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Research Article

INTEGRATED MANAGEMENT OF COLLAR ROT OF BELL PEPPER

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Abstract- Collar rot caused by *Sclerotinia sclerotiorum* (Lib.) de bary is one of the most important diseases of Sweet pepper (*Capsicum annuum* L .var. *grossum* Sendt.) causing severe damage to the crop and reducing potential yield. To develop an effective management practice against stem rot of bell pepper, integration of Cultural components, Chemical and biological control revealed that combination of ridge planting + *E. globulus*(10%) + Bavistin (0.1%) was the most effective treatment with minimum disease incidence (22.15%) and maximum disease control (77.17%) followed by raised bed + *Eucalyptus globulus* + Bavistin, flat field + *Eucalyptus globulus* + Bavistin, ridge planting + Bavistin, raised bed + Bavistin. Ridge planting + *Eucalyptus globulus,* raised bed+ *Eucalyptus globulus,* flat field + Bavistin and flat field + *Eucalyptus globules* were also effective. It is cheaper and eco-friendly practice for the control of collar rot of sweet pepper.

Keywords- Collar rot, Sweet pepper, Bavistin, *Eucalyptus globulus*

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Introduction

Sweet pepper (*Capsicum annuum* L.var. *grossum* Sendt.) is a belonging to Solanaceae family. Globally capsicum is cultivated in 1. 93Mha with a production of 31.14 MT in 2013 [1]. In India, bell pepper production has gone up to 172.0 thousand tones under the area 30.0 thousand hectares in 2014-15 [2]. It is commercially grown in Himachal Pradesh, Tamil Nadu, Karnataka and some parts of Uttar Pradesh having mild climate with humid environmental conditions. Collar rot caused by *Sclerotinia sclerotiorum* is one of the most important diseases of Capsicum causing severe damage to the crop and reducing potential yield [3-6]. *Sclerotinias clerotiorum* (Lib.) de bary is an ubiquitous polyphagus fungus in nature and a most widespread destructive pathogen of vegetable and field crops [7-9]. Due to strict soil borne nature and wide host range of the pathogen, it is difficult to manage this disease through host resistance. Chemical control is undesirable and even inadequate as a long term solution to crop health. The effectiveness of chemicals is irregular because of soil borne pathogen which makes accessibility of sclerotia to fungicides rather difficult. Because of the limitations in the use of fungicides as well as to minimize the pollution hazards, use of fungal antagonists as bio-control agents against *Sclerotinia sclerotiorum* is likely to be least expensive and safer than the plant protection chemicals. Moreover, incorporation of mycoflora for controlling the disease can help in reducing the chances of acquired resistance by the pathogen. Unlike chemicals, antagonistic micro-organisms can change their nature through genetic alterations and can thus, give a relatively durable control of the pathogen. The knowledge of disease etiology is of utmost significance for the successful management of the disease through integrated disease management approach for the effective management of collar rot.

Material and Methods

A field trial on integrated disease management on collar rot of bell pepper at Experiment farm of Plant Pathology at CSK HPKV, Palampur. The combination of cultural, chemical and biological control was evaluated. Cultural component included Different planting techniques *viz*., Raised bed, Ridge planting and flat field. Chemical and biological control included dipping of roots of bell pepper seedlings in 0.1 per cent concentration of Bavistin and 10 per cent concentration of *Eucalyptus* extract for 1 hr respectively before transplanting. Twelve combinations included:

T1: Raised bed
T2: Ridge planting
T3: Flat field
T4: Raised bed + Fungicide
T5: Ridge planting + Fungicide
T6: Flat field + Fungicide
T7: Raised bed + Botanical
T8: Ridge planting + Botanical
T9: Flat field + Botanical
T10: Raised bed + Fungicide + Botanical
T11: Ridge planting + Fungicide + Botanical
T12: Flat field + Fungicide + Botanical

Experiment was laid out in a Randomized Block Design with three replications. Cultivar 'California wonder' was used in the experiment. The field was divided into 36 plots each of size 1.8 × 1.5 m^2. Twelve bell pepper plants were sown in each plot. The trial was conducted under irrigated conditions. Recommended agronomic practices as per package of practices were applied. Data on disease incidence were recorded by counting number of diseased plants/plot and per cent disease incidence calculated. Observations were recorded at weekly interval from the date of first appearance of disease till the termination of experiment. Fruit yield was recorded at every picking and analyzed on per plot basis.

Results and Discussion

Data on the integrated management of stem rot of bell pepper under field conditions are presented in [Table-1]. It is evident from the table that ridge planting + *Eucalyptus globulus* (10%) + Bavistin (0.1%) was most effective and significantly best treatment with minimum disease incidence (22.15%) and maximum disease control (77.17%) followed by raised bed + *Eucalyptus globulus* + Bavistin, flat field + *Eucalyptus globulus* + Bavistin, ridge planting + Bavistin and raised bed + Bavistin where disease incidence was 31.26, 43.71, 49.11 and 52.66 per cent, respectively with 67.78, 54.94, 49.38 and 45.72 per cent disease control, respectively. Ridge planting + *Eucalyptus globulus,* raised bed+ *Eucalyptus globulus,* flat field + Bavistin and flat field + *Eucalyptus globulus* were also effective with 62.72, 68.26, 71.34 and 78.23 per cent disease incidence and 35.35, 29.64, 26.46 and 19.36 per cent disease control, respectively. Maximum disease incidence (90.05%) was observed in raised bed with minimum disease control (7.17%) followed by ridge planting with 86.43 per cent disease incidence and 10.91 per cent disease control.

Table-1 *Integrated disease management of Sclerotinia sclerotiorum in sick plots*

Treatments	Disease incidence (%)	Disease control (%)	Yield (q/ha)
Raised bed (T1)	90.05 (71.61)	7.17	16.50
Ridge planting (T2)	86.43 (68.38)	10.91	20.55
Flat field (T3)*	97.01 (80.04)	0.00	3.02
Raised bed + fungicide** (T4)	52.66 (46.52)	45.72	40.00
Ridge planting + fungicide (T5)	49.11 (44.49)	49.38	41.35
Flat field + fungicide (T6)	71.34 (57.63)	26.46	25.58
Raised bed + Biopesticide*** (T7)	68.26 (55.71)	29.64	28.70
Ridge planting + Biopesticide (T8)	62.72 (52.37)	35.35	33.14
Flat field + Biopesticide (T9)	78.23 (62.19)	19.36	22.24
Raised bed + Biopesticide + fungicide (T10)	31.26 (33.99)	67.78	48.53
Ridge planting + Biopesticide + fungicide (T11)	22.15 (28.08)	77.17	55.74
Flat field + Biopesticide + fungicide (T12)	43.71 (41.39)	54.94	44.56
CD	**2.58**		**0.36**

*T3=Check **Fungicide=Bavistin (0.1%)
***Biopesticide=*Eucalyptus globulus* (10%)

Figures in parentheses represent the arc sine transformed values Pinto *et al.,* [10] leaf extracts of *Eucalyptus citriodora* at 1000 and 10000ppm in acetone-water completely inhibited mycelial growth and sclerotial germination of *S. cepivorum*. Thus, this extract is potentially useful for the control of garlic white rot and its effect will be evaluated under field conditions.

Ashraf *et al.*,[11] was noticed that out of five plant extracts tested, leaf extract of *Eucalyptus globulus* (62.0%) showed maximum inhibitory effect against the mycelial growth of *S. sclerotiorum* followed by *C. zeylanicum* extract (55.7%). On the other hand, *T. foenum-graecum* produced the lowest effect against *S. sclerotiorum* with 30.0% reduction in mycelial growth. This antifungal activity of *E. globulus* extract may be attributed to the presence mostly of oxygenated monoterpenes and monoterpene hydrocarbons [12].

Chattopadhyay *et al.* (2004) [13] reported that bulb extract of *A. sativum* as seed treatment integrated with its foliar spray provided the highest reduction of *Sclerotinia* rot, there by reduced losses in seed yield and overcame stunting due to the disease. Thus, the study demonstrated the potential of integration of natural tools for managing Sclerotinia rot of mustard. Sharma [14] and Sharma and Kanwar [15] found Bavistin 0.1 per cent most effective against *S. sclerotiorum.* Prajapati and Narain[16] found Bavistin and Companion (Carbendazim + Mancozeb) to be most effective in controlling the pathogen among different groups of fungicides. Chattopadhyay *et al.* [17] reported that garlic bulb extract was a better choice than chemical fungicides in oilseed crop diseases. They elaborated that *Sclerotinia* rot of Indian mustard could be effectively tackled by seed treatment with 1 per cent (w/v) garlic (*Allium sativum*) bulb extract, better when supplemented by foliar spray of same extract at flower initiation stage of the crop. In trial of disease management, incidence of *Sclerotinia* rot was found lowest in seed treatment with garlic bulb extract. However, highest seed yield (16% increase over control) was recorded in combination of seed treatment and foliar spray with *Trichoderma harzianum* [18, 19]. Since there is no other reports related to collar rot of *capsicum* sp. caused by *Sclerotinia sclerotium*, hence results could not be compared.

Conclusion

In the present findings, ridge planting + *Eucalyptus globulus*(10%)+Bavistin (0.1%) was most effective and significantly best treatment with minimum disease incidence (22.15%) and maximum disease control (77.17%) and maximum yield (55.74 q/ha) was achieved.

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Conflict of Interest: None declared

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