of Thiophanate methyl (0.1%) - 20.52/ha] with 38.93 per cent increase over control. The treatment T_4 [Three sprays of Propionazole (0.1%)] recorded 19.43t/ha with 31.19 per cent increase over control was at par with T_3 [Seed treatment with *T. viride* + three sprays with *Sapindus trifoliatus* (30%)] which recorded yield of 19.34t/ha with 31.01% increase over control and T_5 [Three sprays with Thiophanate methyl (0.1%) recorded yield of 19.31 t/ha with 30.74% increase over control. Least effective

treatment was T_6 [three sprays with *Sapindus trifoliatus* (30%)] with yield of 16.78 t/ha and 13.68 per cent increase over control. The yield recorded from control plot was 14.81t/ha. Potphode (2011) [7] reported that, maximum yield (48.61q/ha) was recorded from the treatment including seed dressing with Tricyclazole + three sprays of Difenconazole against anthracnose of bitter gourd. The economics of the trial conducted (pooled analysis) (Table 5) in both the seasons revealed that, the treatment T_1 [Seed treatment with *T. viride*+ Three sprays of Propiconazole (0.1%)] was found most effective with highest gross returns (Rs. 5,63,519/-) with additional income of Rs. 1,60,539/- and highest ICBR (0.80). An additional income of Rs.1, 55,369/- was recorded from T_2 with ICBR of 0.77. The treatments T_5 and T_3 recorded same ICBR (0.61). Least additional returns (Rs. 53,604/-) were recorded due to three sprays each of soapnut with ICBR of 0.26.

Table1: Integrated Management of anthracnose with bio-agents, chemical fungicides and plant extract (Kharif, 2018)

Tr. No.	Treatment	Per cent Disease Intensity (PDI)				Per cent disease control compared to untreated
		Before Spray (30 DAS)	First spray (45 DAS)	Second spray (60 DAS)	Third spray (75 DAS)	
T_1	Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%)	15.06 (22.83)	18.57 (25.53)	21.37 (27.54)	23.22 (28.80)	60.88
T_2	Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%)	15.77 (23.40)	19.38 (26.12)	22.17 (28.09)	24.26 (29.51)	59.13
T_3	Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%)	15.60 (23.26)	19.05 (25.88)	22.73 (28.47)	25.00 (30.00)	57.89
T_4	Three sprays ofPropiconazole (0.1%)	17.33 (24.60)	21.06 (27.32)	25.72 (30.48)	26.79 (31.17)	54.87
T_5	Three sprays of Thiophanate Methyl (0.1%)	17.68 (24.86)	22.13 (28.06)	25.52 (30.34)	27.15 (31.40)	54.26
T_6	Three sprays of *Sapindus trifoliatus* (30%)	17.58 (24.79)	28.66 (32.37)	36.84 (37.37)	50.22 (45.13)	15.41
T_7	Control	18.00 (25.10)	30.86 (33.75)	44.81 (42.02)	59.37 (50.40)	-
	S. Em±	0.14	0.18	0.13	0.16	-
	C. D (P=0.05)	0.43	0.56	0.39	0.50	-

Table 2: Integrated Management of anthracnose with bio-agents, chemical fungicides and plant extract (Rabi, 2018-19)

Tr. No.	Treatment	Per cent Disease Intensity (PDI)				Per cent disease control compared to untreated
		Before Spray (30 DAS)	First spray (45 DAS)	Second spray (60 DAS)	Third spray (75 DAS)	
T_1	Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%)	17.68 (24.86)	19.45 (26.17)	22.48 (28.30)	25.47 (30.31)	50.55
T_2	Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%)	18.28 (25.31)	20.37 (26.83)	23.55 (29.03)	26.37 (30.90)	48.80
T_3	Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%)	18.49 (25.46)	20.91 (27.21)	24.69 (29.79)	27.38 (31.55)	46.84
T_4	Three sprays of Propiconazole (0.25%)	20.58 (26.98)	21.92 (27.92)	26.56 (31.02)	28.55 (32.30)	44.57
T_5	Three sprays of Thiophanate Methyl (0.1%)	21.78 (27.82)	23.95 (29.29)	27.80 (31.82)	28.95 (32.55)	43.79
T_6	Three sprays of *Sapindus trifoliatus* (30%)	21.79 (27.83)	28.32 (32.15)	36.21 (36.99)	41.18 (39.92)	20.05
T_7	Control	22.32 (28.19)	32.48 (34.75)	40.74 (39.66)	51.51 (45.87)	-
	S. Em±	0.17	0.20	0.16	0.20	-
	C. D (P=0.05)	0.54	0.63	0.49	0.63	-

Table 3: Integrated Management of anthracnose with bio-agents, chemical fungicides and plant extract (Pooled)

Tr. No.	Treatment	Per cent Disease Intensity (PDI)				Per cent disease control compared to untreated
		Before Spray (30 DAS)	First spray (45 DAS)	Second spray (60 DAS)	Third spray (75 DAS)	
T_1	Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%)	16.37 (23.86)	19.01 (25.85)	21.93 (27.92)	24.35 (29.57)	56.07
T_2	Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%)	17.03 (24.37)	19.88 (26.48)	22.86 (28.56)	25.32 (30.21)	54.32
T_3	Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%)	17.05 (24.39)	19.98 (26.55)	23.71 (29.14)	26.19 (30.78)	52.75
T_4	Three sprays of Propiconazole (0.1%)	18.96 (25.81)	21.49 (27.62)	26.15 (30.75)	27.67 (31.74)	50.09
T_5	Three sprays of Thiophanate Methyl (0.1%)	19.73 (26.37)	23.04 (28.68)	26.66 (31.09)	28.05 (31.98)	49.40
T_6	Three sprays of *Sapindus trifoliatus* (30%)	19.69 (26.34)	28.49 (32.26)	36.53 (37.18)	45.70 (42.53)	17.56

T_7	Control	20.16 (26.68)	31.67 (34.25)	42.77 (40.84)	55.44 (48.12)	-
	S. Em±	0.10	0.15	0.10	0.14	-
	C. D (P=0.05)	0.30	0.47	0.30	0.45	-

Table 4: Effect of Integrated Management on yield of bottle gourd.

Tr. No.	Treatment	*Kharif*,2018		*Rabi*, 2018-19		Pooled	
		*Yield (t/ha.)	% increase over control	*Yield (t/ha.)	% increase over control	*Yield (t/ha.)	% increase over control
T_1	Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%)	21.12	41.00	20.24	39.01	20.71	40.22
T_2	Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%)	20.58	37.13	20.43	40.32	20.52	38.93
T_3	Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%)	19.06	27.13	19.63	34.82	19.34	31.01
T_4	Three sprays of Propiconazole (0.1%)	19.91	32.73	18.93	30.01	19.43	31.19
T_5	Three sprays of Thiophanate Methyl (0.1%)	19.69	30.80	19	30.49	19.31	30.74
T_6	Three sprays of *Sapindus trifoliatus* (30%)	16.39	9.13	17.20	18.13	16.78	13.68
T_7	Control	15.00		14.56		14.81	-
	S.Em±	0.54	-	0.28	-	0.29	-
	C.D (P=0.05)	1.66	-	0.87	-	0.88	-

* Mean of three replications

Table 5: Economics of fungicides, bio-agent and botanical in integrated management of bottle gourd anthracnose (Pooled)

Tr. No.	Treatment	Basic input cost (Rs.)	Additional cost (Rs.)		Total input cost (Rs.)	*Yield (t/ha.)	** Gross returns (Rs.)	Increase in yield over control (T/ha.)	Additional returns due to treatment (Rs.)	ICBR
			Fungicide/ bioagent/ organical /phyto Extract	Labour cost (Rs.)						
T_1	Seed treatment with *Trichoderma viride* +Three sprays of Propiconazole (0.1%)	1,95,155	1,850	1800	1,98,805	20.71	5,63,519	5.90	1,60,539	0.80
T_2	Seed treatment with *Trichoderma viride* + Three sprays of Thiophanate Methyl (0.1%)	1,95,155	2,525	1800	1,99,480	20.52	5,58,349	5.71	1,55,369	0.77
T_3	Seed treatment with *Trichoderma viride* + Three sprays of *Sapindus trifoliatus* (30%)	1,95,155	3,275	1800	2,00,230	19.34	5,26,241	4.53	1,23,261	0.61
T_4	Three sprays of Propiconazole (0.1%)	1,95,155	1,575	1800	1,98,530	19.43	5,28,690	4.62	1,25,710	0.63
T_5	Three sprays of Thiophanate Methyl (0.1%)	1,95,155	2,250	1800	1,99,205	19.31	5,25,425	4.5	1,22,445	0.61
T_6	Three sprays of *Sapindus trifoliatus* (30%)	1,95,155	3,000	1800	1,99,955	16.78	4,56,584	1.97	53,604	0.26
T_7	Control	1,95,155	-	-	1,95,155	14.81		-	-	-

*Mean of three replications **Selling rates of bottle gourd@Rs.27210/t

Conclusion

The disease can be effectively managed by integration of the treatments comprising combination of bio-agent and fungicides. Seed treatment with *Trichoderma viride* followed by three sprays of Propiconazole (0.1%) commencing from 30 DAS followed by two more sprays at 15 days interval was the best economical treatment in terms disease control and yield maximization.

References

1. Anonymous. National Horticultural Board Database, India, 2017.
2. Chauhan RS. Studies on anthracnose disease of bottle gourd caused by Colletotrichum lagenarium (PASS.) ELL. And HALST. Ph.D. (Agri.).Thesis submitted to Haryana Agricultural University, Hisar, 2002.
3. Dubale YD. Studies on management of Turmeric leaf spot caused by *Colletotrichum spp*. A MSc. Thesis submitted to Dr. B.S.K.K.V. Dapoli. (M.S), 2018.
4. Gopinath K, Radhakrishnana NV, Jayraj J. Effect of propiconazole and difenoconazole on the control of anthracnose of chilli fruits caused by *Colletotrichum capsici*. Crop Protection. 2006; 25(9):1024-1031.
5. Jadhav DK, Fugro PA, Kadam JJ. Management of anthracnose and root-knot nematode complex and evaluation of resistance source in bitter gourd. Journal of Plant Disease Sciences. 2010; 5(2):238-241.
6. Jemima MB, Prasadini. Nutrient composition and antioxidant activity of raw and processed bottle gourd varieties. Food Science. 2011; 36:3122-3124.
7. Potphode PD. Epidemiology and management of anthracnose of bitter gourd (*Momordica charantia* L.) incited by *Colletotrichum lagenarium* (Pass.) Ell. And Halst. A PhD. thesis submitted to DBSKKV, Dapoli (M.S.), 2011.
8. Shinde NS. Studies on anthracnose disease of cucurbits incited by *Colletotrichum lagenarium* (Pass.) Ell. And Halst. A M.Sc. thesis submitted to DBSKKV, Dapoli (M.S.), 1993.