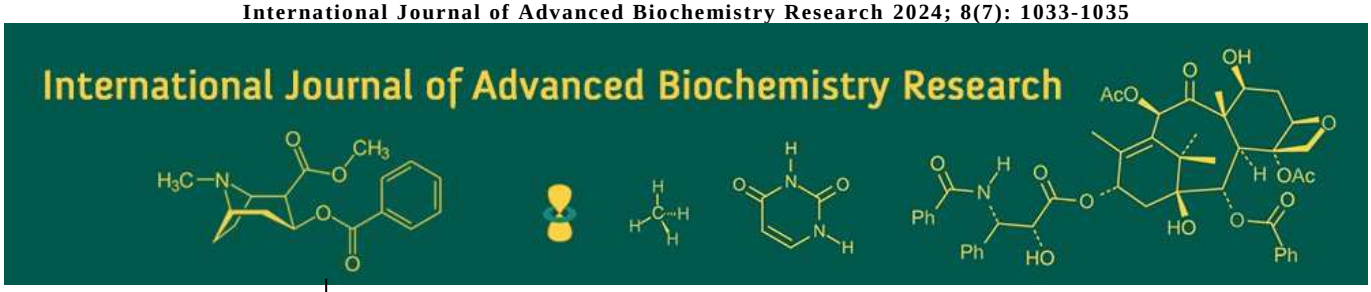

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Evaluation of different insecticides against whitefly on summer mungbean

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Abstract
A field experiment was conducted on mungbean crop to evaluate different insecticides against whitefly, *Bemisia tabaci* during summer season of 2022. The results indicated that minimum whitefly adult populations was recorded in treatment where Seed treatment with imidacloprid 600 FS @5 ml/kg seed + thiamethoxam 25WG @ 0.3 ml/l (0.90) First spray and at second spray the mean population of whitefly is 1.00/ trifoliate Whereas, overall mean 0.95 whitefly / trifoliate was recorded.

Keywords: Whitefly, *Bemisia tabaci*, mungbean, IPM 02-3, insecticide

Introduction
Mungbean (*Vigna radiata* L. Wilczek) is a vital grain legume, commonly consumed as human food in various forms such as cooked, fermented, milled, or sprouted. Its seeds are highly nutritious, containing 24% protein, 1.3% fat, 56.7% carbohydrate, 3.5% minerals, 4.1% fiber, 124 mg calcium, 326 mg phosphorus, 7.3 mg iron, and providing 334 calories per 100 grams. This rich nutritional profile makes mungbean a popular choice, especially for vegetarians, often referred to as the "poor man's meat." India stands out as the largest producer of mungbean globally, accounting for 65% of the world's acreage and 54% of global production (Jayappa *et al.*, 2017) [1]. Despite this, the average productivity of mungbean in India remains low, with various factors contributing to this issue, among which insect pests are a significant concern. Approximately 64 species of insect pests have been identified feeding on mungbean at different growth stages (Lal, 1985) [3]. Among these, the whitefly, *Bemisia tabaci* (Gennadius), poses a major threat, capable of causing complete yield losses under severe infestation conditions (Narasimhan *et al.*, 2010) [4]. Whiteflies hinder the plant's photosynthesis by promoting the growth of sooty mold on the honeydew they secrete. Moreover, they act as vectors for the yellow mosaic virus disease. While insecticides can effectively control whiteflies, their indiscriminate use has led to several problems such as insecticide resistance, pest resurgence, harmful residues, and disturbances to the agro-ecosystem. Therefore, present study was undertaken to evaluate the efficacy of different insecticides against whitefly, *B. tabaci*, in mungbean.

Materials and Methods
The present study was undertaken at the Research Farm, Rice section, Birsa Agricultural University, Kanke during Summer, 2022. Mungbean crop, variety IPM 02-3 was sown on 1st March, 2022 in a randomized block design (RBD) with three replications having plot size of 9 sqm each. Plant to plant and row to row spacing was maintained 10cm and 30 cm, respectively. All the recommended agronomic package of practices were followed to raise the good crop. Whitefly adult population were recorded from five randomly selected plants in each replication, one day before spraying of insecticide and then at 3, 7 and 10 days after spray (First spray: 30 days after sowing, second spray: 10 days after the first spray). The data was statistically analyzed with analysis of variance (ANOVA) and means at 5% level of significance.

Results and Discussion

Before spraying, the whitefly population ranged from 2.28 to 2.67 per trifoliate. After the first spray, the average whitefly population per trifoliate leaf ranged from 0.90 to 4.09. The lowest number of whiteflies, 0.90, was observed in T_8, which involved seed treatment with imidacloprid and thiamethoxam. This was closely followed by T_3 with 0.91 whiteflies, where seeds were treated with imidacloprid and diafenthurion. T_4, treated with imidacloprid and pyriproxyfen, had 1.05 whiteflies, while T_5, treated with imidacloprid and spinosad, had 1.14. The highest number of whiteflies, 4.09, was found in the control group whereas in second spray the average number of whiteflies on mungbean per trifoliate leaf ranged from 1.00 to 7.25. The lowest number of whiteflies, just 1.00, was found in treatment T_8, which involved seed treatment with imidacloprid 600 FS at 5 ml/kg seed combined with thiamethoxam 25 WG at 0.3 ml/l. This was closely followed by treatment T_3, with 1.05 whiteflies, which used imidacloprid and Diafenthurion 50WP at 1.25 ml/l. Treatment T_4, combining imidacloprid with Pyriproxyfen 10EC at 2 ml/l, resulted in 1.11 whiteflies, while treatment T_5, using imidacloprid with Spinosad 45 SC at 0.30 ml/l, had 1.27 whiteflies. The control group had the highest number of whiteflies, averaging 7.25 per trifoliate. The combined results of both sprays show that whitefly populations were effectively controlled with the treatment (0.95) T_8 (seed treatment with imidacloprid 600 FS at 5 ml/kg seed + thiamethoxam 25WG at 0.3 ml/l). This treatment performed similarly to (0.98) T_3 (seed treatment with imidacloprid 600 FS at 5 ml/kg seed + diafenthiuron 50WP at 1.25 ml/l), (1.05) T_4 (seed treatment with imidacloprid 600 FS at 5 ml/kg seed + pyriproxyfen 10EC at 2 ml/l), and (1.14) T_5 (seed treatment with imidacloprid 600 FS at 5 ml/kg seed + spinosad 45SC at 0.30 ml/l). The results of this study align with those of Shobharani *et al.* (2019) [6], who found that treating seeds with imidacloprid and spraying with thiamethoxam were highly effective against sucking pests such as aphids and jassids. Similarly, Rajawat *et al.* (2017) [5] and Kar *et al.* (2018) [2] also observed that this combination of seed treatment and spray was very effective in controlling sucking pests, including whiteflies, aphids, and thrips.

Table 1: Efficacy of insecticides for management of whitefly on mungbean during summer 2022

Treatments	Before Spray	Whitefly (numbers / trifoliate)								Overall Mean
		1st Spray (30 days after sowing)			MEAN	2nd Spray (40 days after sowing)			MEAN	
		3 DAS	7 DAS	10 DAS		3 DAS	7 DAS	10 DAS		
T_1: Seed Treatment with imidacloprid 600 FS @ 5 ml/Kg seed	2.28	2.29 (1.81)	2.68 (1.913)	3.02 (2.003)	2.67 (1.912)	3.15 (2.035)	3.23 (2.056)	3.31 (2.074)	3.23 (2.057)	2.95 (1.987)
T_2: T_1 + Bt var. kurstaki	2.3	2.34 (1.827)	2.66 (1.913)	2.87 (1.969)	2.62 (1.903)	3.04 (2.009)	3.33 (2.079)	3.4 (2.097)	3.26 (2.063)	2.94 (1.985)
T_3: T_1 + Diafenthiuron 50 WP @ 1.25 g/l	2.47	0.96 (1.398)	0.79 (1.338)	0.98 (1.409)	0.91 (1.382)	1 (1.411)	0.95 (1.395)	1.19 (1.479)	1.05 (1.43)	0.98 (1.406)
T_4: T_1 + Pyriproxyfen 10 EC @ 2.00 ml/l	2.41	1.06 (1.434)	0.97 (1.403)	1.12 (1.456)	1.05 (1.432)	1.12 (1.456)	0.98 (1.405)	1.2 (1.482)	1.11 (1.452)	1.08 (1.443)
T_5: T_1 + Spinosad 45 SC @ 0.30 ml/l	2.4	0.99 (1.41)	1.18 (1.476)	1.24 (1.494)	1.14 (1.461)	1.17 (1.475)	1.43 (1.558)	1.2 (1.483)	1.27 (1.505)	1.2 (1.483)
T_6: T_1 + Chlorantraniliprole 18.5 SC @ 0.20 ml/l	2.3	2.11 (1.756)	1.49 (1.576)	2.48 (1.862)	2.03 (1.736)	2.85 (1.954)	1.66 (1.628)	3.38 (2.089)	2.63 (1.895)	2.33 (1.817)
T_7: T_1 + Azadirachtin 10000 ppm @ 1.5 ml/l	2.51	1.66 (1.618)	1.35 (1.526)	1.79 (1.661)	1.6 (1.611)	1.51 (1.578)	1.07 (1.436)	2.98 (1.976)	1.85 (1.673)	1.73 (1.646)
T_8: T_1 + Thiamethoxam 25 WG @ 0.30 g/l	2.5	0.54 (1.241)	0.94 (1.384)	1.21 (1.48)	0.9 (1.373)	0.95 (1.393)	0.85 (1.358)	1.2 (1.479)	1 (1.413)	0.95 (1.392)
T_9: T_1 + NSKE @ 5%	2.67	1.77 (1.663)	1.43 (1.557)	1.89 (1.7)	1.7 (1.641)	1.84 (1.685)	1.51 (1.584)	1.93 (1.711)	1.76 (1.66)	1.73 (1.651)
T_{10}: T_1 + Karanj oil @ 5%	2.43	1.98 (1.725)	1.75 (1.659)	1.7 (1.645)	1.81 (1.676)	1.99 (1.73)	1.78 (1.666)	1.67 (1.634)	1.81 (1.677)	1.81 (1.676)
T_{11}: Control	2.45	2.49 (1.863)	4.23 (2.271)	5.54 (2.538)	4.09 (2.237)	5.67 (2.552)	8.33 (2.973)	7.75 (2.94)	7.25 (2.865)	5.67 (2.573)
C.D. @ 5%	NS	0.225	0.235	0.252	0.197	0.278	0.418	0.288	0.228	0.191
S. Em (±)		0.076	0.079	0.085	0.066	0.094	0.141	0.097	0.077	0.064
SE(d)		0.107	0.112	0.12	0.094	0.132	0.199	0.137	0.109	0.091
C.V. (%)		8.115	8.35	8.396	6.883	9.251	14.006	9.034	7.428	6.434

DAS: Days after spray. *Value in parenthesis are square root transformation values

Conclusion

The 2022 field experiment on mungbean demonstrated that seed treatment with imidacloprid 600 FS (5 ml/kg) followed by thiamethoxam 25 WG (0.3 ml/l) was the most effective against whitefly (Bemisia tabaci). This combination resulted in the lowest overall whitefly population (0.95 per trifoliate leaf) after both the first and second sprays. Other treatments, such as imidacloprid with diafenthiuron, pyriproxyfen, or spinosad, also controlled whiteflies effectively but were slightly less efficient. The control group had the highest whitefly numbers, emphasizing the importance of targeted insecticide use. These results support using imidacloprid and thiamethoxam in Integrated Pest Management (IPM) for effective whitefly control in mungbean crops.

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