

Original Research Article

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Toxicological Studies of Mulberry Powdery Mildew Effective Fungicide Residues on Growth and Development of Silkworm (*Bombyx mori* L.), Cocoon and Silk Quality Parameters

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ABSTRACT

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Study on assessing the toxic effects of fungicides on silkworm (*Bombyx mori* L.) and also on cocoon and silk quality parameters revealed that carbendazim 50% WP and wettable sulphur 80% WP at 0.1% were found to have no toxic effect by showing zero larval mortality at three days after treatment. The larval weight and larval length of 29.33 g and 5.73 cm respectively in carbendazim 50% WP and 29.10 g and 5.42 cm in wettable sulphur 80% WP was found to be higher than other fungicidal treatments. The cocoon characters like cocoon weight of 11.37g and 11.22 g, pupal weight of 8.40 g and 8.29 g, shell weight of 2.95 g and 2.93 g, shell ratio of 26.12 and 26.11 per cent and cocoon yield of 398.34 g/df and 392.70 g/df was higher in carbendazim 50% WP and wettable sulphur 80% WP at 0.1 per cent concentration respectively. The silk quality traits like filament length of 857.02 m and 820.58 m, filament weight of 0.20 g and 0.21 g and denier of 2.14 % and 2.27 % was found to be higher in carbendazim 50% WP and wettable sulphur 80% WP treatment at 0.1 concentration.

Introduction

Mulberry (*Morus alba*) is a perennial plant belongs to the family *Moraceae*, the food plant of silkworm (*Bombyx mori* L.). It is cultivated in both tropical and temperate countries of the world. Though mulberry cultivation is practiced in various climates in India, it is extensively grown in the tropical zone covering Karnataka, Andhra Pradesh and Tamil Nadu states with about 90 percent of area where, most of the sericulture industry is concentrated. In the sub-tropical zone, West Bengal, Himachal Pradesh and the north eastern states have major areas under mulberry cultivation (Datta, 2011). Among the major diseases occurring on the

mulberry powdery mildew caused by *Phyllactinia corylea* causes 5-10% loss due to defoliation and an additional loss of 20-25% through destruction of leaf area (Sukumar and Ramalingam, 1989; Teotia and Sen, 1994). Feeding the diseased leaves affect the growth and development of silkworm. The disease is managed by spraying systemic fungicides. Since, the mulberry leaf is fed directly to the silkworms and as the worms are highly fragile, the fungicidal spray residues affect the health and cocoon quality and weight. Also, the information on the residual toxicity of fungicides on silkworm is little and inadequate. Hence, there is a need to screen

the fungicides for selection of suitable, effective and safer compounds for control of diseases in mulberry and the present study undertaken is in this direction.

Materials and Methods

Toxicological studies on silkworm (*Bombyx mori* L.) Cross breed hybrid (Pure Mysore x CSR2) was carried out Department of Plant Pathology, College of Agriculture, V.C. Farm, Mandya. Different concentrations of fungicides viz., T₁, T₂, T₃ (Carbendazim 50% WP at 0.1, 0.2 and 0.3% concentration); T₄, T₅, T₆ (Wettable sulphur 80% WP at 0.1, 0.2 and 0.3% concentration); T₇, T₈, T₉ (Tebuconazole 50%+Trifloxystrobin 25% WG at 0.1, 0.2 and 0.3% concentration); T₁₀, T₁₁, T₁₂ (Carbendazim 12%+ Mancozeb 63% WP at 0.1, 0.2 and 0.3% concentration); T₁₃, T₁₄, T₁₅ (Hexaconazole 5% EC at 0.1, 0.2 and 0.3% concentration); T₁₆, T₁₇, T₁₈ (Difenconazole 25% EC at 0.1, 0.2 and 0.3% concentration); T₁₉, T₂₀, T₂₁ (Mancozeb 75% WP at 0.1, 0.2 and 0.3% concentration); T₂₂ Control (Water spray) were prepared by w/v and w/w and the mulberry leaves were immersed in respective aqueous solutions for 2-3 minutes to absorb the solution uniformly. Later, the leaves were shade dried for 30 seconds, the treated leaves were fed once to 3rd instar 1st day silkworm larvae. After treatment imposition, fresh untreated leaves were offered until final day of 5th instar. Leaves sprayed with water and fed to silkworms served as control. Treatments were replicated thrice by using twenty worms with the statistical design of CRD.

Results and Discussion

Fungicide residue effect on larval mortality

The observations of fungicidal toxicity on larval mortality were recorded during 3rd instar stage at 1, 2 and 3 days after treatment

(DAT). In the present investigation it was observed that all the fungicides showed toxic effects on silkworm larvae at 1st and 2nd days after treatment. However, the toxic effects were gradually reduced at 3 days after treatment in some fungicides at different concentrations.

First day after treatment (DAT), it was noticed that the maximum larval mortality (31.89%) was recorded in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% which is on par with carbendazim 12%+ mancozeb 63% WP (30.80%) at 0.3%. This was followed by hexaconazole 5% EC (23.20%) at 0.3%, mancozeb 75% WP (22.93%) at 0.3%. The zero per cent larval mortality was observed in control treatment and least larval mortality of 4.95 per cent was recorded in wettable sulphur 80% WP at 0.1 per cent which was on par with carbendazim 50% WP (4.99%) at 0.1 per cent concentration. The data is presented in Table 1.

At second DAT, it was found that the maximum larval mortality (20.78%) was recorded in tebuconazole 50%+ trifloxystrobin 25% WG at 0.3% which is on par with mancozeb 75% WP (19.93%) at 0.3% and tebuconazole 50%+ trifloxystrobin 25% WG (19.48%) at 0.2 per cent concentration. The lowest larval mortality (0.00%) was observed in control treatment and it was followed by wettable sulphur 80% WP (4.00%) at 0.1% which is on par with carbendazim 50% WP (4.02%) at 0.1 per cent concentration and other treatments showed a significant effect on larval mortality, with mancozeb 75% WP (19.93%) at 0.3% and tebuconazole 50%+trifloxystrobin 25% WG (19.48%) at 0.2 per cent concentration. The zero per cent larval mortality was observed in control treatment and it was followed by wettable sulphur 80% WP (4.00%) at 0.1% which was on par with carbendazim 50% WP (4.02%) at 0.1 per cent concentration and

other treatments showed a significant effect on larval mortality.

Three DAT the maximum larval mortality (16.65%) was recorded in tebuconazole 50%+ trifloxystrobin 25% WG at 0.3% which was statistically significant over other treatments during three days after treatment (DAT). This was followed by carbendazim 12%+ mancozeb 63% WP (13.95%) at 0.3 per cent concentration and hexaconazole 5% EC with 12.04% at 0.3% and 11.36 per cent with mancozeb 75% WP at 0.3%. The zero per cent larval mortality was observed in control treatment, wettable sulphur 80% WP at 0.1% and carbendazim 50% WP at 0.1% which were statistically significant when compared with other treatments. Similar results were reported by Sikdar *et al.*, (1979) and Aherkar *et al.*, (1995).

Fungicide residue effect on larval weight

The observations of fungicidal toxicity on larval weight were recorded during 5th, 6th and 7th day of 5th instar, and it was found that there was a significant difference between treatments. The results from the Table 2 revealed that all the seven fungicides used at three different concentrations showed a significant effect on larval weight during 5th day of 5th instar. The highest larval weight (20.30g) was recorded in control treatment which is at par with carbendazim 50% WP with 18.85g at 0.1 per cent concentration, followed by wettable sulphur 80% WP with 18.73g at 0.1%. These treatments were statistically significant over other treatments.

The lowest larval weight (14.56g) was recorded in tebuconazole 50%+ trifloxystrobin 25% WG at 0.3% which is on par with hexaconazole 5% EC (14.60g) at 0.3 per cent concentration followed by mancozeb 75% WP (14.87g) at 0.3 per cent concentration.

At 6th day of 5th instar it was found that the maximum larval weight (24.94g) was noted in control treatment which was on par with carbendazim 50% WP (23.78g) at 0.1% followed by wettable sulphur 80% WP (23.42g) at 0.1% and hexaconazole 5% EC (22.30g) at 0.1%. The lowest larval weight (19.30g) was observed in tebuconazole 50%+ trifloxystrobin 25% WG at 0.3% followed by carbendazim 12%+ mancozeb 63% WP (19.32g) at 0.3 per cent concentration (Table 2).

During 7th day of 5th instar it was noticed that the highest larval weight (30.62g) was recorded in control treatment which is found on par with carbendazim 50% WP (29.33g) at 0.1% followed by (29.10g) with wettable sulphur 80% WP at 0.1%.

However, the lowest larval weight of 21.80g was found in tebuconazole 50%+ trifloxystrobin 25% WG at 0.3% followed by carbendazim 12%+ mancozeb 63% WP (21.97g) at 0.3% and mancozeb 75% WP (22.81g) at 0.3%. It may be due to non-toxic effect of fungicides on growth and development of silkworm from 3 days after treatment. Similar results were obtained by Gayathri *et al.*, (2011)

Fungicide residue effect on larval length

The observations of fungicidal toxicity on larval length was recorded during 5th, 6th and 7th day of 5th instar and found that there was a significant difference between treatments. During 5th instar, 5th day it was found that the larval length in control treatment, carbendazim 50% WP treated at 0.1%, carbendazim 50% WP at 0.2%, wettable sulphur 80% WP at 0.1% and wettable sulphur 80% WP at 0.2% has no significant difference when compared to other treatments with 4.85, 4.78 4.75, 4.73 and 4.70 cm respectively.

Table.1 Effect of powdery mildew effective fungicides on larval mortality of silkworm (*Bombyx mori* L.)

Tr	Fungicides	Conc. (%)	Larval mortality (%)		
			1 DAT	2 DAT	3 DAT
T ₁	Carbendazim 50% WP	0.1	4.99 (12.91)	4.02 (11.56)	0.00 (0.00)
T ₂	Carbendazim 50% WP	0.2	10.02 (18.45)	8.50 (16.95)	4.95 (12.85)
T ₃	Carbendazim 50% WP	0.3	12.11 (20.36)	10.02 (18.45)	4.99 (12.91)
T ₄	Wettable sulphur 80% WP	0.1	4.95 (12.85)	4.00 (11.54)	0.00 (0.00)
T ₅	Wettable sulphur 80% WP	0.2	12.22 (20.46)	10.02 (18.45)	4.59 (12.37)
T ₆	Wettable sulphur 80% WP	0.3	16.00 (23.58)	14.90 (22.70)	4.96 (12.87)
T ₇	Tebuconazole 50%+Trifloxystrobin 25% WG	0.1	19.02 (25.85)	12.00 (20.27)	4.99 (12.91)
T ₈	Tebuconazole 50%+Trifloxystrobin 25% WG	0.2	20.07 (26.61)	19.48 (26.19)	8.00 (16.43)
T ₉	Tebuconazole 50%+Trifloxystrobin 25% WG	0.3	31.89 (34.38)	20.78 (27.12)	16.65 (24.08)
T ₁₀	Carbendazim 12%+ Mancozeb 63% WP	0.1	10.00 (18.43)	12.23 (20.47)	4.90 (12.79)
T ₁₁	Carbendazim 12%+ Mancozeb 63% WP	0.2	21.17 (27.39)	16.96 (24.32)	9.97 (18.40)
T ₁₂	Carbendazim 12%+ Mancozeb 63% WP	0.3	30.80 (33.70)	17.86 (25.00)	13.95 (21.93)
T ₁₃	Hexaconazole 5% EC	0.1	9.47 (17.92)	9.13 (17.59)	5.18 (13.15)
T ₁₄	Hexaconazole 5% EC	0.2	12.85 (21.00)	17.82 (24.97)	10.01 (18.44)
T ₁₅	Hexaconazole 5% EC	0.3	23.20 (28.79)	16.90 (24.27)	12.04 (20.30)
T ₁₆	Difenconazole 25% EC	0.1	10.37 (18.78)	9.33 (17.78)	6.24 (14.46)
T ₁₇	Difenconazole 25% EC	0.2	12.41 (20.62)	12.22 (20.46)	9.27 (17.72)
T ₁₈	Difenconazole 25% EC	0.3	16.00 (23.58)	16.01 (23.58)	10.07 (18.50)
T ₁₉	Mancozeb 75% WP	0.1	16.94 (24.30)	8.29 (16.73)	4.99 (12.91)
T ₂₀	Mancozeb 75% WP	0.2	19.00 (25.84)	13.07 (21.19)	10.01 (18.44)
T ₂₁	Mancozeb 75% WP	0.3	22.93 (28.61)	19.93 (26.51)	11.36 (19.69)
T ₂₂	Control (Water spray)	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	S.Em±		0.69	0.57	0.31
	CD @ P=0.05		1.98	1.61	0.87

Tr = Treatment; DAT = Days after treatment; Figures in the parenthesis are Arc sine transformed values;

Table.2 Toxic Effect of different fungicides on larval weight and larval length of silkworm (*Bombyx mori* L.)

Tr	Fungicides	Conc. (%)	Average larval weight (g) at 5 th instar			Average larval length (cm) at 5 th instar		
			5 th day	6 th day	7 th day	5 th day	6 th day	7 th day
T ₁	Carbendazim 50% WP	0.1	18.85	23.78	29.33	4.78	5.45	5.73
T ₂	Carbendazim 50% WP	0.2	16.57	20.70	25.63	4.75	5.33	5.42
T ₃	Carbendazim 50% WP	0.3	16.63	19.73	25.61	4.57	5.19	5.21
T ₄	Wettable sulphur 80% WP	0.1	18.73	23.42	29.10	4.73	5.37	5.42
T ₅	Wettable sulphur 80% WP	0.2	16.19	20.88	26.45	4.70	5.30	5.36
T ₆	Wettable sulphur 80% WP	0.3	16.26	19.60	23.61	4.54	5.21	5.26
T ₇	Tebuconazole 50%+Trifloxystrobin 25% WG	0.1	16.67	21.97	23.23	4.60	5.31	5.35
T ₈	Tebuconazole 50%+Trifloxystrobin 25% WG	0.2	15.33	20.40	22.71	4.55	5.13	5.20
T ₉	Tebuconazole 50%+Trifloxystrobin 25% WG	0.3	14.56	19.30	21.80	4.32	4.68	4.78
T ₁₀	Carbendazim 12%+ Mancozeb 63% WP	0.1	16.21	20.67	23.63	4.58	5.05	5.13
T ₁₁	Carbendazim 12%+ Mancozeb 63% WP	0.2	15.41	20.31	22.88	4.47	4.93	5.07
T ₁₂	Carbendazim 12%+ Mancozeb 63% WP	0.3	15.25	19.32	21.97	4.33	4.71	4.85
T ₁₃	Hexaconazole 5% EC	0.1	17.37	21.24	25.35	4.57	5.13	5.21
T ₁₄	Hexaconazole 5% EC	0.2	17.31	22.30	23.52	4.51	5.10	5.16
T ₁₅	Hexaconazole 5% EC	0.3	14.60	21.17	23.35	4.45	4.83	4.98
T ₁₆	Difenconazole 25% EC	0.1	17.45	21.71	24.28	4.62	5.18	5.26
T ₁₇	Difenconazole 25% EC	0.2	17.09	21.27	23.96	4.53	5.16	5.22
T ₁₈	Difenconazole 25% EC	0.3	15.63	20.80	23.79	4.45	4.99	5.13
T ₁₉	Mancozeb 75% WP	0.1	17.38	21.08	25.27	4.61	5.22	5.29
T ₂₀	Mancozeb 75% WP	0.2	15.90	21.32	25.04	4.59	5.07	5.17
T ₂₁	Mancozeb 75% WP	0.3	14.87	19.47	22.81	4.47	4.98	5.09
T ₂₂	Control (Water spray)	control	20.30	24.94	30.62	4.85	5.47	5.94
		S.Em±	0.92	0.69	0.70	0.09	0.03	0.13
		CD @ P=0.05	2.62	1.96	2.01	0.25	0.08	0.36

Tr= Treatment; Figures in the parenthesis are arc sine transformed values

Table.3 Effect of powdery mildew effective fungicides on cocoon and silk parameters of silkworm (*Bombyx mori* L.)

Tr	Conc . (%)	Average Pupal weight (g)	Average Cocoon weight (g)	Average Shell weight (g)	Average Shell ratio (%)	Cocoon yield/1dfl (g)	Average filament length (m)	Average filament weight (g)	Denier (%)
T ₁	0.1	8.40	11.37	2.95	26.12 (30.73)	398.34	857.02	0.20	2.14
T ₂	0.2	6.87	7.23	1.81	25.03 (30.02)	253.05	813.82	0.21	2.37
T ₃	0.3	6.60	6.74	1.44	21.36 (27.52)	235.90	763.17	0.21	2.48
T ₄	0.1	8.29	11.22	2.93	26.11 (30.73)	392.70	820.58	0.21	2.27
T ₅	0.2	6.87	7.69	2.01	26.10 (30.72)	269.15	792.45	0.21	2.42
T ₆	0.3	6.33	6.83	1.49	21.81 (27.84)	239.05	786.15	0.22	2.51
T ₇	0.1	7.96	9.77	1.94	19.85 (26.45)	341.95	785.25	0.22	2.52
T ₈	0.2	5.74	7.09	1.35	19.04 (25.87)	248.15	730.57	0.21	2.57
T ₉	0.3	5.62	6.93	1.31	18.90 (25.77)	242.55	657.67	0.21	2.87
T ₁₀	0.1	7.20	8.95	1.75	19.55 (26.24)	312.21	783.45	0.20	2.35
T ₁₁	0.2	5.93	7.33	1.40	19.09 (25.09)	256.55	776.93	0.21	2.48
T ₁₂	0.3	5.76	7.08	1.32	18.64 (25.57)	247.80	741.38	0.22	2.68
T ₁₃	0.1	7.83	9.50	1.54	16.21 (23.74)	332.50	754.65	0.20	2.38
T ₁₄	0.2	6.40	7.61	1.21	15.90 (23.50)	266.35	745.87	0.20	2.45
T ₁₅	0.3	6.00	6.69	0.69	10.31 (18.73)	234.15	682.65	0.19	2.57
T ₁₆	0.1	7.70	9.32	1.62	17.38 (24.64)	326.20	773.55	0.21	2.44
T ₁₇	0.2	6.37	7.52	1.15	15.29 (23.02)	263.20	753.30	0.22	2.59
T ₁₈	0.3	6.30	7.15	0.85	11.88 (20.16)	250.25	723.60	0.22	2.71
T ₁₉	0.1	6.97	8.75	1.78	20.34 (26.80)	306.25	820.58	0.21	2.31
T ₂₀	0.2	6.09	7.19	1.10	15.29 (23.02)	250.81	792.45	0.21	2.43
T ₂₁	0.3	6.17	7.13	0.76	10.65 (19.04)	249.55	776.93	0.22	2.58
T ₂₂	contr	8.61	11.80	3.15	26.69 (31.10)	413.00	936.45	0.25	2.30
S.Em±		0.12	0.42	0.07	1.13	0.38	15.69	0.009	0.11
CD @ P=0.05		0.33	1.19	0.20	3.21	1.08	44.72	0.026	0.32

Tr = Treatment; Figures in the parenthesis are arc sine transformed values

The minimum larval length of 4.32 cm was observed in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% followed by 4.33 cm in carbendazim 12%+ mancozeb 63% WP at 0.3%, hexaconazole 5% EC at 0.3% and difenconazole 25% EC at 0.3% recorded 4.45cm and 4.47 cm in case of mancozeb 75% WP at 0.3% (Table 2).

At 5th instar, 6th day, it was found that there was no significant difference between control treatment and carbendazim 50% WP at 0.1% for larval length with 5.47cm and 5.45cm respectively and these were significantly superior over other treatments. The minimum larval length of 4.68cm was recorded in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% followed by carbendazim 12%+ mancozeb 63% WP (4.71cm) at 0.3%. The highest larval length 5.94cm was observed in control treatment which was on par with carbendazim 50% WP (5.73cm) treated at 0.1% which was significantly superior over other treatments during 5th instar, 7th day. The minimum larval length of 4.78cm was noticed in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% followed by carbendazim 12%+ mancozeb 63% WP (4.85cm) at 0.3 % and hexaconazole 5% EC (4.98cm) at 0.3%.

Fungicide residue effect on cocoon quality

The cocoon weight was maximum (11.80g) in control treatment which is on par with carbendazim 50% WP (11.37g) at 0.1% which was at par with followed by wettable sulphur 80% WP (11.22) at 0.1% but all other treatments shown significant effect on cocoon weight. The minimum cocoon weight of 6.69g was noticed in hexaconazole 5% EC treated at 0.3% as indicated in Table 3.

The pupal weight was maximum (8.65g) in control treatment which is on par with carbendazim 50% WP (8.40g) treated at 0.1% followed by wettable sulphur 80% WP

(8.29g) at 0.1%. The next best pupal weight of 7.96g was observed in tebuconazole 50%+trifloxystrobin 25% WG at 0.1%. The minimum pupal weight of 5.62g was noticed in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% which is closely followed by tebuconazole 50%+trifloxystrobin 25% WG (5.74g) at 0.2% and carbendazim 12%+ mancozeb 63% WP (5.76g) at 0.3% (Table 3).

The maximum shell weight (3.15g) was recorded in control treatment which is on par with carbendazim 50% WP (2.95g) treated at 0.1%. The next best treatment was recorded in wettable sulphur 80% WP with (2.93g) at 0.1%. The minimum shell weight (0.69g) was recorded in hexaconazole 5% EC at 0.3% which was on par with mancozeb 75% WP (0.76g) at 0.3%, followed by difenconazole 25% EC with (0.85g) at 0.3% (Table 3).

The findings of the present investigation are in accordance with Chandru *et al.*, (1995) who reported that the beneficial effects of the carbendazim at 2 and 3 per cent concentration with respect to larval, cocoon, shell weight and cocoon to shell ratio.

Similar results were obtained by Govindaiah *et al.*, (1994) who reported that feeding the silkworm with leaves treated by fungicides *viz.*, carbendazim, dinocap, wettable sulphur chlorothalonil, mancozeb and captafol immediately after three days after spraying had no effect on silkworm and there was no significant difference in mortality percentage, weight of larvae, cocoon weight, shell weight, cocoon yield and silk ratio between control and treatments.

The maximum shell ratio of 26.69 per cent was observed in control treatment which is on par with carbendazim 50% WP (26.12%) treated at 0.1% and wettable sulphur 80% WP (26.11%) at 0.1%, followed by wettable sulphur 80% WP (26.10%) at 0.2% and

carbendazim 50% WP (25.03%) treated at 0.2%. The minimum shell ratio was recorded in hexaconazole 5% EC (10.31%) at 0.3% which was on par with mancozeb 75% WP (10.65%) treated at 0.3% and difenconazole 25% EC (11.88%) at 0.3% (Table 3).

The maximum cocoon yield of 413.00g was recorded in control treatment which is statistically significant over other treatments.

The next best cocoon yield was recorded in carbendazim 50% WP with 398.34g at 0.1%. The lowest cocoon yield was recorded in hexaconazole 5% EC at 0.3 per cent with 234.15g

Fungicide residue effect on silk quality

The maximum filament length of 936.45m was recorded in control treatment which was significantly superior over other treatments. The next best was noticed in carbendazim 50% WP (857.02m) treated at 0.1%, followed by wettable sulphur 80% WP (820.58m) at 0.1% and 813.82m in carbendazim 50% WP at 0.2%. The lowest filament length of 657.67m was recorded in tebuconazole 50%+trifloxystrobin 25% WG at 0.3% which was significantly less when compared to other treatments as shown in Table 3.

The filament weight was maximum (0.25g) in control treatment which was significantly superior over other treatments. There was no significant difference in Wettable sulphur 80% WP at 0.3%, tebuconazole 50%+trifloxystrobin 25% WG at 0.3%, carbendazim 12%+ mancozeb 63% WP at 0.3%, difenconazole 25% EC at 0.2%, difenconazole 25% EC at 0.3% and mancozeb 75% WP at 0.3% with (0.22g) and rest of the other treatments were on par with each other with 0.21g. The minimum filament weight (0.19g) was recorded in hexaconazole 5% EC at 0.3% (Table 3).

The effect of fungicides on denier was significant. The larvae administered with leaves treated with carbendazim 50% WP at 0.1% recorded the lowest denier of (2.14) which was significantly superior over control (2.40). The fungicidal treatments viz., wettable sulphur 80% WP at 0.1%, mancozeb 75% WP at 0.1%, carbendazim 12%+ mancozeb 63% WP at (0.1%, carbendazim 50% WP at 0.2% and hexaconazole 5% EC affected little on denier of 2.27, 2.31, 2.35, 2.37 and 2.38 respectively which were on par with control treatment (2.40). However, the fungicide tebuconazole 50%+trifloxystrobin 25% WG at 0.3% failed to improve the denier as they recorded 2.83 and was on par with carbendazim 12%+ mancozeb 63% WP (2.68) treated at 0.3% and difenconazole 25% EC (2.59) at (0.3%) followed by mancozeb 75% WP (2.58) at 0.3%, whereas, hexaconazole 5% EC and tebuconazole 50%+trifloxystrobin 25% WG showed 2.57 at 0.3% followed by wettable sulphur 80% WP (2.51) at 0.3% (Table 3).

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