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Evaluation of flubendiamide 3.5% + hexaconazole 5% WG for the management of lepidopteron pests and powdery mildew disease in blackgram

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Abstract
A field experiment was conducted during Kharif, 2016 to evaluate the efficacy of Flubendiamide 3.5% + Hexaconazole 5% WG for the management of lepidopteron pests and powdery mildew disease in blackgram at Agricultural Research station, Bidar, Karnataka. Among the two doses of evaluated, Flubendiamide 3.5% + Hexaconazole5% WG @ 1250 g/ha was proved to be ideal for the management of *Spodoptera litura*, *Helicoverpa armigera* and powdery mildew disease in blackgram with increase in the yield.

Keywords: Lepidopteron pests, powdery mildew disease, flubendiamide 3.5% + hexaconazole 5% WG, blackgram

Introduction
Blackgram, *Vigna mungo* (L.) is an important pulse crop grown throughout India. It has rich source of protein, phosphoric acid and established itself as a highly valuable with ability to improve the soil by fixing atmospheric nitrogen. The area under black gram in India is about 3.25 million ha with production of 1.81 million tonnes and productivity of 463 kg/ha. Though blackgram is grown in large area, the productivity was low due to various biotic and abiotic stresses. The main reasons for low yield are the susceptibility of the crop to insects, weeds and diseases caused by fungus, virus and bacteria.

Among the several factors responsible for such poor yield, undoubtedly, insect infestation is considered as one of the most important factor. In India about 18 species of insect pests damage the blackgram (Singh and Singh, 1977) [17]. The annual yield loss due to insect pests has been estimated to 30 per cent in urdbean and mung bean (Hamad and Dubey, 1983) [5]. In blackgram, the avoidable loss in yield due to insect pest was recorded to be 34.7 per cent (Saxena, 1983) [14]. Chhabra and Kooner (1985) found 54.3 per cent of losses caused by insect pests' complex in urdbean.

Apart from insect pests, blackgram crop suffers from various diseases caused by fungus, virus and bacteria. Among foliar fungal diseases, powdery mildew and rust are the more prevalent disease on blackgram, which occurs at later stages of crop growth. Powdery mildew becomes severe in dry season causing 9.0-50.0 per cent yield loss (Reddy *et al*., 2008 and Pandey *et al*., 2009). Powdery mildew caused by *Erysiphe polygoni*, is a problem in cool dry weather. The yield losses caused by foliar disease are proportional to the disease severity depending upon the stage of infection, genotypes and environmental conditions. Yield loss is much high when the pathogen infects the crop before flowering, however, it results in complete loss of the crop if disease occurs at seedling stage.

Since, blackgram is a short duration crop; Farmers rely on pesticides for the management of insect pests and diseases in black gram. Hence, the present study was undertaken to evaluate the efficacy of a newer insecticide and fungicide combination, Flubendiamide 3.5% + Hexaconazole 5% WG at different doses against lepidopteron pests and powdery mildew disease in blackgram under field conditions.

Flubendiamide activates the ryanodine sensitive calcium release channels (ryanodine receptors) on the intracellular calcium homeostasis, which induces body contraction followed by a rapid cessation of feeding. Flubendiamide is classified in group 28 (RyR modulator) in the IRAC (Insecticide Resistance Action Committee) classification and fits well into strategies of Insect Resistant Management (Nishimatsu *et al.*, 2005) [11].

Materials and Methods

A field experiment was conducted at Agricultural Research Station, Bidar during Kharif 2016 to evaluate the bio-efficacy of Flubendiamide 3.5% + Hexaconazole 5% WG in blackgram against *Spodoptera litura*, *Helicoverpa armigera* and powdery mildew diseases. The trial was laid in Randomized block design with eight treatments replicated thrice. Blackgram Var, DU-1 was sown at 45cm × 10cm spacing and all the recommended package of practices was followed to raise the crop, except plant protection measures. First spray was done at initiation of pest infestation in all the experimental plots and subsequent one more spray was given based on pest incidence. Observations on pre-treatment larval counts of lepidopterans were recorded at one day before treatment imposition and post treatment counts were recorded at 3, 7 days after imposition of treatment per meter row length and subjected for Square root transformation and statistical analysis.

The observation on powdery mildew and rust diseases was done before spray and at 10 days after each spray and worked out the Per cent Disease Index (PDI) using the formula as given below.

$$\text{Per cent Disease Index (PDI)} = \frac{\text{Sum of individual diseases ratings}}{\text{No. of observations assessed}} \text{ X } \frac{100}{\text{Maximum diseases ratings}}$$

The seed yield was recorded plot wise after harvest and converted to hectare basis and subjected for statistical analysis.

Results and Discussion

Management of lepidopteron insect pests, *Spodoptera litura*, *Helicoverpa armigera* and powdery mildew disease in blackgram with Flubendiamide 3.5% + Hexaconazole 5% WG was carried out at Agricultural Research Station, Bidar during Kharif, 2016. The data on the efficacy of different doses of Flubendiamide 3.5% + Hexaconazole 5% WG has been presented in table 1 and 2.

One day before spray larval population of *Spodoptera litura* in all the treatments ranged from 5.67 to 6.33 per meter row length and there was no significant difference among the treatments. Three days after spraying Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250 g/ha and Flubendiamide 20% WG @ 218.75 g/ha recorded significantly a lowest number of larvae, 1.33 and 1.67 larvae per meter row length (mrl) and these two treatments were followed by Flubendiamide 20% WG @ 175 g/ha, Flubendiamide 39.35% SC @ 100 ml/ha and Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha with 2.67 larvae/mrl, 2.80 larvae/mrl and 3.00 larvae/mrl respectively. However, highest population was recorded in untreated control (9.45 larvae/mrl) (Table 1).

Seven days after spraying Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250 g/ha and Flubendiamide 20% WG @ 218.75 g/ha recorded significantly a lowest number of larvae, 0.44 and 0.56 larvae per meter row length (mrl) and these two treatments were followed by Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha, Flubendiamide 39.35% SC @ 100 ml/ha and Flubendiamide 20% WG @ 175 g/ha with 0.89 larvae/mrl, 0.93 larvae/mrl and 1.00 larvae/mrl respectively, with respect to larval population of *Spodoptera litura.* However, highest population was recorded in untreated control (10.11 larvae/mrl).

Efficacy of Flubendiamide 3.5% + Hexaconazole 5% WG on larval population of *Helicoverpa armigera* was presented in Table.1. The Helicoverpa larval population ranged from 4.33 to 5.67 larvae/mrl among all the treatments and there was no significant difference among the treatments with respect to larval population.

Three days after spraying Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250 g/ha and Flubendiamide 20% WG @ 218.75 g/ha recorded significantly a lowest number of larvae, 1.5 and 1.67 larvae per meter row length (mrl) and these two treatments were followed by Flubendiamide 39.35% SC @ 100 ml/ha, Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha and Flubendiamide 20% WG @ 175 g/ha with 1.83 larvae/mrl, 2.67 larvae/mrl and 2.83 larvae/mrl respectively. However, highest population was recorded in untreated control (8.33 larvae/mrl) (Table 1).

Seven days after spraying Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250 g/ha and Flubendiamide 20% WG @ 218.75 g/ha recorded significantly a lowest number of larvae, 0.83 and 1.17 larvae per meter row length (mrl) and these two treatments were followed by Flubendiamide 20% WG @ 175 g/ha, Flubendiamide 39.35% SC @ 100 ml/h and Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha with 1.50 larvae/mrl, 1.87 larvae/mrl and 1.90 larvae/mrl respectively. However, highest population was recorded in untreated control (10.00 larvae/mrl) (Table 1).

Table 1: Effect of Flubendiamide 3.5%+ Hexaconazole 5% WG on lepidopteron larval population of blackgram during Kharif 2016

Sl. No.	Treatments	Dose/ha (formulation)	Average population of *Spodoptera litura*/MRL			Average population of *Helicoverpa armigera*/MRL		
			1DBS	3DAS	7DAS	1DBS	3DAS	7DAS
1.	Flubendiamide 3.5% + Hexaconazole 5% WG	1000g	6.00 (2.64)	3.00 (2.00)	0.89 (1.37)	5.00 (2.43)	2.67 (1.92)	1.90 (1.70)
2.	Flubendiamide 3.5% + Hexaconazole 5% WG	1250g	5.67 (2.58)	1.33 (1.53)	0.44 (1.20)	4.33 (2.31)	1.50 (1.58)	0.83 (1.35)
3.	Flubendiamide 20% WG	175g	6.33 (2.71)	2.67 (1.92)	1.00 (1.41)	5.33 (2.52)	2.83 (1.96)	1.50 (1.58)
4.	Flubendiamide 20% WG	218.75g	6.00 (2.65)	1.67 (1.63)	0.56 (1.25)	4.67 (2.38)	1.67 (1.63)	1.17 (1.47)
5.	Hexaconazole 5% EC	1250ml	6.33 (2.71)	8.56 (3.09)	9.22 (3.19)	5.50 (2.55)	6.83 (2.79)	8.83 (3.13)
6.	Flubendiamide 39.35% SC	100ml	6.00 (2.65)	2.80 (1.95)	0.93 (1.39)	5.67 (2.58)	1.83 (1.68)	1.87 (1.69)
7.	Quinalphos 25% EC	1500ml	6.00 (2.65)	4.67 (2.38)	2.89 (1.97)	5.00 (2.45)	5.67 (2.56)	4.33 (2.28)
8.	UTC	-	6.33 (2.69)	9.45 (3.23)	10.11 (3.32)	5.67 (2.58)	8.33 (3.05)	10.00 (3.31)
S Em±			0.08	0.10	0.12	0.09	0.12	0.11
CD (0.05)			NS	0.30	0.36	NS	0.35	0.33

DAS-Days after Sowing, Figures in the parentheses are square root transformed values

Table 2: Effect of Flubendiamide 3.5%+ Hexaconazole 5% WG on Powdery mildew disease and yield of blackgram during Kharif 2016

Sl. No.	Treatments	Dose/ha (formulation)	Per cent disease Index				Yield (q/ha)
			1st Spray		2nd Spray		
			1 DBS	10DAS	1DBS	10DAS	
1	Flubendiamide 3.5% + Hexaconazole 5% WG	1000g	7.35 (15.72)	4.7 (12.52)	6.8 (15.12)	6.00 (14.17)	7.61
2	Flubendiamide 3.5% + Hexaconazole 5% WG	1250g	7.47 (15.86)	3.16 (10.14)	5.2 (13.18)	5.15 (13.11)	9.03
3	Flubendiamide 20% WG	175g	7.14 (15.49)	15.12 (22.89)	26.7 (31.11)	31.88 (34.36)	6.51
4	Flubendiamide 20% WG	218.75g	7.25 (15.61)	15.75 (23.38)	26.73 (31.14)	32.70 (34.86)	7.19
5	Hexaconazole 5% EC	1250ml	7.18 (15.54)	3.55 (10.86)	6.1 (14.30)	6.25 (14.47)	4.00
6	Flubendiamide 39.35% SC	100ml	7.27 (15.64)	15.5 (23.20)	14.75 (22.59)	22.18 (28.09)	7.01
7	Quinalphos 25% EC	1500ml	7.45 (15.83)	16.75 (24.16)	27.75 (31.80)	33.15 (35.14)	5.11
8	UTC	-	7.32 (15.69)	17.15 (24.47)	29.15 (32.68)	35.00 (36.22)	3.82
S Em±			0.45	0.83	0.85	1.01	0.42
CD (0.05)			NS	2.51	2.56	3.07	1.27

DAS-Days after Sowing, Figures in the parentheses are arc sine transformed values

Powdery mildew disease incidence

One day before first spray Percent Disease Index (PDI) ranged from 7.18 to 7.47 in all the treatments. Ten days after first spray, Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250g/ha & Hexaconazole 5% EC @ 1250 ml/ha recorded lowest PDI of 3.16 and 3.55 respectively. These two treatments were followed by Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha by recording 4.70 PDI. However, untreated control recorded highest PDI of 17.15. Similar trend was observed during second spray (Table 2).

Yield

The yield data of Blackgram varied between 3.82 to 9.03 q/ha. The treatment comprising of Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250 g/ha has recorded significantly highest yield (9.03 q/ha), which was followed by Flubendiamide 3.5% + Hexaconazole 5% WG @ 1000 g/ha (7.61 q/ha), Flubendiamide 20% WG @ 218.75 g/ha (7.19 q/ha) and Flubendiamide 39.35% SC @ 100 ml/h (7.01 q/ha). All other treatments were found inferior to the above treatments, (Table 2). Untreated control recorded lowest blackgram yield of 3.82 q/ha.

Since the pesticide was new and combination of insecticide and fungicide, the reviews on this pesticide was not available. Hence, the results of individual products available on different crops are discussed here. Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250g/ha and 1000g/ha, were found very effective in managing lepidopteron pests and powdery mildew disease with increased yield of blackgram compared to the standard check and untreated control. These findings are in accordance with Mahalakshmi *et al.*, 2016 [10], who reported that flubendiamide 20% WG @ 60 g a.i./ha was proved better in curtailing both leaf eating caterpillar, *Spodoptera litura* and spotted pod borer, *Maruca vitrata* both in terms of larval population and pod damage coupled with higher seed yield. Ashok Kumar and Shivaraju (2009) [2] reported that flubendiamide 480 SC @ 48 g a.i/ha and Thiodicarb 75 WP @ 562.5g a.i./ha were highly effective followed by Indoxacarb 14.5 SC @ 75g a.i/ha in controlling the pod borers in blackgram. These findings are also in agreement with Tatagar *et al.* (2009) [18] who reported that Flubendiamide 20 WG @ 60 g a.i./ha was most effective in chilli against *S. litura* and *Helicoverpa armigera* resulting in highest yield with lowest fruit damage. Superior field efficacy of Flubendiamide was also reported against H. armigera in chickpea (Deshmukh *et al.*, 2010) [4], in tobacco (Shivanna *et al.*, 2012) [16], and in tomato (Ametha and Bunker, 2007) [1]; brinjal fruit and shoot borer (Jagginavar *et al.*, 2009; Chakraborti and Sarkar, 2011) [6]; *Aproaerema modicella* in groundnut (Praveena *et al*., 2011) [9]; yellow stem borer and leaf folder (Kulagod *et al*., 2011) [8]; and whorl maggot (Sharma and Srivastava, 2009) [12] in rice.

Further, Flubendiamide 20% WG @ 218.75 g/ha and Flubendiamide 39.35% SC @ 100 ml/ha were also proved to be very effective in managing *Spodoptera litura* and *Helicoverpa armigera* in blackgram. These findings were also in accordance with the Mahalakshmi *et al.*, 2016 [10], who reported that flubendiamide 20% WG @ 60 g a.i./ha was proved better in curtailing both leaf eating caterpillar, *Spodoptera litura* and spotted pod borer, *Maruca vitrata* both in terms of larval population and pod damage coupled with higher blackgram seed yield.

Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250g/ha and 1000g/ha and were followed by Hexaconazole 5% EC @ 1250 ml/ha found very effective in managing powdery mildew disease with increased yield of blackgram compared to untreated control. The present findings are in accordance with the results of Channaveeresh (2013) [3] who reported that, azoxystrobin 250% SC, hexaconazole 5% EC, myclobutanil 10% WP @ 0.1 per cent were more effective in managing the powdery mildew disease in blackgram and recorded significantly least PDI of 11.73 per cent was observed with azoxystrobin 250% SC @ 0.1% after spraying at maturity stage of the crop followed by hexaconazole 5% EC @ 0.1% (14.28 PDI). Khunti *et al*., (2002) [7] observed that penconazole and hexaconazole effectively minimized the disease intensity of powdery mildew and increased the yield to considerable extent in green gram.

Conclusion

Flubendiamide 3.5% + Hexaconazole 5% WG @ 1250g/ha and 1000g/ha, were found very effective in managing lepidopteron pests and powdery mildew disease of blackgram when they occur simultaneously.

References

1. Ameta OP, Bunker GK. Efficacy of flubendiamide against fruit borer, *Helicoverpa armigera* in tomato with safety to natural enemies. Indian J Pl. Prot. 2007; 35:235-237.
2. Ashokkumar CT, Shivaraju C. Evaluation of newer insecticide molecules against pod borers of black gram. Karnataka J Agri. Sci. 2009; 22(3):521-523.
3. Channaveeresh TS. Studies on integrated management of powdery mildew of blackgram caused by *erysiphe polygoni* dc. M. Sc., Agri., Thesis. Dept., of Plant pathology, UAS, Dharwad, 2013.

4. Deshmukh SG, Sureja BV, Jethva DM, Chatar VP. Field efficacy of different insecticides against *Helicoverpa armigera* (Hubner) infesting chickpea. Legume Res. 2010; 33:269-273.
5. Hamad SE, Dubey SL. Losses due to insect pests in North Bihar. Indian J Entomology. 1983; 1:136-146.
6. Jagginavar SB, Sunitha ND, Biradar AP. Bioefficacy of flubendiamide 480 SC against brinjal fruit and shoot borer, *Leucinodes orbonalis* Guen. Karnataka J Agri. Sci. 2009; 22(3):712-713.
7. Khunti JP, Bhoraniya MF, Vora VD. Management of powdery mildew and Cercospora leaf spot of mungbean by some systemic fungicides. J Mycol. & Plant Pathol. 2002; 32(1):103-105.
8. Kulagod SD, Hegde M, Nayak GV, Nayak AS, Vastrad PS, Hugar *et al*. Evaluation of insecticides and bio-rationals against yellow stem borer and leaf folder on rice crop. Karnataka J Agri. Sci. 2011; 24:244-246.
9. Praveena YV, Kotikal YK, Awaknavar JS, Kenchanagoudar PV, Somashekar. Evaluation of newer insecticides against groundnut leaf miner *Aproaerema modicella* Deventer. Karnataka J Agri. Sci. 2011; 24:542-545.
10. MahaLakshmi MS, Sreekanth M, Adinarayana Y, Koteswara Rao Y. Evaluation of Flubendiamide 20% WG (Takumi 20% WG) against legume pod borer, *Maruca vitrata* (Fabricius) in blackgram under field conditions. International Research Journal of Natural and Appl. Sci. 2016; 3(6):134-139.
11. Nishimatsu T, Hirooka T, Kodama H, Tohnishi M, Seo A. Flubendiamide-a new insecticide for controlling lepidopterous pests. Proceedings of the BCPC International Congress, Crop Science & Technology, Glasgow, United Kingdom. 2005; 2A3:57-64.
12. Pandey S, Sharma M, Kumari S, Gaur PM, Chen W, Kaur L *et al*. Integrated foliar diseases management of legumes. In: Grain Legumes: Genetic improvement, Management and Trade, Ed. By Masood Ali *et al*. Indian Society of Pulses Research and Development, Indian Institute of Pulses Research, Kanpur, India, 2009, 143-161.
13. Reddy KS, Dhanasekar P, Dhole VJ. A review on powdery mildew disease resistance in mungbean. J Food Leg. 2008; 21(3):151-155.
14. Saxena HP. Losses in blackgram due to insect pests (special issue on crop losses due to insect pest). Indian J ENT. 1983; 2:294-297.
15. Sharma K, Pawan, Srivastava Ajai. Field evaluation of new insecticides and combinations against rice whorl maggot, *Hydrellia philippina* and leaf folder, *Cnaphalocrocis medinalis*. Oryza. 2009; 46:335-336.
16. Shivanna BK, Gangadhara Naik B, Gayathri Devi S, Krishna Naika R. Impact of biopesticides on budworm incidence and its effect on yield in FCV tobacco. Intl. J Life Sci. Biotech. & Pharm. Res, 1, 2012.
17. Singh KM, Singh RN. Succession of insect pests in greengram and blackgram under dryland condition at Delhi. Indian J ENT. 1977; 39(4):365-370.
18. Tatagar MH, Mohankumar HD, Shiva Prasad M, Mesta RK. Bio-efficacy of flubendiamide 20 WG against chilli fruit borers, *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fb.). Karnataka J Agri. Sci. 2009; 22(3):579-581.
19. Toshini Masanori, Tetsuyoshi Nishimatsu, Kazuhiko Mobota, Takashi Hirooka, Akira Seo. Development of a Novel Insecticide, Flubendiamide. J Pesti. Sci. 2010; 35:490-491.