Bio-Efficacy of Granular Insecticides against White Grub (*Holotrichia consenguinea* Blanch) in Tulip (*Tulipa gesneriana* L) under Temperate Condition of Kashmir

Abstract

The field trial was conducted during 2018-19 and 2020-21 at Urban Technology Park, Habak, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (UT of Jammu and Kashmir) to evaluate the bio-efficacy of various insecticides viz., Clothiandin 50 WDG @ 300 g *a.i.*/ ha, Thiamethoxam 25 WG@ 80 g *a.i.*/ ha,Imidacloprid + Fipronil 80 WDG @ 300 g a.i./ha and Imidacloprid 70 WG@ 300 g *a.i.*/ ha against white grubs infesting tulip. The required amount of insecticides was applied in furrows by incorporating with pulverized soil before sowing of the tulip bulbs. Experimental results indicated that all the insecticidal treatments were significantly superior in respect of *per cent* reduction of bulb damage in both weight and number basis as well as reducing the number of grubs per square meter over the untreated control. However, the plots treated with Imidacloprid + Fipronil 80% WDG @ 300 g a.i./ha recorded lowest *per cent* of tuber damage (6.64 and 4.78 % both in weight and number basis) as well as least number of grubs (0.96/m^2) resulting in a marked increase in bulb yield of 220.78kg/500m^2. On the other hand, untreated control recorded lowest bulb yield (125.50kg/500m^2) with a very high levels of infestation (73.74% and 67.43% based on weight and number, respectively) of bulb caused by the grubs. The economics of various treatments revealed that the height net gain was procured in Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha that registered maximum B.C. ratio (1.57) followed by Imidacloprid 70 % WG @ 300 g a.i./ha (1.42). On the basis of efficacy of various treatments and economics,Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha was superior for effective and economical management of white grub in tulip crop.

Keywords: Bio-efficacy, GranularInsecticides, Tulip White Grub, Management.

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1. Introduction:

According to National horticulture board, area under floriculture sector in India during 2019-20 was 305 thousand hectares with a production of 762 thousand tonnes cut flowers and 2301 thousand tonnes loose flowers.In 2020-21, India exported 15,695.31 MT of floriculture commodities worth Rs. 575.98 crores or 77.84 million dollars to the world (Nath and Datta, 2022). India produces around 8.90 lakh tonnes of cut flowers and 19.0 lakh tonnes of loose flowers annually on an area of 3.40 lakh hectares, thus, generating significant money for the government through local and international trade.The Jammu & Kashmir UT having a diverse climate makes it ideal for floriculture commercialization yet the potential has been fully exploited. With the efforts of SKUAST-K and government of Jammu & Kashmir, the state's floriculture area has risen to 0.75 thousand hectares with a production of 0.42 thousand MT of loose flower and 1.82 thousand MT of cut flower (Sheikh *et al.*, 2015).This industry has potential for growth in the valley, as evidenced by the fact that in J&K, flower farming began on 80 ha in 1996 and has since grown to 350 ha, with estimated annual revenue of Rs. 13.50 million. A total of 9.297 hectares have been covered under protected cultivation by raising Tubular Structure Poly Houses, High Tech Poly Houses, Shade Net Houses, etc. in the private sector and over 1500 youth are directly employed in Kashmir Division's commercial floriculture industry (Wani *et al.*, 2016). Tulips are very famous spring -blooming perennial ornamental bulbous flowers grown due to their attractiveness. Tulip cultivation is limited in India. However, Himachal Pradesh and hilly areas of Jammu and Kashmir are perfect for Tulip cultivation. Tulip ranks among the top selling cut flowers at global level is becoming one of the leading flower crop in Kashmir. It is gaining popularity among flower growers of the valley due to congenial climatic condition coupled with increasing demand of dry bulbs for cut flower production. Insect-pests are the major biotic factor responsible for low yield and inferior quality of bulb/ flower.Considering the fact that the attack of various insect- pests is a major constraint in Tulip cultivation in Kashmir conditions, the proposed investigation was carried.

2. Materials and Methods

Bio-field efficacy of different insecticides were evaluated against the grubs of *Holotrichiaconsenguinea* in tulip (*Tulipa gesneriana* L) at Urban Technology Park, Habak, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (UT of Jammu and Kashmir) during 2018-19 and 2020-21.The experiment was laid out as

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RBD (Randomized Block Design) with corms planting in 30x 15 cm spacing in four replication (Plat-1). Four insecticidal treatments *viz*., Clothiandin 50 WDG @ 300 g *a.i.*/ ha, Thiamethoxam 25 WG@ 80 g *a.i.*/ ha,Imidacloprid + Fipronil 80 WDG @ 300 g a.i./ha and Imidacloprid 70 WG@ 300 g *a.i.*/ ha were incorporated with pulverized soil and thereafter, these were applied in furrows before sowing of the tulip tubers. In case of untreated control, water was sprayed in respective plots.The efficacy of each treatmentwas assessedon the basis ofper cent tuber damage caused by grubs both in weight andnumber basis also on the number of grubs per square meter atthe time of harvest and tuber yield. The tuber damage (weight and number basis) was calculated by following the methodology as Sharma (2013) delineated below:

Tuber damage by weight(TD%)=(Wd/Wt)×100Where,

Wd=weight of damaged tubers in a plot; Wt=total weight of tubers in same plot

Tuber damage by number (TD%)=(Nd/Nt)×100Where,

Nd=Number of damaged tubers in a plot; Nt=total number of tubers in same plot

Data on per cent tuber infestation for both weight and numberbasis were transformed into angular values (arcsin √x). Dataongrubpopulationwastransformedusingsquareroottransformation √(x+0.5) and finally all the transformed valueswere analyzed by using analysis of variance (ANOVA) forRandomized BlockDesign (Gomez and Gomez,1984).

3.Results and Discussion:

Perusal of the data for rabi 2018-19 and 2020-21 season shown in Table1 revealed that the all the treatments were significantly superior over untreated control in reducing the bulb damage (Plat-2) against white grub in tulip (*Tulipa gesneriana*) during the individual years and in pooled analysis as well. In 2018-19 Imidacloprid + Fipronil 80% WDG @ 300 g a.i./ha was found very effective in reducing bulb damage against white grub both in terms of weight and number recording values of 7.65 *per cent* and 5.56 *per cent* , respectively. It was followed by Imidacloprid 70 % WG @ 300 g a.i. /ha which registered bulb damage of 18.64 *per cent* and 16.01 *per cent* on the basis of weight and number, respectively.In 2020-21 too the results followed a similar trend with Imidacloprid + Fipronil 80 % WDG @ 300 g

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a.i./ha exhibiting least bulb damage on both weight and number basis with values of 5.63 and 3.99 %, respectively. The insecticidal treatments also differed significantly among each other in their efficacy to reduce the bulb damage against white grub in the tulip. Similarly in the pooled results with treatment Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha performed very well and recorded significantly superior values of *per cent* damage caused to the bulb registering figuring of 6.64 *per cent* and 4.78 *per cent* on weight and the number basis, respectively against white grub in tulip. Maximum bulb damage both on weight and number basis was observed in untreated control in the individual years and also in the pooled results.Number of grub/m^2 was significantly lessened by different treatments as compared to untreated control. In 2018-19 least number of grubs (0.94/m^2) was recorded in Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha being at par with Imidacloprid 70 % WG @ 300 g a.i./ha(1.95/$m^{2)}$. The values of grubs/m^2found in Clothiandin 50% WDG @ 300 g a.i. /ha (2.88/$m^{2)}$ and in Thiamethoxam 25% WG @ 80 g a.i. /ha (3.77/m^2) were also comparable Figure 1. In 2020-21, all the treatments were comparable among each other being significantly superior over untreated control. Pooled results, however, detected significant variations between insecticides and over untreated control in their effect on the number of grubs recorded /m^2. Height values of grubs/m^2 were recorded in untreated control in 2018-19 and 2020-21 (5.92/m^2 and 6.30/m^2) and in pooled results (6.11/m^2) as well. Results pertaining to bulb yield showed that insecticidal treatments affected significantly improvement in the bulb yield of tulip against white grub. Significantly highest bulb yield was observed in Imidacloprid + Fipronil 80 % WDG @ 300 g a.i. /ha (220.78kg/500m^2) followed by and at par with Imidacloprid 70 % WG @ 300 g a.i./ha (212.34kg/500m^2). The lowest bulb yield (125.50kg/500m^2) was found in untreated control. The economics of various treatments revealed that the height net gain was procured in Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha that registered maximum B.C. ratio (1.57) followed by Imidacloprid 70 % WG @ 300 g a.i./ha (1.42). Least B.C ratio was recorded in untreated control (0.79). On the basis of efficacy of various treatments and net gain Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha was considered superior for effective and economical management of white grub in tulip crop.This study is in close agreement with the findings of Mane and Mohite (2014) who observed that soil application of Imidacloprid 40% + Fipronil 40% 80 WG at 300 g/ha was found the most effective when compared maximum yield recorded in Imidacloprid+Fipronil 80 WG (220.78kg/500m^2). In our investigation, the highest yield and Cost: Beneft ratio were obtained in the plot treated with Fipronil40% + Imidacloprid 40% WG (1:57). The neonecotinoid group of insecticides

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viz.,Clothiandin50WDG,Thiamethoxam25WGandImidacloprid 70 WG also proved promising in reducing tuberinfestations caused by the grubs of *Holotrichiaconsenguinea*. The ability tomanage of white grub by usingdifferent neonicotinoid insecticides was also supported by the earlierfindings of Kumar and Pandey (2022).

4. Conclusion:

Experimental results indicated that all the insecticidal treatments were significantly superior in respect of *per cent* reduction of bulb damage in both weight and number basis as well as reducing the number of grubs per square meter over the untreated control. However, the plots treated with Imidacloprid + Fipronil 80% WDG @ 300 g a.i./ha recorded lowest *per cent* of tuber damage (6.64 and 4.78 % both in weight and number basis) as well as least number of grubs (0.96 per square meter) resulting in a marked increase in bulb yield of 220.78kg/500m^2.

On the other hand, untreated control recorded lowest bulb yield (125.50kg/500m^2) with a very high levels of infestation (73.74% and 67.43% based on weight and number, respectively) of bulb caused by the grubs of *Holotrichiaconsenguinea* Blanch. The economics of various treatments revealed that the height net gain was procured in Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha that registered maximum B.C. ratio (1.57) . On the basis of efficacy of various treatments and net gain Imidacloprid + Fipronil 80 % WDG @ 300 g a.i./ha was considered superior for effective and economical management of white grub in tulip crop.

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Plate 1. Experiment on bio-efficacy of some granular insecticides against soil arthropods in tulip (*Tulipa gesneriana*) at Urban Technology Park, Habak,SKUAST-K

Plate 2. Tulip bulbs infested with white grub

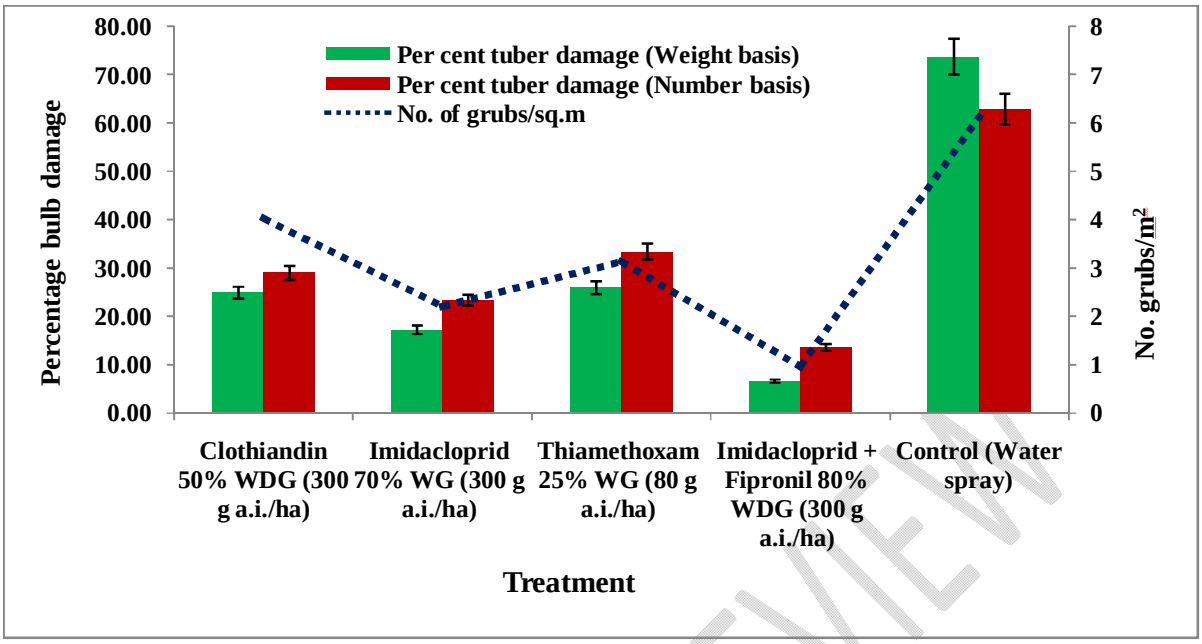

Figure 1: Effect of different treatment against white grub in bulb on tulip during 2018-19 and 2020-21

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Table 1: Evaluation of some granular insecticides against whitegrub(*Holotrichiacon senguinea* Blanch) in tulip (*Tulipa gesneriana* L) at Urban technology park ,Habak (Pooled of two years).

Treatments	Dose (*a.i.*/ha)	Per cent bulb damage (weight basis)			*Per cent* bulb damage (number basis)			No. of grubs/ m^2			Yield (kg/ $500m^2$) weight basis	B:C ratio
		2018-19	2020-21	Pooled	2018-19	2020-21	Pooled	2018-19	2020-21	Pooled	Pooled	Pooled
Clothiandin 50% WDG	300 g a.i./ha	26.30* (30.85)**	23.53 (28.99)	24.92 (29.92)	21.37 (24.49)	20.72 (27.06)	21.05 (27.28)	2.88* (9.74)***	3.38 (10.57)	3.13 (10.16)	200.67	1.29
Imidacloprid 70% WG	300 g a.i./ha	18.64 (25.56)	15.83 (23.40	17.23 (24.48)	16.01 (23.58)	13.84 (21.81)	14.92 (22.70)	1.95 (8.01)	2.45 (8.97)	2.20 (8.49)	212.34	1.42
Thiamethoxam 25% WG	80 g a.i./ha	21.63 (27.68)	30.33 (33.40)	25.98 (30.54)	18.58 (25.52)	26.83 (31.17)	22.70 (28.35)	3.77 (11.18)	4.27 (11/92)	4.02 (11.55)	180.56	1.07
Imidacloprid + Fipronil 80% WDG	300 g a.i./ha	7.65 (16.01)	5.63 (13.60)	6.64 (14.81)	5.56 (13.58)	3.99 (11.52)	4.78 (12.55)	0.94 (5.53)	0.99 (5.67)	0.96 (5.60)	220.78	1.57
Control	Water spray	68.36 (55.78)	79.13 (62.89)	73.74 (59.34)	62.50 (52.72)	72.36 (58.30)	67.43 (55.30)	5.92 (11.04)	6.30 (14.46)	6.11 (14.25)	125.50	0.79
SE(m)	-	0.62	0.92	0.55	2.35	0.84	0.56	0.38	0.44	0.29	4.45	-
CD(0.05)	-	1.91	2.83	1.62	2.36	2.53	1.63	1.17	1.37	0.85	13.50	-
CV (%)	-	3.97	5.66	1.23	5.38	5.419	1.35	7.83	8.60	2.06	5.78	-
Year	-	-	-	S	-	-	S	-	-	S	-	-
Treatment x Year	-	-	-	S	-	-	S	-	-	S	-	-

*Data are mean of four replications

** Data in parenthesis are angular transformed values ,

***Data in parenthesis are square root transformed values

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