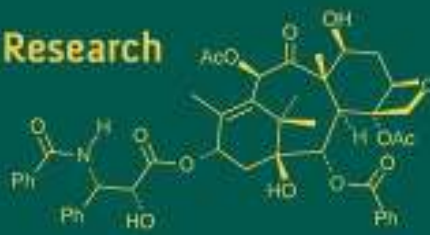
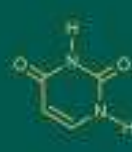
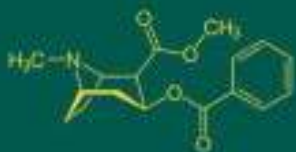


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M Safna
Department of Agricultural
Entomology, College of
Agriculture, Kerala
Agricultural University,
Thrissur, Kerala, India

Berin Pathrose
Department of Agricultural
Entomology, College of
Agriculture, Kerala
Agricultural University,
Thrissur, Kerala, India

M Allada
Department of plant
pathology, GB pant University
of Agriculture and Technology,
Uttarakhand, India

Naduvilthara U Visakh
Department of Agricultural
Entomology, College of
Agriculture, Kerala
Agricultural University,
Thrissur, Kerala, India

RR Rachana
ICAR-NBAIR, Bengaluru,
Karnataka, India

A Latha
Agricultural Research Station,
Kerala Agricultural
University, Thrissur, Kerala,
India

Mani Chellappan
Department of Agricultural
Entomology, College of
Agriculture, Kerala
Agricultural University,
Thrissur, Kerala, India

Corresponding Author:
M Safna
Department of Agricultural
Entomology, College of
Agriculture, Kerala
Agricultural University,
Thrissur, Kerala, India

Comparative assessment of chemical and biorational insecticides for management of *Thrips parvispinus* (Karny) in cowpea

M Safna, Berin Pathrose, M Allada, Naduvilthara U Visakh, RR Rachana, A Latha and Mani Chellappan

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Abstract

Efficacy of insecticides and biorational insecticides against *Thrips parvispinus* Karny (Thysanoptera: Thripidae) infesting cowpea (*Vigna unguiculata*) was evaluated during summer 2023 and rabi 2023-24. The treatments included emamectin benzoate, spinosad, thiamethoxam, fluxametamide, azadirachtin, *Lecanicillium lecanii*, insecticidal soap and horticultural mineral oil. The results revealed emamectin benzoate as the most effective insecticide, with average thrips population of 10.84 and 9.13 thrips/plant during the first season (summer) and 8.94 and 6.33 thrips/plant in the next season (rabi) followed by fluixametamide with an average thrips population of 13.51 and 11.12 thrips/plant during summer and 10.28 and 8.33 thrips/plant during rabi, respectively. Average leaf and flower damage intensity of emamectin benzoate increased linearly with thrips population (2.38 and 3.42). The lowest number of damaged flowers (3.53 flowers/plant), the highest number of pods (9.29 pods/plant) with longer pods (29.30 cm) and a higher number of seeds per pod (15.87seeds/pod) was also recorded in emamectin benzoate, followed by fluxametamide in the first season and a similar trend was followed during rabi. The results of the large-scale trials of the most effective treatments were also consistent with the results of the first season, with emamectin benzoate being the most effective treatment (8.94 and 6.33 thrips/plant). These findings emphasize the importance of an integrated approach using chemical and biorational agents for the sustainable management of thrips in cowpea.

Keywords: Emamectin benzoate, fluxametamide, horticultural mineral oil, thrips population per plant, intensity of leaf and flower damage, yield

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp.) is an important leguminous crop with high protein content and adaptable to diverse agroclimatic conditions. It contributes to human and livestock nutrition (Singh *et al.*, 2003) ^[24]. It also fixes atmospheric nitrogen through root nodules (Kolawale *et al.*, 2000) ^[10]. Insect pests are among the major factors contributing to its poor grain and fodder yields. Thrips are among the most damaging pests infesting cowpea (Ren *et al.*, 2025) ^[20]. Thrips belongs to Thysanoptera, and the major phytophagous thrips belong to the family Thripidae. It damages leaves, flowers, and pods, resulting in yield losses ranging from 20% to 80% (Singh and Allen, 1980) ^[26]. Browning of stipules, distortion, and flower bud abortion are common damage symptoms resulting from thrips feeding, and severe infestations can lead to complete crop failure (Oladejo *et al.*, 2017) ^[17]. In India, 18 thrips species have been recorded as invasive (Tyagi *et al.*, 2024) ^[30]. Among them, *Thrips parvispinus* Karny has been reported from a wide range of crops and has undergone rapid geographical expansion. Recent havoc caused by *T. parvispinus* in chilli has resulted in 70 to 100 per cent economic losses in Andhra Pradesh, Telangana, and Karnataka (Sridhar *et al.*, 2021) ^[27].

Effective management strategies are required to sustainably control invasive species such as *T. parvispinus*. Thrips are difficult to detect in crop fields due to their small size and cryptic nature. Species identification and adoption of timely management are necessary for its sustainable management. Considering these factors, this study was undertaken to assess the efficacy of biorational and chemical insecticides for managing thrips infesting cowpea.

Materials and Methods

Two field trials were conducted at Kerala Agricultural University, Vellanikkara (10.54840 °N longitude: 76.28724 °E) in two seasons. The first trial, with a plot size of 2x2 m² per replication, comprised 10 treatments, including biorational and chemical insecticides, in a randomized block design (RBD) with three replications. The insecticides were emamectin benzoate 5% SG @ 11 g a.i ha⁻¹, spinosad 45% SC @ 73 g a.i ha⁻¹, thiamethoxam 25 WG @ 25 g a.i ha⁻¹, fluxametamide 10 EC @ 40 g a.i ha⁻¹, broflanilide 20 SC @ 20 g a.i ha⁻¹, azadirachtin 1% @ 3 ml/litre, *Lecanicillium lecanii* (NBAIR strain V18) @ 20 g/litre, insecticidal soap @ 5 ml/litre, horticultural mineral oil @ 25 ml/litre (HMO) and untreated control. The second trial, with a plot size of 20 m² per replication, comprised the two most effective treatments from biorationals and the two most effective treatments from chemical insecticides, as recorded in the first trial. These were HMO and *L. lecanii*, emamectin benzoate and fluxametamide. The cowpea variety Kashi Kanchan was selected for the experiments and seeds were pre-soaked and sown 2-3 seeds per pit at a spacing of 30 x 20 cm. Two sprays were given at 15-day intervals from 30 days after sowing. The observations were taken from 8.00 am to 10 am (Togola *et al.*, 2019) [29]. The observations regarding the thrips population in the plant, the intensity of damage to leaves and flowers, the number of pods per plant, pod length, the number of seeds per pod and yield were recorded. Damage intensity was derived from leaf and flower scoring. Scoring of foliar injury level by thrips was based on the scale given by McLeod and Rashid (2012), whereas scoring of thrips damage in flowers was according to the scale given by Jackai and Singh (1988) [8]. The intensity of thrips damage for both leaves and flowers was expressed using the formula $R = (nb)/N$, where n = number of leaves or flowers damaged at the same level, b = level of damage (0-5 for leaves, 1-9 for flowers), and N = Total number of leaves or flowers in the sample (Duchovskiene, 2006) [6]. The data were analysed statistically using ANOVA and means were compared by LSD ($p \leq 0.05$).

Results

The present investigation revealed that emamectin benzoate 5% SG was the most effective treatment in reducing the population of *T. parvispinus* during both seasons. The lowest thrips population recorded in emamectin benzoate treated plots was 10.84 and 9.13 thrips/plant during first and second spray in the first season (summer) followed by fluxametamide (13.51 and 11.12 thrips/plant), spinosad (15.30 and 13.28 thrips/plant), broflanilide (17.55 and 15.06 thrips/plant) and thiamethoxam (19.33 and 17.15 thrips/plant). Among biorational insecticides, HMO recorded the least number of thrips (21.35 and 18.70

thrips/plant), followed by *L. lecanii* (22.99 and 20.53 thrips/plant), and insecticidal soap (24.22 and 22.08 thrips/plant). However, azadirachtin, the botanical treatment, was less effective (32.42 and 26.33 thrips/plant) (Tables 1 and 2).

The damage caused by *T. parvispinus* on leaves and flowers is expressed as the intensity of damage. It varied directly with the thrips population. The pooled mean indicated that emamectin benzoate had the lowest intensity of damage in both leaves and flowers (2.38 and 3.42), followed by spinosad (2.73 and 4.12), fluxametamide (2.82 and 3.68), and broflanilide (2.84 and 4.37). Among biorational insecticides, HMO exhibited lower thrips damage, with pooled means of 3.10 and 5.19, followed by *L. lecanii* (3.23 and 5.57), insecticidal soap (3.52 and 5.84), and azadirachtin (3.71 and 6.40) (Fig 1).

Pod length was measured, and the analysis revealed that plots treated with emamectin benzoate and fluxametamide had the longest pods (29.30 cm) among all treatments. This was followed by spinosad (28.44 cm), thiamethoxam (27.92 cm) and broflanilide (27.76 cm). *Lecanicillium lecanii* and HMO produced longer pods (27.48 cm and 27.37 cm) than all other biorational insecticides, followed by insecticidal soap (27.22 cm) (Table 7). Azadirachtin-treated plots exhibited smaller pods (26.29 cm). The number of seeds per pod was consistent with pod length. The highest number of seeds was observed in emamectin benzoate (15.87 seeds/pod), followed by spinosad (15.00 seeds/pod), fluxametamide (15.05 seeds/pod), and broflanilide (14.84 seeds/pod). Among biorational pesticides, HMO and *L. lecanii* recorded the highest seed numbers (13.78 and 13.71 seeds/pod), followed by insecticidal soap (13.40 seeds/pod). The lowest number of pods was recorded in azadirachtin with a pooled mean of 12.20 seeds/pod (Fig 2).

The extent of damage to flowers was quantified as the number of damaged flowers per plant. The lowest number of damaged flowers was observed in emamectin benzoate-treated plots, with a pooled mean of 3.53, followed by fluxametamide (4.31), spinosad (4.49) and thiamethoxam (5.80). HMO recorded fewer damaged flowers (7.69) among biorationals, followed by *L. lecanii* (12.00) and insecticidal soap (12.29). The least effective treatment was azadirachtin with a pooled mean of 16.00. The highest number of pods was recorded from emamectin-treated plots (9.29 pods/plant), followed by fluxametamide (6.89 pods/plant), spinosad (5.67 pods/plant), broflanilide (5.38 pods/plant) and thiamethoxam (5.09 pods/plant). Among biorationals, HMO recorded the highest number of pods (4.27 pods/plant), followed by *L. lecanii* (3.51 pods/plant), insecticidal soap (3.31 pods/plant). Azadirachtin remains the treatment with the lowest yield (2.89 pods/plant) (Fig 3).

Table 1: Thrips population after first spray (summer 2023)

No. of thrips per plant (No.s/plant)											
Sr. No.	Treatment	Days after treatment (DAT)								Average thrips population	
		Pre-count	3 DAT	5 DAT	7 DAT	9 DAT	11 DAT	13 DAT	15 DAT		
1	Emamectin benzoate	23.50	11.17 ^f	10.43 ⁱ	9.50 ^j	8.97 ^j	8.33 ⁱ	11.58 ^h	15.92 ^h		10.84 ⁱ
2	Spinosad	21.17	16.00 ^{de}	15.37 ^{gh}	14.08 ^{gh}	13.00 ^g ^h	12.00 ^g ^h	16.33 ^{fg}	20.33 ^{fg}		15.30 ^g ^h
3	Thiamethoxam	23.58	17.08 ^d	19.42 ^{ef}	18.72 ^{ef}	18.08 ^{ef}	17.00 ^{ef}	20.33 ^{de}	24.67 ^{de}		19.33 ^{ef}
4	Fluxametamide	24.08	13.67 ^{ef}	12.92 ^{hi}	11.92 ^{hi}	11.17 ^{hi}	10.67 ^{hi}	15.00 ^g ^h	19.25 ^{gh}		13.51 ^{hi}
5	Broflanilide	21.75	17.25 ^d	17.25 ^{fg}	16.41 ^{fg}	15.50 ^{fg}	14.41 ^{fg}	18.83 ^{ef}	23.16 ^{ef}		17.55 ^{fg}
6	Azadirachtin	22.17	21.50 ^b	26.75 ^b	26.33 ^b	25.33 ^b	24.50 ^b	28.00 ^b	32.42 ^b		26.40 ^b
7	<i>L. Lecanii</i>	22.42	18.17 ^{cd}	23.65 ^{cd}	22.83 ^{cd}	21.58 ^{cd}	20.92 ^{cd}	24.58 ^{bc}	29.17 ^{bc}		22.99 ^{cd}
8	Insecticidal soap	24.67	18.50 ^{bcd}	25.08 ^{bc}	23.88 ^{bc}	22.92 ^{bc}	22.33 ^{bc}	26.17 ^{bc}	30.67 ^b		24.22 ^{bc}
9	HMO	24.75	20.67 ^{bc}	21.10 ^{de}	20.33 ^{de}	19.00 ^{de}	18.50 ^{de}	22.83 ^{cd}	27.00 ^{cd}		21.35 ^{de}
10	Control (water spray)	22.33	33.00 ^a	32.33 ^a	34.33 ^a	34.33 ^a	38.00 ^a	40.00 ^a	45.00 ^a		36.71 ^a

Values are means of three replicates. Values with the same letters are not significantly different at $p < 0.05$.

Table 2: Thrips population after the second spray (summer 2023)

No. of thrips per plant (Nos./plant)										
Sr. No.	Treatment	Days after treatment (DAT)								Average thrips population
		Pre-count	3 DAT	5 DAT	7 DAT	9 DAT	11 DAT	13 DAT	15 DAT	
1	Emamectin benzoate	15.92 ^h	9.25 ^f	9.92 ^h	8.75 ⁱ	8.08 ⁱ	7.75 ^f	9.83 ^g	10.33 ^g	9.13 ⁱ
2	Spinosad	20.33 ^{fg}	12.00 ^{def}	14.08 ^{fg}	13.08 ^{gh}	12.17 ^{gh}	11.00 ^{ef}	14.83 ^{ef}	15.75 ^{ef}	13.28 ^{gh}
3	Thiamethoxam	24.67 ^{de}	13.25 ^{cde}	18.58 ^{de}	17.83 ^{ef}	17.08 ^{ef}	16.17 ^{cd}	18.17 ^{de}	19.00 ^{de}	17.15 ^{ef}
4	Fluxametamide	19.25 ^{gh}	10.50 ^{ef}	11.92 ^{gh}	10.58 ^{hi}	10.08 ^{hi}	9.67 ^f	12.08 ^{fg}	13.00 ^{fg}	11.12 ^{hi}
5	Broflanilide	23.16 ^{ef}	13.08 ^{cde}	16.33 ^{ef}	15.58 ^{fg}	14.41 ^{fg}	13.41 ^{de}	15.5 ^{ef}	17.08 ^e	15.06 ^{fg}
6	Azadirachtin	32.42 ^b	17.17 ^b	26.08 ^b	25.50 ^b	24.42 ^b	23.50 ^b	25.50 ^b	26.33 ^b	24.07 ^b
7	<i>L. Lecanii</i>	29.17 ^{bc}	13.75 ^{cd}	23.00 ^c	21.42 ^{cd}	20.67 ^{cd}	19.83 ^{bc}	22.00 ^{bc}	23.00 ^{bc}	20.53 ^{cd}
8	Insecticidal soap	30.67 ^b	15.42 ^{bc}	24.17 ^{bc}	23.25 ^{bc}	22.00 ^{bc}	21.58 ^b	23.58 ^b	24.58 ^b	22.08 ^{bc}
9	HMO	27.00 ^{cd}	15.75 ^{bc}	20.08 ^d	19.50 ^{de}	18.25 ^{de}	17.33 ^c	19.50 ^{cd}	20.50 ^{cd}	18.70 ^{de}
10	Control (water spray)	45.00 ^a	43.33 ^a	44.33 ^a	46.33 ^a	46.66 ^a	44.66 ^a	47.00 ^a	49.33 ^a	45.95 ^a

Values are means of three replicates. Values with the same letters are not significantly different at $p < 0.05$

During the second season (rabi), also, emamectin benzoate 5% SG was the most effective insecticide, recording the lowest thrips populations of 8.94 and 6.33 thrips/plant in the first and second sprays (Tables 3 and 4). This was followed by fluxametamide 10 % EC (10.28 and 8.33 thrips/plant), HMO (12.89 and 10.96 thrips/plant) and *L. lecanii* (17.75 and 15.13 thrips/plant). The intensity of damage on leaves and flowers was consistent with the thrips population in the plant. Pooled mean of damage intensity on leaves and

flowers revealed that emamectin benzoate as the treatment with the lowest thrips damage (2.21 and 3.57), followed by fluxametamide (2.86 and 3.87), HMO (3.69 and 4.79) and *L. lecanii* (3.90 and 4.97) (Fig 4). The yield obtained was also consistent with the results of the previous experiment. Emamectin benzoate exhibited superior yield performance (3.3 kg per 5 plants), followed by fluxametamide (2.85 kg per 5 plants), HMO (2.1 kg per 5 plants), and *L. lecanii* (1.65 kg per 5 plants) (Table 5).

Table 3: Thrips population after first spray (rabi 2023-24)

No. of thrips per plant (Nos./plant)										
Sr. No.	Treatment	Days after treatment (DAT)								Average thrips population
		Pre-count	3 DAT	5 DAT	7 DAT	9 DAT	11 DAT	13 DAT	15 DAT	
1	Emamectin Benzoate	24.12 ^a	10.81 ^e	9.69 ^e	9.00 ^d	8.56 ^d	6.87 ^e	8.50 ^e	9.19 ^d	8.94 ^e
2	Fluxametamide	24.75 ^a	12.87 ^d	11.06 ^d	9.81 ^d	8.87 ^d	8.69 ^d	10.12 ^d	10.56 ^d	10.28 ^d
3	HMO	24.31 ^a	15.44 ^c	13.12 ^c	12.87 ^c	11.94 ^c	11.06 ^c	12.62 ^c	13.19 ^c	12.89 ^c
4	<i>L. lecanii</i>	24.44 ^a	20.75 ^b	19.19 ^b	17.81 ^b	16.69 ^b	15.75 ^b	16.75 ^b	17.37 ^b	17.75 ^b
5	Control (water spray)	24.00 ^a	24.62 ^a	25.62 ^a	26.06 ^a	26.25 ^a	25.87 ^a	26.75 ^a	27.31 ^a	26.06 ^a

Values are means of three replicates. Values with the same letters are not significantly different at $p < 0.05$

Table 4: Thrips population after second spray (rabi 2023-24)

No. of thrips per plant (Nos./plant)										
Sr. No	Treatment	Days after treatment (DAT)								Average thrips population
		Pre-count	3 DAT	5 DAT	7 DAT	9 DAT	11 DAT	13 DAT	15 DAT	
1	Emamectin Benzoate	9.19 ^d	8.44 ^e	7.44 ^e	6.62 ^e	5.25 ^e	3.94 ^e	5.56 ^e	7.06 ^e	6.33e
2	Fluxametamide	10.56 ^d	10.19 ^d	9.25 ^d	8.94 ^d	8.12 ^d	6.87 ^d	8.44 ^d	10.00 ^d	8.83d
3	HMO	13.19 ^c	12.37 ^c	11.25 ^c	11.00 ^c	10.06 ^c	9.44 ^c	10.44 ^c	12.19 ^c	10.96c
4	<i>L. lecanii</i>	17.37 ^b	17.62 ^b	15.94 ^b	15.06 ^b	14.37 ^b	13.19 ^b	14.37 ^b	15.37 ^b	15.13b
5	Control (water spray)	27.31 ^a	27.87 ^a	27.62 ^a	28.37 ^a	29.06 ^a	29.56 ^a	30.00 ^a	29.81 ^a	28.90a

Values are means of three replicates. Values with the same letters are not significantly different at $p < 0.05$

Table 5: Yield obtained from different treatments

Yield (Kg/5 plants)						
Sr. No.	Treatment	Harvest intervals				Cumulative yield
		1 st harvest	2 nd harvest	3 rd harvest	4 th harvest	
1	Emamectin Benzoate	2.9 ^a	3.75 ^a	3.75 ^a	2.75 ^a	3.3 ^a
2	Fluxametamide	2.3 ^b	3.15 ^{ab}	3.45 ^a	2.55 ^a	2.85 ^b
3	HMO	1.85 ^b	2.5 ^{bc}	2.6 ^b	1.4 ^b	2.1 ^c
4	<i>L. lecanii</i>	2.15 ^b	2.0 ^c	1.45 ^c	0.95 ^{bc}	1.65 ^d
5	Control (water spray)	0.6 ^c	0.6 ^d	0.55 ^d	0.45 ^c	0.55 ^e

Values are means of three replicates. Values with the same letters are not significantly different at $p < 0.05$.

Discussion

The significant reduction in thrips population under emamectin benzoate treatment may be attributed to its neurotoxic mode of action. Similar findings have been reported in earlier studies, in which emamectin benzoate caused a significant reduction in thrips populations (Sahu *et al.*, 2015) [23].

Choudhary *et al.* (2022) [5] revealed that emamectin benzoate significantly suppressed thrips populations at 24 h after application. Higher efficacy of emamectin benzoate (0.59/leaf) and (0.55thrips/leaf) was recorded in chilli against *Scirtothrips dorsalis*, which was superior to the standard check dimethoate 30 EC @ 2 ml l⁻¹

(Ravikumar *et al.*, 2016) ^[19]. Among other chemical insecticides, fluxametamide, spinosad, broflanilide, and thiamethoxam also showed significant effectiveness in managing thrips populations. The effectiveness of spinosad observed in the present study is in agreement with previous studies by Misra (2012) ^[13], who reported that spinosad 45SC recorded the lowest 0.78-0.88 thrips at both 3 DAS (Days After Spray) and 7 DAS in tomato, which highlights its translaminar movement and rapid action leading to a significant reduction in thrips population. Spinosad was found to be the most effective treatment against *S. dorsalis* in winter strawberries (Renkema *et al.*, 2020) ^[21]. Similarly, new insecticide molecules have been reported to substantially suppress thrips populations due to their novel mode of action and minimal risk of resistance (Asahi *et al.*, 2018; Nakao *et al.*, 2016) ^[2, 16]. However, their rational application and resistance management guidelines are recommended to prevent resistance development in insects such as *Plutella xylostella* (Roy *et al.*, 2023) ^[22]. Thiamethoxam, a second-generation neonicotinoid, also suppressed thrips populations considerably compared with biorational insecticides. A seed treatment with thiamethoxam 30 FS + spray with imidacloprid 17.8 SL, seed treatment with imidacloprid 17.8 SL + spray with thiamethoxam 30 FS and seed treatment with thiamethoxam 70 WS + spray with imidacloprid 17.8 SL effectively reduced the thrips population, *Megalurothrips sjostedti* infesting cowpea whereas, azadirachtin did not show a distinct effect on thrips (Kaushik *et al.*, 2015) ^[9]. Hassan *et al.* (2024) ^[7] observed a higher initial percentage decrease in thrips population, *T. tabaci*, in thiamethoxam-treated plots with a diminution percentage (D%) of 93.3 ± 1.7 infesting onion.

In contrast, biorational treatments such as HMO, *L. lecanii*, insecticidal soap and azadirachtin were comparatively less effective than chemical insecticides. HMO is an inexpensive and environmentally friendly pest management alternative that effectively reduces thrips populations. Studies revealed that HMO reduced the insect population (64%) and found it effective against bean thrips, *Megalurothrips distalis* infesting mung bean (Singh *et al.*, 2020) ^[25]. *Lecanicillium lecanii* is a potential microbial biocontrol agent that reduces thrips populations and can serve as an alternative to the continuous, non-judicious application of synthetic insecticides. Subramaniam *et al.* (2021) ^[28] demonstrated that *L. lecanii* at 1500 g (1×10^7 conidia/ml), mixed in 400 litres of water, was effective against the tea thrips (*Scirtothrips bispinosus*), and that the powder formulation was safer for natural enemies in the tea ecosystem. Insecticidal soaps and azadirachtin are also promising, eco-friendly pest management alternatives that are effective against thrips. Azadirachtin was found to be the least effective among all treatments. Previous studies also indicated that azadirachtin reduced thrips incidence by 71.10%. In contrast, studies reported that neem seed powder extract (NSPE) (4%) and neem soap (NS) (1%) significantly reduced the population of *Thrips tabaci* in onion (Moorthy *et al.*, 2013) ^[14]. Aristizábal *et al.* (2017) ^[1] also demonstrated that biorational insecticides, such as HMO and azadirachtin, performed inferior to the standard check, spinosad.

The lowest leaf and flower damage intensity observed in emamectin benzoate compared to biorational insecticides. These findings were consistent with those of Ataide *et al.*

(2025) ^[3], who reported that chemical pesticides caused the highest mortality and the lowest leaf-feeding damage against *T. parvispinus* in bioassays compared with biorational treatments. Similarly, another study revealed a strong correlation between damage score and thrips population of *M. sjostedti* in cowpea (Zinettaabu *et al.*, 2023) ^[31].

The lowest number of damaged flowers was observed in emamectin benzoate-treated plots. Similar findings were reported earlier by Muthukrishnan *et al.* (2012) ^[15], who also reported that emamectin benzoate 5 SG was significantly effective at 11.0 and 22.0 g a.i./ha against *Rhipiphorothrips cruentatus* in grapes when sprayed twice at 15-day intervals. The highest number of pods was recorded from emamectin-treated plots. This was consistent with the study by Likhitar *et al.* (2024) ^[11], which indicated that emamectin benzoate 5% SG (17.52%) and spinosad 45% SC (19.79%) were the best treatments, with the lowest pod infestation, against *Maruca vitrata* infesting cowpea. Similar findings have been reported by Chandrika *et al.*, (2024) ^[4].

Emamectin benzoate and fluxametamide had the longest pods with highest number of seeds. Pod length and the number of seeds per pod decreased with increasing thrips infestation. This was in agreement with previous reports. Omo-Ikerodah *et al.* (2009) ^[18] reported that significant pod damage and yield reduction were observed in cowpea due to thrips infestation.

Conclusion

The results from both experiments across two seasons indicated that emamectin benzoate was the most effective treatment for reducing thrips populations. The superior performance of emamectin benzoate may be attributed to its neurotoxicity, which leads to rapid cessation of feeding. This was followed by fluxametamide, spinosad, thiamethoxam, and broflanilide, which provided substantial control of thrips. The reduction in thrips population is directly linked to fewer damaged flowers, lower damage intensity on leaves and flowers, and higher yield. Overall, the results clearly indicate that chemical insecticides, especially emamectin benzoate and fluxametamide, provide significant control of *T. parvispinus*. Biorational insecticides offered moderate suppression and are suitable for integrated pest management strategies. These findings can aid in the integrated use of chemical and biorational insecticides for effective management of thrips in cowpea.

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Conflict of Interest

No conflict of interest.

References

1. Aristizábal LF, Chen Y, Cherry RH, Cave RD, Arthurs SP. Efficacy of biorational insecticides against chilli thrips, *Scirtothrips dorsalis* (Thysanoptera: Thripidae), infesting roses under nursery conditions. J Appl Entomol. 2017;141(4):274-284.

2. Asahi M, Kobayashi M, Kagami T, Nakahira K, Furukawa Y, Ozoe Y. Fluxametamide: a novel isoxazoline insecticide that acts via distinctive antagonism of insect ligand-gated chloride channels. *Pestic Biochem Physiol.* 2018;151:67-72.
3. Ataide LM, Vargas G, Velazquez-Hernandez Y, De Giosa M, Reyes-Arauz I, Villamarin P, *et al.* Greenhouse evaluation of conventional and biorational insecticides for managing the invasive *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae). *Agriculture.* 2025;15(13):1451.
4. Chandrika MP, Kumar A. Comparative efficacy and economics of biopesticides with emamectin benzoate against diamondback moth, *Plutella xylostella* (L.) in cabbage, *Brassica oleracea* var. *capitata* (L.). *Int J Plant Soil Sci.* 2024;36(7):733-739.
5. Choudhary JS, Monobrullah MD, Kumar R, Raghav DK, Singh AK. Field efficacy of insecticides against chilli thrips (*Scirtothrips dorsalis*) and their effect on coccinellids. *Indian J Agric Sci.* 2022;92(10):1196-1201.
6. Duchovskienė L. The abundance and population dynamics of onion thrips (*Thrips tabaci* Lind.) in leek under field conditions. *Agron Res.* 2006;4:163-166.
7. Hassan ESM, El-Sheikh MF, Hegazy FH, Ali FA, Mesbah II. Efficacy of bioinsecticides, synthetic insecticides, macro and micronutrients for the management of onion thrips, *Thrips tabaci* in onion: a field trial. *J Crop Health.* 2024;76(4):799-810.
8. Jackai LEN, Singh SR. Screening techniques for host plant resistance to cowpea insect pests. *Trop Grain Legume Bull.* 1988;35:2-18.
9. Kaushik AK, Yadav SK, Srivastava P. Comparative efficacy of some insecticides for thrips control in cowpea (*Vigna unguiculata* L.). *Ann Plant Prot Sci.* 2015;23(2):294-297.
10. Kolawole GO, Tian G, Singh BB. Differential response of cowpea lines to aluminum and phosphorus application. *J Plant Nutr.* 2000;23(6):731-740.
11. Likhitar KP, Sisodia AS, Pralhad P, Barhate BM, Kumar A. Effect of selected insecticides and biopesticides against pod borer, *Maruca vitrata* of cowpea. *Int J Adv Biochem Res.* 2024;8(11S):107-109. DOI: 10.33545/26174693.2024.v8.i11Sb.2819.
12. McLeod P, Rashid T. Impact of tobacco thrips on cowpea. *Plant Health Prog.* 2012;13(1):6.
13. Misra HP. Field efficacy of a new molecule of insecticide against tomato thrips and its impact on coccinellid predators. *SAARC J Agric.* 2012;10(1):63-70.
14. Moorthy PK, Shivaramu K, Kumar NK, Ranganath HR, Saroja S. Comparative efficacy of neem products, essential oils and synthetic insecticides for the management of onion thrips, *Thrips tabaci* Lindeman. *Pest Manag Horticult Ecosyst.* 2013;19(1):23-26.
15. Muthukrishnan N, Govindan K, Visnupriya M. Effect of emamectin benzoate 5 SG against thrips and fruit borer complex on grapevine. *Madras Agric J.* 2012;99(10-12):871-876.
16. Nakao T, Banba S. Broflanilide: A meta-diamide insecticide with a novel mode of action. *Bioorg Med Chem.* 2016;24(3):372-377.
17. Oladejo AS, Boukar O, Fatokun CA, Obisesan IO. Genetic analysis of thrips resistance in cowpea (*Vigna unguiculata* [L.] Walp.). *Euphytica.* 2017;213(9):216.
18. Omo-Ikerodah EE, Fatokun CA, Fawole I. Genetic analysis of resistance to flower bud thrips (*Megalurothrips sjostedti*) in cowpea (*Vigna unguiculata* (L.) Walp.). *Euphytica.* 2009;165(1):145-154.
19. Ravikumar A, Chinniah C, Manisegaran S, Irulandi S, Mohanraj P. Effect of biorationals against the thrips, *Scirtothrips dorsalis* Hood infesting chilli. *Int J Plant Prot.* 2016;9(1):158-161.
20. Ren X, He Y, Wei X, Zheng L, Yu H, Huang X, *et al.* Thrips spatio-temporal distribution in cowpea (*Vigna unguiculata* (L.) Walp.) flowers based on the flower structures and floral development stage. *Plants.* 2025;14(24):3753.
21. Renkema JM, Krey K, Devkota S, Liburd OE, Funderburk J. Efficacy of insecticides for season-long control of thrips (Thysanoptera: Thripidae) in winter strawberries in Florida. *Crop Prot.* 2020;127:104945.
22. Roy D, Sau S, Adhikary S, Biswas A, Biswas S, Chakraborty G, *et al.* Resistance risk assessment in diamondback moth, *Plutella xylostella* (L.) to fluxametamide. *Crop Prot.* 2023;163:106101.
23. Sahu MK, Yadu YK, Verma D. Evaluation of different insecticides and plant product against chilli thrips, *Scirtothrips dorsalis*, and their effect on natural enemies. *J Plant Dev Sci.* 2015;7(8):631-638.
24. Singh BB, Ajeigbe HA, Tarawali SA, Fernandez-Rivera S, Abubakar M. Improving the production and utilization of cowpea as food and fodder. *Field Crops Res.* 2003;84(1-2):169-177.
25. Singh H, Cheema HK, Singh R. Field evaluation of horticultural mineral oils and botanicals against bean thrips, *Megalurothrips distalis* (Karny) (Thysanoptera: Thripidae), in summer mung bean. *Egypt J Biol Pest Control.* 2020;30(1):124.
26. Singh SR, Allen DJ. Pests, diseases, resistance, and protection in cowpea. In: Summerfield RJ, Bunting AH, editors. *Advances in legume science.* Kew: Royal Botanic Gardens; 1980. p. 419-443.
27. Sridhar V, Chandana PS, Rachana R. Global status of *Thrips parvispinus* (Karny, 1922), an invasive pest. *J Res PJTSAU.* 2021;49(4):1-11.
28. Subramaniam MSR, Babu A, Deka B. *Lecanicillium lecanii* (Zimmermann) Zare & Gams, as an efficient biocontrol agent of tea thrips, *Scirtothrips bispinosus* Bagnall (Thysanoptera: Thripidae). *Egypt J Biol Pest Control.* 2021;31(1):38.
29. Togola A, Boukar O, Chamarthi S, Belko N, Tamò M, Oigiangbe N, *et al.* Evaluation of cowpea mini core accessions for resistance to flower bud thrips *Megalurothrips sjostedti* Trybom (Thysanoptera: Thripidae). *J Appl Entomol.* 2019;143(6):683-692.
30. Tyagi K, Patidar A, Singha D, Kumar V. Fauna of India checklist: Arthropoda: Insecta: Thysanoptera (version 1.0). Kolkata: Zoological Survey of India; 2024. Available from: <https://doi.org/10.26515/Fauna/1/2023/Arthropoda:Insecta:Thysanoptera>
31. Zinettaabu D, Tengey TK, Alidu SM, Abdulai M, Ibrahim H, Ofori E. Evaluation of cowpea F₂ population for resistance to flower bud thrips (*Megalurothrips sjostedti*). *J Exp Agric Int.* 2023;45(2):47-55.