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Optimizing Grasshopper Pest Management: A Comparative Study of Insecticides in Bahariya Oasis and Dakahlia

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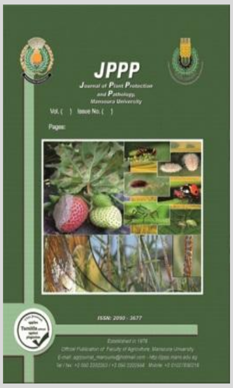

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ABSTRACT

Grasshoppers are among the most destructive agricultural pests globally, causing significant crop losses and threatening food security, particularly in regions like Egypt. This study comprehensively assessed the field efficacy of seventeen insecticides against significant grasshopper populations, particularly, *Euprepocnemis plorans plorans,* Charpentier, 1825 (Orthoptera: Acrididae), across two distinct Egyptian agricultural regions: Bahariya Oasis (Giza Governorate) and Dakahlia Governorate. The research systematically compared the performance of fast-acting chemical groups, including pyrethroids and avermectins, with slower-acting insect growth regulators (IGRs). Results demonstrated that pyrethroids (Kafrothrin, Lamdathrin, Alphazed, Cyperco) achieved rapid and near-complete mortality (97-99.8%) within 48 hours in both locations, highlighting their critical role for immediate pest suppression during acute outbreaks and rapid crop loss mitigation. The avermectin class (Benomect, Speedo, Excellent) also exhibited robust and persistent residual activity, yielding high mortality rates (91-93.4%) after 48 hours. In contrast, insect growth regulators (Scorch, Kafroseil) displayed a characteristic delayed effect, with their efficacy gradually increasing to approximately 45% mortality after 6 days, consistent with their mode of action disrupting insect development. Minor regional variations, such as slightly higher initial efficacy in Bahariya Oasis, potentially linked to lower humidity, influenced immediate compound performance. These findings decisively affirm the crucial role of pyrethroids and avermectins for grasshopper control. Concurrently, they underscore the strategic importance of integrating IGRs into integrated pest management (IPM) programs for sustainable, long-term population regulation and effective resistance management. This research refines localized IPM strategies, balancing rapid control with ecological sustainability, and contributes to global efforts in mitigating pesticide resistance and environmental impact.

Keywords*:* Control; Insecticides; Grasshoppers; Egypt

INTRODUCTION

Grasshoppers (Orthoptera: Acrididae) rank among the most devastating agricultural pests globally, capable of causing catastrophic crop losses and threatening food security (Latchininsky *et al*., 2011).

In Egypt, where agriculture contributes significantly to the national economy, grasshopper outbreaks pose a persistent challenge to farmers, particularly in regions like Bahariya Oasis and Dakahlia Governorate. Species such as *Euprepocnemis plorans plorans* and *Heteracris annulosa* are particularly destructive, exhibiting rapid population growth and voracious feeding behaviors that can decimate entire fields within days (Abdel-Fattah & Abdel-Lattef, 2013). The economic repercussions of these infestations are severe, often necessitating costly and repeated insecticide applications that strain agricultural budgets and raise ecological concerns (Belayneh, 2005).

The primary obstacle in grasshopper management lies in their remarkable adaptability and the limitations of conventional control strategies. While chemical insecticides remain the most widely used intervention, their efficacy is increasingly compromised by resistance development, particularly in pyrethroid and organophosphate compounds (Ahmad *et al*., 2006).

Furthermore, the non-target effects of broad-spectrum insecticides on pollinators, natural predators, and soil ecosystems underscore the urgent need for more sustainable pest management approaches (Desneux *et al*., 2007). Environmental variables, such as temperature and humidity, further influence insecticide performance, creating regional disparities in control outcomes that complicate standardized recommendations (Matthews *et al*., 2014).

Extensive research has been conducted to evaluate alternative control methods, including biological agents and insect growth regulators (IGRs). For instance, entomopathogenic fungi like *Metarhizium anisopliae* have shown promise in long-term grasshopper suppression but require specific environmental conditions to achieve optimal efficacy (Bateman *et al.,* 1993). Similarly, IGRs such as hexaflumuron and lufenuron disrupt chitin synthesis, offering a slower but more sustainable reduction in nymphal populations (Dhadialla *et al*., 1998). However, field studies comparing the performance of these diverse chemical classes under Egyptian agroecological conditions remain limited, leaving critical gaps in locally tailored pest management guidelines.

This study addresses these gaps by systematically evaluating the efficacy of seventeen insecticides, including pyrethroids, avermectins, neonicotinoids, and IGRs, against grasshopper populations in Bahariya Oasis and Dakahlia

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Governorate. By assessing mortality rates, residual activity, and environmental interactions, the research provides a nuanced understanding of insecticide performance in distinct climatic zones. The findings aim to refine integrated pest management (IPM) strategies, balancing rapid knockdown effects with long-term sustainability. Moreover, the study contributes to global efforts to mitigate pesticide resistance and ecological harm, aligning with the FAO's recommendations for locust and grasshopper management (Cressman & Dobson, 2001).

MATERIALS AND METHODS

Field trial and bioassay:

During the season 2024 many ecological surveys were carried out to evaluate the major insect pests of family Acrididae prevailing. Trials to 17 insecticides in table (1) were done at Atmeda village, Dakahlia Governorate and Baharia oasis western desert of Egypt. A suitable infested area characterized by high population tested nymphs were 3rd, 4th and 5th instars only.

Table 1. Groups and concentration of the pesticides

Trade Name	Concentration	Formulation	Active ingredient	Rate of Application
		Neonicotinoid class		
Crstprid Plus	70%	SP	Acetamiprid	10-15ml/100L water
Imigen	70%	WS	imidacloprid	30-50gm/100L water
Kafroxam	25%	WG	thiamethoxam	80-100gm/fed.
Rubek	22.7%+27.3%	WP	Acetamiprid+Binfthrin	100gm/fed.
Imidazed	20%	SC	imidacloprid	125-150ml/100L water
		Pyrethroid class		
Kafrothrin	2.5%	EC	Deltamethrin	250-300ml/fed.
Lamdathrin	5%	EC	Lambadacehalotherin	375-400ml/fed.
Alphazed	10%	EC	Alpha-cypermethrin	250ml/fed.
cyperco	20%	EC	Cypermethrin	375-400ml/fed.
		Avermectin class		
Benomect	9.1%	WG	Emamictin benzoate	40gm/fed.
Speedo	5.7%	WG	Emamictin benzoate	80gm/fed.
Excellent	1.9%	EC	Emamictin benzoate	250-300ml/fed.
		Spinosyn class		
Tracer	24%	SC	Spinosad	50ml/fed.
		Diamide class		
Coragen	20%	SC	chlorantraniliprole	60ml/fed.
		Insect Growth Regulators class		
Scorch	10%	EC	Hexaflumuron	200ml/fed.
Kafroseil	5%	EC	Lufenuron	160ml/fed.
Roxal	10%	WG	Pyriproxyfen	51ml/100L water

Spraying equipment tested on alfalfa plants and berseem:

Spray equipment and calibration Motorized knapsack mist blower was used in the present investigation. Normal spray nozzle was used for LV application Spray solution flow rates and swath width, were measured according to (Cressman and Dobson 2001).

The plots were aligned in parallel direction to the prevailing wind, in order to inhibit pollution of spray drift from one plot to the other durind spraying. Control plot was put upwind in relation to the others and sprayed with water only. Spraying was executed in the early morning when conditions were suitable for spraying (wind speed: 3-4 m/sec., measured using anemometer, temperature: 27°C. and relative humidity: 64% (Atmeda village), 40% (Baharia oasis). Spraying was executed using Kanapsach mistblower sprayer with flow scale graded from 1 to 5 ; the scale no 3 was selected and calibarated. The flow rate was 1.2 l /min; spraying hight was 0.5 m above vegetation and walking speed of the operator was 50 m/min. = 3 km/hr. swath width of 5 m.

Bioassay procedure:

To define grasshopper nymphs numbers, each treatment was represented by three replicate cages 0.5 m X 0.5 m. The insects were collected randomly from the same treatment after application directly by using sweep-net and placed 30 insects in each cage. The cages were kept and fed with treated plants (alfalfa, at Baharia oasis) and (berseem, at Atmida, Met-Ghamr) to the insects treated. Mortality countes after diferent period of treatment 1,2 days for Pyrethroids, Avermectins and 3, 6 days for Insect Growth Regulators. Assessments: in cages daily, routine work includes removing the previous uneaten food, faces and dead insects and counting the living insects before introducing the fresh food.

Statistical analysis of results was done according to SAS (1996) for biological studies: Dancan's for biological evaluation of insectisides in field.

RESULTS AND DISCUSSION

Results

1- Detailed Explanation of Results:

The presented data comprehensively evaluate the mortality percentages of *E. plorans plorans* following insecticide application in two different locations: Bahariya Oasis (Table 2) and Dakahlia Governorate (Table 3). The insecticides are categorized into two groups based on their mode of action and the duration of observation: fast-acting compounds (observed at 24 and 48 hours) and slower-acting compounds, primarily Insect Growth Regulators (observed at 3 and 6 days).

Results from Bahariya Oasis (Table 2):

Mortality percentage after (48 hours):

The efficacy of most insecticides increased significantly by 48 hours. Lamdathrin (99.4%) and Cyperco (99.6%) achieved near-complete mortality. Kafrothrin (99%) and Alphazed (98.6%) also maintained high levels of control.

Neonicotinoids and Avermectins generally showed good residual activity, with mortality percentages for

Kafroxam reaching 89%, Benomect 93.4%, Speedo 92.8%, and Excellent 93%.

Insect Growth Regulators mortality after (3 and 6 days):

Scorch, Kafroseil, and Roxal, belonging to the Insect Growth Regulators (IGRs) class, exhibited very low mortality at 24 and 48 hours, which is expected due to their mode of action. By 6 days, their efficacy increased, with Scorch reaching 46%, Kafroseil 45.8%, and Roxal 37% mean mortality. This delayed effect is characteristic of IGRs, which interfere with insect development.

Results from Dakahlia Governorate (Table 3):

Mortality percentage after (48 hours):

All tested insecticides showed an increase in mortality by 48 hours. Cyperco achieved almost complete control (99.8%). Lamdathrin (98%), Kafrothrin (98.4%), and Alphazed (97.8%) also maintained high levels of efficacy. Avermectins like Benomect (91.4%), Speedo (92.4%), and Excellent (92%) also showed good residual activity.

Insect Growth Regulators mortality after (3 and 6 days):

By 6 days, their effectiveness increased to 45.4% for Scorch, 44.4% for Kafroseil, and 38.4% for Roxal.

Table 2. Effect of different insecticides against *E. plorans plorans* after 1, 2 days, 3 and 6 days post treatment when applied using LV technique at Bahariya Oasis.

No.	insecticides	Mortality percentage %												Significant
		After 24hr.					Mean	After 48 hr.					Mean	
		Rep.1	Rep.2	Rep.3	Rep.4	Rep.5	24hr.	Rep.1	Rep.2	Rep.3	Rep.4	Rep.5	48hr.	
1	Crstprid Plus	73	75	73	71	73	73	88	88	86	90	89	88.2	a
2	Imigen	80	76	77	75	79	77.4	91	88	87	87	89	88.4	a
3	Kafroxam	81	80	79	81	79	80	90	89	88	89	89	89	a
4	Rubek	71	73	71	71	70	71.2	84	85	83	84	83	83.8	b
5	Imidazed	69	70	68	67	70	68.8	82	83	80	80	81	81.2	b
6	Kafrothrin	97	99	98	98	99	98.2	98	10	98	99	100	99	c
7	Lamdathrin	98	96	97	95	98	96.8	99	100	98	100	100	99.4	d
8	Alphazed	97	100	96	9	99	97.8	97	100	98	99	99	98.6	c
9	cyperco	97	98	97	97	99	97.6	99	100	99	100	100	99.6	c
10	Benomect	85	89	86	84	90	86.8	94	93	94	94	92	93.4	d
11	Speedo	88	90	87	87	89	88.2	92	95	92	95	90	92.8	d
12	Excellent	90	85	88	88	84	87	93	93	94	93	92	93	d
13	Tracer	65	66	68	63	68	66	75	79	76	78	77	77	e
14	Coragen	78	75	74	79	73	75.8	82	83	84	85	89	84.6	b
		After 3days						After 6 days						
15	Scorch	31	2925	25	30	27	28.4	44	49	46	51	40	46	f
16	Kafroseil	24	33	27	21	28	26.6	42	43	50	47	47	45.8	f
17	Roxal	19	22	16	18	24	19.8	38	40	33	37	37	37	j

Table 3. Effect of different insecticides against *E. plorans plorans* after 1, 2 days., 3 and 6 days post treatment when applied using LV technique at Dakahlia Governorate.

No.	insecticides	Mortality percentage %												Significant
		After 24hr.					Mean	After 48 hr.					Mean	
		Rep.1	Rep.2	Rep.3	Rep.4	Rep.5	24hr.	Rep.1	Rep.2	Rep.3	Rep.4	Rep.5	48hr.	
1	Crstprid Plus	69	71	73	68	66	69.4	86	85	87	88	86	86.4	A
2	Imigen	65	71	71	67	70	68.8	88	86	85	86	87	86.4	A
3	Kafroxam	72	71	75	74	75	73.4	89	88	89	88	87	88.2	A
4	Rubek	64	66	63	65	62	64	83	82	84	83	81	82.6	b
5	Imidazed	60	63	61	60	59	60.6	79	80	81	79	78	79.4	b
6	Kafrothrin	92	93	93	93	94	93	99	98	99	98	98	98.4	c
7	Lamdathrin	94	93	94	94	94	93.8	98	99	98	97	98	98	c
8	Alphazed	93	91	95	92	92	92.6	98	98	97	98	98	97.8	c
9	cyperco	95	94	92	95	96	94.4	100	100	100	99	100	99.8	c
10	Benomect	84	80	79	78	85	81.2	92	91	93	91	90	91.4	d
11	Speedo	81	87	80	84	86	83.6	93	91	93	94	91	92.4	d
12	Excellent	80	83	84	84	84	83	92	95	92	91	90	92	d
13	Tracer	59	57	60	61	59	59.2	72	77	78	77	76	76	b
14	Coragen	61	63	60	62	64	62	79	78	77	78	79	78.2	b
		After 3days						After 6 days						
15	Scorch	30	29	27	32	28	29.2	42	46	49	44	46	45.4	e
16	Kafroseil	28	27	29	27	26	27.4	43	43	46	45	45	44.4	e
17	Roxal	18	17	20	19	22	19.2	40	37	37	40	38	38.4	f

Best Performing Compounds and Comparisons:

Compounds 1-14 (Fast-acting insecticides):

Bahariya Oasis:

After 48 hours:

Lamdathrin and Cyperco demonstrated the highest efficacy, achieving nearly 100% mortality. Kafrothrin and Alphazed also maintained very high control (98.6-99%). The Avermectin class (Benomect, Speedo, Excellent) also performed very well at 48 hours, with mortality rates exceeding 92%.

Dakahlia Governorate:

After 48 hours:

Cyperco achieved almost complete mortality (99.8%). Lamdathrin, Kafrothrin, and Alphazed also showed excellent residual control (97.8-98.4%). Avermectins maintained good efficacy, ranging from 91.4% to 92.4%.

Overall Best Performers (1-14):

The Pyrethroid insecticides (Kafrothrin, Lamdathrin, Alphazed, and Cyperco) are consistently the most effective fast-acting compounds in both locations, providing rapid and high mortality rates, particularly by 48 hours post-treatment. The Avermectin class (Benomect, Speedo, Excellent) also demonstrated very strong and consistent performance, particularly in terms of residual activity.

Compounds 15-17 (Insect Growth Regulators):

Bahariya Oasis:

Scorch and Kafroseil showed comparable efficacy at both 3 and 6 days, with mortality rates reaching around 46% by day 6. Roxal exhibited slightly lower efficacy (37%).

Dakahlia Governorate:

Scorch and Kafroseil again demonstrated similar performance, reaching approximately 45% mortality by day 6. Roxal was consistently the least effective among the IGRs.

Overall Best Performers (15-17):

Scorch and Kafroseil are the more effective IGRs compared to Roxal, showing a delayed but sustained increase in mortality over 6 days.

Significance Comparison between Compounds:

Compounds 1-14 (Fast-acting insecticides):

Bahariya Oasis:

The Pyrethroid group (Kafrothrin, Lamdathrin, Alphazed, Cyperco) consistently showed a 'c' or 'd' significance, indicating they are in the highest efficacy groups. Lamdathrin and Benomect, Speedo, Excellent show 'd' significance for 48hr data. Neonicotinoids (Crstprid Plus, Imigen, Kafroxam) generally fall into the 'a' significance group, indicating moderate efficacy. Rubek, Imidazed, Tracer, and Coragen fall into the 'b' or 'e' significance groups, suggesting lower efficacy compared to the top performers.

Dakahlia Governorate:

Pyrethroids (Kafrothrin, Lamdathrin, Alphazed, Cyperco) are consistently in the 'c' significance group, indicating high efficacy. Neonicotinoids (Crstprid Plus, Imigen, Kafroxam) are in the 'A' significance group, suggesting moderate efficacy. Rubek, Imidazed, Tracer, and Coragen are in the 'b' significance group, indicating lower efficacy.

Interpretation of Significance:

In both locations, Pyrethroids generally occupy the highest statistical significance groups (e.g., 'c' or 'd'), demonstrating their statistically superior performance compared to other chemical classes. Neonicotinoids show a statistically significant moderate effect, while compounds like Tracer and Coragen are statistically less effective.

Compounds 15-17 (Insect Growth Regulators):

Bahariya Oasis:

Scorch and Kafroseil both exhibit an 'f' significance, placing them in a similar efficacy group. Roxal falls into the 'j' significance group, indicating it is statistically less effective than Scorch and Kafroseil.

Dakahlia Governorate:

Scorch and Kafroseil are grouped under 'e' significance, suggesting comparable efficacy. Roxal is in the 'f' significance group, indicating lower efficacy.

Interpretation of Significance:

For IGRs, Scorch and Kafroseil consistently perform at a statistically similar level, which is significantly better than Roxal in both study sites.

Comparison and Superiority Between the Two Application Regions:

A comparative analysis of the data from Bahariya Oasis (Table 2) and Dakahlia Governorate (Table 3) reveals some interesting differences in insecticide efficacy, although the overall trends remain largely consistent.

General Trends:

In both locations, Pyrethroids (Kafrothrin, Lamdathrin, Alphazed, Cyperco) and Avermectins (Benomect, Speedo, Excellent) consistently exhibited the highest mortality rates among the fast-acting insecticides. IGRs (Scorch, Kafroseil, Roxal) showed a delayed but increasing effect over time in both regions.

Differences in Efficacy:

Bahariya Oasis generally showed slightly higher mortality percentages for some insecticides compared to Dakahlia Governorate, particularly at 24 hours for certain compounds. For example, the mean 24-hour mortality for Crstprid Plus was 73% in Bahariya versus 69.4% in Dakahlia. Similarly, Kafroxam was 80% in Bahariya compared to 73.4% in Dakahlia. This might suggest differences in environmental factors (e.g., temperature, humidity, sunlight exposure), application conditions, or potential differences in the susceptibility of the local *E. plorans plorans* populations.

However, by 48 hours, the differences between the two regions often narrowed, with many insecticides achieving comparable high levels of control. For instance, Cyperco reached 99.6% mean mortality at 48 hours in Bahariya and 99.8% in Dakahlia, indicating excellent performance in both areas.

For the IGRs, the mortality percentages at 3 and 6 days were relatively similar between the two regions, suggesting that their mode of action is less influenced by immediate environmental variations that might affect contact or rapid degradation of the fast-acting insecticides.

Overall Conclusion regarding regions:

While the overall ranking of insecticides remains similar, Bahariya Oasis demonstrated a slight edge in initial knockdown for some compounds, possibly due to local environmental conditions. However, the long-term efficacy, particularly for the most potent insecticides and IGRs, is comparable across both regions. This indicates that the broad effectiveness of these chemical classes is maintained despite geographical differences.

Best Chemical Groups based on the provided table (1):

Based on the efficacy data, the following chemical groups showed superior performance:

Pyrethroid class:

This group, including Deltamethrin (Kafrothrin), Lambdacyhalothrin (Lamdathrin), Alpha-cypermethrin (Alphazed), and Cypermethrin (Cyperco), consistently demonstrated the highest and most rapid mortality rates in both Bahariya Oasis and Dakahlia Governorate. Their broad-spectrum activity and rapid knockdown make them excellent choices for immediate control of *E. plorans plorans*.

Avermectin class:

Compounds like Emamectin benzoate (Benomect, Speedo, Excellent) also showed very high and sustained efficacy, particularly by 48 hours post-treatment. This class offers strong residual activity and is highly effective against chewing insects.

Insect Growth Regulators class (for delayed but sustained control):

While slower in action, Hexaflumuron (Scorch) and Lufenuron (Kafroseil) provided significant mortality over 6 days. These compounds are crucial for integrated pest management programs as they disrupt insect development and can lead to long-term population suppression.

Discussion

The efficacy of seventeen water-based insecticides against *Euprepocnemus plorans plorans* and other grasshopper species was evaluated under field conditions in Egypt. The results revealed significant differences in mortality rates among chemical classes, with Pyrethroids and Avermectins demonstrating rapid knockdown effects, while Insect Growth Regulators (IGRs) exhibited delayed but sustained activity. These findings align with global research on acridid pest management and underscore the need for context-specific insecticide selection.

The Pyrethroid class (e.g., Kafrothrin, Lamdathrin) achieved near-complete mortality (97–99.8%) within 48 hours, consistent with their neurotoxic action on insect sodium channels (Soderlund, 2012). Their rapid efficacy is critical for outbreak suppression, particularly in high-value crops where immediate control is prioritized (Belayneh, 2005). However, overreliance on Pyrethroids may accelerate resistance, as documented in other grasshopper populations (Senem *et al*., 2019).

The Avermectin class (e.g., Benomect, Speedo) also showed high efficacy (91–93.4%), likely due to their unique mechanism of disrupting chloride channels (Ōmura, 2003). Their strong residual activity makes them suitable for prolonged protection, though non-target effects on beneficial arthropods must be considered (Desneux *et al*., 2007).

In contrast, IGRs (e.g., Scorch, Kafroseil) required 6 days to reach ~45% mortality, reflecting their chitin inhibition mode of action (Dhadialla *et al*., 1998). While slower, IGRs are invaluable for IPM programs targeting nymphal stages and reducing population regrowth (Peveling & Demba, 2003).

Slightly higher initial mortality in Bahariya Oasis (e.g., Crstprid Plus: 73% vs. 69.4% in Dakahlia) may reflect lower humidity (43% vs. 70%), which can reduce insecticide degradation on foliage (Matthews, 2008).

The superior performance of Pyrethroids and Avermectins supports their use for rapid control, but resistance management strategies—such as rotating chemical classes—are essential (French-Constant, 2013). Integrating IGRs or biopesticides like *Metarhizium anisopliae* (Lomer *et al*., 2001) could mitigate resistance risks while reducing ecological impacts (Stark & Banks, 2003).

While this study focused on efficacy, sublethal effects on pollinators and natural enemies warrant investigation (Desneux *et al*., 2007). Additionally, climate change may alter grasshopper behavior and insecticide persistence (Thomas *et al*., 2022), necessitating adaptive management. the present study agrees with previous work of Abdelatef, 2021; Soltan 2020; Abdel-Fattah and Abdelatef 2013 against grasshoppers concerning speed of toxic action Rubek, Imidazed, Kafrothrin, Lamdathrin, Alphazed and cyperco then Benomect, Speedo and Excellent showed same speed. post treatment in Egypt, El-Gammal, and Mohamed, (2008), this results may be due to susceptibility differences between the grasshoppers species, also methoxyfenozide is working as insect growth regulator and may be need more time to kill nymphal stages and it is effect on adults is low, or may be due it is activity limited to Lepidoptera and Coleoptera,. Efficacy of incicticides were proved against rangeland grasshoppers when applied as Reduced Agent Area Treatments (RAATs) the applied dose was about 14.6 g/ha, (Foster *et al*., 2010 Bradshaw *et al*., 2013). Current investigation proved that addition of propylene glycol to diluent water, could prevent droplets evaporation when water based pesticides applied as ULV spray technique, where the droplets size were significantly reduced as well as relative span, also produced sufficient droplets per cm2 , these criteria were suitable for locust control (Rachadi, 2010 and Matthews *et al*., 2014), in the present work is cticides under study were applied as water based formulation in LV spray techniques, the resulted efficacy were almost identical which prove the effectiveness of spraying to control grasshoppers in Egypt.

CONCLUSION

For rapid control of *E. plorans plorans*, Pyrethroids and Avermectins are highly recommended. For a more sustainable approach and disruption of the pest life cycle, Insect Growth Regulators like Scorch and Kafroseil should be considered as part of an integrated pest management strategy, especially if longer-term control is desired. The choice of insecticide should also consider local resistance patterns and environmental impact.

REFERENCES

Abdelatef, G. M. (2021). Effectiveness of some new water based insecticides against locust and grasshoppers applied as LV and ULV spray techniques in Egypt. J. of Plant Protection and Pathology, Mansoura Univ. 12 (4), 307-311.

Abdel-Fattah, T. A., Abdel-Lattef, G. M. (2013). Comparison between two spraying equipment and two carriers on the efficacy of some pesticides against different species of grasshoppers in the field. Egyptian Journal of Applied Sciences. 28(1), 1–9.

Ahmad, M., Denholm I., Bromilow R. H. (2006). Delayed cuticular penetration and enhanced metabolism of deltamethrin in pyrethroid-resistant strains of Helicoverpa armigera from China and Pakistan. Pest Manag. Sci. Former. Pestic. Sci. 62, 805–810. 10.1002/ps.1225

Bateman, R. P., Carey, M., Moore, D., Prior, C. (1993). The enhanced infectivity of *Metarhizium anisopliae* var. *acridum* in oil formulations to desert locusts at low humidity. Annals of Applied Biology. 122, 145–152.

Belayneh, Y. T. (2005). Acridid pest management in the developing world. Outlook on Agriculture. 34(1), 7–14.

Bradshaw J., Jenkins, K., Whipple, S. D., Patrick, R. (2013). Evaluation of a new chemistry for Rangeland grasshopper control. Nebraska beef cattle reports.721: 45-48

Cressman, K., Dobson, H. M. (2001). Desert Locust Guidelines: 7. Appendices. Food and Agriculture Organization of the United Nations.

Desneux, N., Decourtye, A., Jean-Marie D. (2007). Sublethal effects of pesticides on Beneficial Arthropods. *Annual Review of Entomology, 52*, 81–106. https://doi.org/ 10.1146/ annurev.ento.52.110405.091440

Dhadialla, T. S., Carlson , G. R., Le, D. P. (1998). New insecticides with ecdysteroidal and juvenile hormone activity. Annual Review of Entomology. 43*,* 545–569. https://doi.org/10.1146/annurev.ento.43.1.545

El-Gammal, A. M., Mohamed, M. T. (2008). Performance of two spinosyn products to combat the grasshopper, Catantops axillaris Thunburg, (Orthoptera: Acrididae) in comparison to a conventional insecticide in Baharia Oasis of Egypt. Egyptian Journal of Biological Pest Control. 18 (1), 215-220.

Foster, R. N., Jech, L. E., Reuter, K. C., Black, L. R., Hill, D. E. (2010). Preliminary field evaluation of aerially applied Coragen for control of grasshoppers on South Dakota rangeland. CPHST laboratory report Fort Collins and Phoenix, U. S. Department of Agriculture Animal and Plant Health Inspection Service. 55-56.

French-Constant, R. H. (2013). Molecular genetics of resistance. Genetics. 194(4), 807–815.

Latchininsky, A., Sword, G., Sergeev, M., Cigliano, M. M., Lecoq, M. (2011). Locusts and Grasshoppers: Behavior, Ecology, and Biogeography. Hindawi Publishing Corporation Psyche. 2011, Article ID 578327, 4 pages doi:10.1155/2011/578327

Lomer, C. J., Bateman, R. P., Johnson, D. L., Langewald, J., Thomas, M. (2001). Biological control of locusts. Annual Review of Entomology, 46, 667–702.https://doi.org/10.1146/annurev.ento.46.1.667

Matthews G., Bateman, R., Miller, P. (2014). Pesticide application methods, 4th edition. Wiley-Blackwell. Pp 536.

Matthews, G.A. (2008), Attitudes and behaviours regarding use of crop protection products—A survey of more than 8500 smallholders in 26 countries. Crop Protection, 27, 834-846. https://doi.org/ 10.1016/ j.cropro.2007.10.013

Ōmura, S. (2003).Chapter 13 - Mode of Action of Avermectin, Editor(s): Satoshi Ōmura,Macrolide Antibiotics (Second Edition), Academic Press, Pp. 571-576, https://doi.org/10.1016/B978-012526451-8/50014-X.

Peveling, R., Demba, S. A. (2003). IGRs in Sahelian ecosystems. Environmental Toxicology and Chemistry. 22*(*11), 2677–2686.

Rachadi, T. (2010). Locust control handbook. CTA Wageningen, Netherlands. Pp 172.

SAS (1996). Statistical analysis system. SAS user's guide: statistics. SAS Institute Inc. Editors, Cary, NC.

Senem A. S., Ömer F. T., Cüneyt E. T., Hayriye Ü., İkbal A. I., Yusuf Z. M. (2019). Insecticide-releasing LLDPE films as greenhouse cover materials. Materials Today Communications. 19, 170-176. https://doi.org /10. 1016 /j.mtcomm.2019.01.015.

Soderlund, D. M. (2012). Pyrethroid neurotoxicity. Advances in Insect Physiology. 42*,* 1–30.

Soltan, E. (2020). Effectiveness and some biochemical effects of Neem against different species of grasshoppers in the field. Egypt. J. Plant Prot. Res. Inst. 3 (1), 486 – 492.

Stark, J. D., Banks, J. E. (2003). Population-level pesticide effects. Annual Review of Entomology. 48*,* 505–519.

Thomas, F., Dominik, P., Lisa, H. (2022). Effects of land-use and climate change on grasshopper assemblages differ between protected and unprotected grasslands. Basic and Applied Ecology. 63(2). 83-92. DO - 10.1016/j.baae.2022.06.005

تحسين مكافحة آفات الجنادب: دراسة مقارنة للمبيدات الحشرية في الواحات البحرية والدقهلية

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الملخص

يعد الجراد من بين أكثر الآفات الزراعية تدميراً على مستوى العالم، حيث تتسبب في خسائر فادحة للمحاصيل وتهدد الأمن الغذائي، خاصة في مناطق مثل مصر. قيّمت هذه الدراسة بشكل شامل الفعالية الحقلية لسبعة عشر نوعاً من المبيدات الحشرية ضد الجنادب، وبالأخص نوع نطاط البرسيم العادي، في منطقتين زراعيتين مصريتين متميزتين :الواحات البحرية ومحافظة الدقهلية. قارن البحث أداء المجموعات الكيميائية سريعة المفعول، بما في ذلك البيريثرويدات والأفيرمكتينات، مع منظمات نمو الحشرات التي تتميز ببطء مفعولها. أظهرت النتائج أن البيريثرويدات (مثل كافروثرين، لامداثرين، ألفازد، سيبركو) حققت معدلات موت سريعة (٩٧-٩٩,٨٪) خلال ٤٨ ساعة في كلا الموقعين، مما يسلط الضوء على دورها الحيوي في القضاء الفوري على الآفة خلال التفشيات الحادة وتخفيف خسائر المحاصيل بسرعة. كما أظهرت مجموعة الأفيرمكتينات (مثل بينومكت، سبيدو، إكسيلنت) نشاطاً متبقياً قوياً ومستمراً، مما أسفر عن معدلات موت عالية (٩١-٩٣,٤٪) بعد ٤٨ ساعة في المقابل، أظهرت منظمات نمو الحشرات (مثل سكورك، كافروسيل) تأثيراً متأخراً مميزاً، حيث زادت فعاليتها تدريجياً لتصل إلى حوالي ٤٥٪ بعد ٦ أيام، وهو ما يتوافق مع طريقة عملها في تعطيل نمو الحشرات. وقد ظهرت اختلافات مكانية طفيفة، مثل الفعالية الأولية الأعلى قليلاً في الواحات البحرية، والتي قد تكون مرتبطة بانخفاض الرطوبة، على الأداء الفوري للمركبات تؤكد هذه النتائج بشكل قاطع الدور الحاسم للبيريثرويدات في مكافحة الجنادب. كما، تؤكد على اهمية دمج منظمات نمو الحشرات في برامج الإدارة المتكاملة للآفات من أجل تنظيم مستدام طويل الأمد للأعداد وإدارة فعالة للمقاومة. يسهم هذا البحث في تحسين استراتيجيات الإدارة المتكاملة للجنادب، موازناً بين المكافحة السريعة والاستدامة البيئية، ويساهم في الجهود العالمية لتخفيف مقاومة المبيدات الحشرية وتأثيرها البيئي.

الكلمات الدالة: الادارة المتكاملة للآفات؛ المبيدات الحشرية؛ الجراد؛ مصر.