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Integrated Disease Management of Downy Mildew Disease in Bottle Gourd (*Lagenaria siceraria* (Mol.) Standl) under Temperate Conditions of Kashmir

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A B S T R A C T

Among the various fungal diseases in bottle gourd, *Pseudoperonospora cubensis* sp. causing downy mildew disease is among the most noxious pathogens that attack this vegetable crop. This pathogen causes considerable losses in yields in the field wherever bottle gourd is cultivated. Keeping this in mind, it is advisable for the growers to manage downy mildew disease of bottle gourd by adopting management measures of concomitant treatments. A field trial was carried out with various treatments for controlling the downy mildew disease in bottle gourd cultivar-Local-1T0+ seed treatment with Carbendazim 12%+mancozeb 63% @ 3g/kg and drenching of captan 70%+hexaconazole 5%wp @0.1% 15 days after germination followed by spray with(imidacloprid 17.8 sl @7.5ml/15 l+neem oil 0.2%) followed by spraying of captan 70%+hexaconazole 5% wp @0.1% followed by fosetyl-al @0.1% followed by spraying of captan 70%+hexaconazole 5% wp @0.1% + spray with (imidacloprid17.8SL@7.5ml/15 l+ neem oil 0.2%) followed by fosetyl-al @0.1% at 30 days after drenching showed highest control of diseases and increase the fruit yield significantly however other treatment also found best effective over control of disease occurred during entire period of crop.

Introduction

Bottle gourd (*Lagenaria siceraria* I) is one of the major culinary vegetables in many tropical and temperate regions around the world and has important medicinal value to use in ayurvedic and unani medicines. Due to meager fat and cholesterol dieticians are recommending bottle gourd consumption to patients (Joshi et. al., 2020). Bottle gourd is also a good source of vitamin-B-complex and ascorbic acid. It is rich in pectin and also contains various saponins, fatty oils, alcohols and has cooling effect on human body by preventing the constipation (Jemima and Prasadini, 2011). There are various causes responsible for the low yield of vegetable (Mehdi and Anwar, 2009) and fungal foliar diseases have played an important role (Anwar and Bhat, 2003). Among the various fungal foliar diseases, downy mildew (*Pseudoperonospora* sp.) causes heavy losses under temperate conditions of Kashmir and no single approach has been used to control

the diseases, therefore an attempt was made to manage the disease.

Materials and Methods

The field experiment which comprised of eight treatments for management of downy mildew disease, during the two years of Kharif 2018- and 2019 was carried out at Plant Pathology Experimental Field, SKUAST Campus, Shalimar, Srinagar, J&K, located at 34^0472 north latitude and 74^0522 east longitude at an elevation of 1591 meters above mean sea level. The field experiment of both the years was conducted on the bottle gourd variety Shalimar-1 under randomized block design with three replications. The seeds were sown on 15th June of every year with 30mx20m plot size at 1mx50cm and all the recommended agronomical practices were followed as per the package of practices of Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir. The experiment under AICRP of both the years was conducted with following different treatments:

T0: Growing of two rows of maize as border crops and use of agri silver mulch sheet.

T1: T0+ seed treatment with seed pro @ 25g/kg and soil drenching of seed pro @5% at 1st true leaf stage after germination followed by 5-6 spray of seed pro (1%) at 10 day interval in rotation with Neem oil (0.02%) alternatively after 15 days after drenching.

T2: T0+ seed treatment with Carbendazim 12%+Mancozeb63% @ 3g/kg and drenching Captan 70%+Hexaconazole 5%wp @0.1% at Ist true leaf stage after the germination followed by 5-6 spraying of seed pro(1%) at 10 day interval in rotation with Neem oil(0.2%) alternatively after 15 days after drenching.

T3: T0+ seed treatment with seed pro @25g/kg and soil drenching of seed pro@5% Ist true leaf stage after germination followed spraying of Captan 70%+Hexaconazole 5% wp @0.1% followed by spraying of (Imidacloprid 17.8SL@7.5ml/15 l+ Neem oil 0.2%) followed by Fosetyl-Al @0.1% followed by Captan 70%+Hexaconazole 5%WP @0.1% followed by spraying of (Imidacloprid 17.8 SL @7.5ml/15 l + Neem oil 0.2%) followed by Fosetyl-AL @0.1% followed by Captan 70%+ Hexaconazole 5% wp @0.1% followed by spraying of (Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by Fosetyl-AL @0.1% at 10 days interval

T4: T0+ seed treatment with seed pro @25g/kg and soil drenching of seed pro@5% Ist true leaf stage after germination followed spraying of(Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by spray Tebuconazole 50%+Trifloxystrobin 25% @1g/l followed Fosteyl-AL@.1%, followed by spray of Tebuconazole 50%+ Trifoloxistrobin 25%@1g/l followed by spray of (Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by Fosetyl-AL @0.1% at 10 days interval.

T5: T0+ seed treatment with Carbendazim 12%+Mancozeb 63% @ 3g/kg and drenching of Captan 70%+Hexaconazole 5%wp @0.1% 15 days after germination followed by spraying of Tebuconazole 50%+ Trifloxystrobin 25% @1g/l +spray with (Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by Fosetyl-AL @0.1% followed by spraying of Tebuconazole 50%+Trifloxystrobin 25% @1g/l+ spray with (Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by Fosetyl-AL @0.1%at 10 days interval

T6: T0+ seed treatment with Carbendazim 12%+Mancozeb 63% @ 3g/kg and drenching

of Captan 70%+Hexaconazole 5%wp @0.1% 15 days after germination followed by spray with(Imidacloprid 17.8 sl @7.5ml/15 l+Neem oil 0.2%) followed by spraying of Captan 70%+Hexaconazole 5% wp @0.1% followed by Fosetyl-al @0.1% followed by spraying of Captan 70%+Hexaconazole 5% wp @0.1% + spray with (Imidacloprid 17.8SL@7.5ml/15 l+ Neem oil 0.2%) followed by Fosetyl-al @0.1% at 30 days after drenching.

T7: Control/without treatment

Disease severity was calculated on the basis of scale given hereunder by Biswas *et al.*, 1992:

Results and Discussion

A perusal of the data presented in Table 1 indicates that the lowest disease incidence of 5.62 % was recorded in treatment T6, which also showed lowest percent disease index (1.20) with highest disease control of 94.35 % and highest yield (197.20 q/ha). The disease incidence in treatment T6 was significantly superior to all other treatments. However, the treatments T1, T2, T3, T4 and T5 were at par with each other with respect to the incidence of disease. Growing of two rows of maize as border crops and use of agri silver mulch sheet alone, without the application of fungicides, did not provide significant disease control and had lowest yield as well. The highest per cent disease index was recorded in treatment T7 (21.25 %), where none of the control measures, neither cultural nor chemical were applied. The yield increase over control was highest in case of T6 followed by T5, T4, T3, T2 and T1, in that order. The lowest yield increase over control was recorded in case of T0, which consisted of two rows of maize as border crop and use of agri silver mulch sheet.

Table.1 Management of Downy Mildew Disease in Bottle Gourd (*Lagenaria siceraria* (Mol.) Standl) under Temperate Condition of Kashmir

Treatments	Disease Incidence (DI)(%)	Percent Disease Index(PDI)	Percent Disease Control(PDC)	Total Yield(q/h)	Yield increase over control (%)
T0	24.50	15.41	27.48	133.80	35.29
T1	16.72	7.14	66.40	162.60	64.41
T2	14.12	6.15	71.05	167.70	69.57
T3	12.00	5.16	75.72	168.90	70.78
T4	11.43	3.10	85.41	190.00	92.11
T5	10.20	2.13	89.98	194.50	96.66
T6	5.62	1.20	94.35	197.20	99.39
T7	35.40	21.25	-	98.90	-
CD 5%	6.25	3.21		21.45	

Essentially this high medicinal value crop is attacked by several diseases out of which prominent ones are downy mildew, anthracnose, Alternaria leaf blight, *Fusarium oxysporum*, *Sclerotium rolfsii* and powdery mildew. Among them downy mildew is a prominent fungal disease incited by *Pseudoperonospora* and becomes most destructive under conducive inclement weather during the reproductive stage of crop. Hither to very meager research work has been done therefore it is advisable to the growers to

manage downy mildew disease of bottle gourd by following integrated management capsule under the stipulated treatments. Recent worldwide studies have shown that there has been a resurgence of *P. cubensis*in the recent past, as a result of which the disease causes more destructive epidemics than have been previously reported (Cohen *et al.,* 2015). This necessitates the development of control measures with holistic approach for effective management of disease. The United States Department of Agriculture's CDM ipmPIPE decision support system has resulted in reduction of 2 to 3 fungicidal sprays as compared to the recommended spray schedules (Ojiambo *et al.*, 2018).

The present study was an attempt to develop an integrated disease management schedule for the management of disease. Thus from the study, it can be concluded that the best downy mildew disease management module should consist of seed treatment with Carbendazim 12%+mancozeb 63% @ 3g/kg and drenching of captan 70%+hexaconazole 5%wp @0.1% 15 days after germination followed by spray with imidacloprid (17.8 sl @7.5ml/15 l+neem oil 0.2%) followed by spraying of captan 70%+hexaconazole 5% wp @0.1% followed by fosetyl-al @0.1% followed by spraying of captan 70%+hexaconazole 5% wp @0.1% + spray with (imidacloprid 17.8SL@7.5ml/15 l+ neem oil 0.2%) followed by fosetyl-al @0.1% at 30 days give result significantly suppressed the incidence and severity of downy mildew disease and thus enhanced the relative disease control..

If management practices are not taken care well in time, this disease may attain an alarming status and may wreak havoc in bottle gourd growing areas particularly in kitchen gardens of the people and in the fields of marginal farmers across Kashmir. Therefore, it is need of the hour to know effective management strategy against this dreaded disease of the crop.

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