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Short Communication

Chemical defense against cruciferous pests in spring rapeseed and mustard crops

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The cruciferous bug complex comprises several species, including the painted or harlequin bug (*Eurydema ventralis* Kol), pentatomid rape bug (*E. oleraracea* L.), and mustard bug (*E. ornata* L.). These insects belong to the Hemiptera order, Shield bug family (Pentatomidae), and Cruciferous bug genus (*Eurydema*). Among them, the predominant species is the cabbage bug, whereas the mustard bug held dominance solely in 2007, remaining absent from records since 2012. These bugs are widely distributed across the entire territory of Ukraine, causing damage to crops in both their adult and larval stages. They use their proboscis to puncture leaf surfaces and floriferous shoots, extracting plant juices. These feeding sites result in the formation of light spots, tissue death, and eventual loss of tissue leading to irregularly shaped holes. The bugs' presence also negatively impacts seed quality, as damaged seeds lead to dropped flowers and ovaries, culminating in reduced seed quality. Notably, the bugs' harmfulness escalates significantly during periods of dry and hot weather.

Keywords: Spring rape, Mustard, Pests, Harmfulness, Cruciferous bugs.

Introduction

During the winter months, immature bugs find shelter beneath fallen leaves along forest edges, gardens, parks, slopes of beams, and roadsides. With the arrival of April and May, these bugs emerge from their wintering sites. Initially, they feed on cabbage weeds, but as cultivated cabbage plants, sprouts, and seedlings emerge, the bug population migrates towards them. The female bugs lay their eggs in groups of 12, typically arranged in two rows on the undersides of leaves. Their egg-laying capacity can reach up to 300 eggs per female. The eggs undergo an embryonic development period lasting from 6 to 12 days. As larvae, they feed on plants for a period of 25 to 40 days before maturing into adult insects. Following this, a second generation is produced in July and August after an additional feeding phase. Both adult bugs and larvae inflict damage on crops by puncturing leaf surfaces and floriferous shoots with their proboscises to extract plant juices. These feeding sites result in the formation of light spots, tissue decay, and the development of irregularly shaped holes. Seed damage leads to dropped flowers and ovaries, thereby reducing seed quality. The threshold for economic harm is reached when 2-3 bugs are present per plant (Hooks, C.R., et al., 2003; Mayanglambam, S., et al., 2021).

Description

Observations on the development of cruciferous bugs were conducted within entomological enclosures fashioned from agricultural fiber, utilizing established counting methods. To manage cruciferous bug populations during the vegetation phase, insecticides were administered in plots where pest numbers surpassed the economic harm threshold. Application of these insecticides followed consistent agro-technical practices and plant development stages. All experiments were conducted at the "Research Field" Educational, Research, and Production Centre of Kharkiv National Agrarian University (Finch, S., Collier, R.H., 2000).

Spraying treatments were executed using a "Lemira-SP-202-01" brand knapsack sprayer at an approximate rate of 250 L/ha. The treatment groups for 2014 were as follows: 1. Control (H_2O); 2. Biscaya, 24% oily dispersion (0.25 L/ha); 3. Mospilan, 20% soluble powder (0.05 kg); 4. Nurelle D, 55% emulsion concentrate (1.0 L/ha) (Thubru, D.P., et al., 2018).

During the 2012–2013 period, a protective measure was undertaken to safeguard spring oilseed cabbage plants from cruciferous bugs' detrimental impact on experimental crops at the "Research Field" Educational, Research and Production Centre. This protective measure involved the application of systemic Biscaya insecticide in a 24% oily dispersion form during the yellow bud phenophase. A control plot was treated with water instead. This insecticide treatment aimed to counter the damage caused by cabbage and rape bugs, cabbage aphids, and rape blossom beetles, all of which had been responsible for yield and quality reductions in previous years (Zhang, J., et al., 2021).

The experimental plots dedicated to spring rape and mustard, where the cruciferous bug-controlling insecticide was tested, covered a total area of 5 m², replicated in triplicate. Post-spraying assessments were conducted at intervals of 3, 7 and 14 days, involving the examination of a 1 m² area within each plot to determine the bug population density per plant (Ku, C.T., et al., 2007).

Upon evaluating the impact of the systemic Biscaya insecticide (24% oily dispersion, applied at a rate of 0.25 L/t) during the yellow bud phenophase, it was observed that the spraying effectively shielded spring rape and mustard crops from cruciferous bug infestations. The research produced valuable insights into the technical efficacy of the spraying procedure, as evidenced by the data. These tables underscore the substantial toxic effects of Biscaya's oily dispersion (24%) on cabbage and rape bugs.

Cruciferous bugs (*Eurydema spp.*) constitute a significant challenge within the context of cabbage crop reproductive organs in the Eastern Forest-Steppe region of Ukraine. These bugs encompass three distinct species: the painted or harlequin (cabbage) bug (*Eurydema ventralis* Kol), the pentatomid rape bug (*E. oleraracea* L.), and the mustard bug (*E. ornata* L.).

Conclusion

During the years 2012-2014, the Biscaya preparation's average technical effectiveness, in the form of 24% oily dispersion, exhibited notable outcomes when applied to spring rape. In a 3-day post-spraying interval, efficiency reached 87.7%, followed by 58.4% at 7 days, and 47.9% at 14 days. Similarly, white mustard showcased technical efficiencies of 92.2%, 83.0%, and 69.5% for the respective timeframes. Chinese mustard exhibited comparable figures, with efficiencies of 92.4%, 83.1%, and 66.7%.

Comparatively, the insecticides Mospilan (20% soluble powder) and Nurelle D (55% emulsion concentrate) demonstrated relatively lower technical efficiencies in comparison to the Biscaya insecticide (24% oily dispersion). Depending on the cultivated crop, the technical efficiencies for Mospilan in a 3-day span ranged from 77.4% to 83.6%, and for Nurelle D, they ranged from 78.4% to 82.0%. Over 7 days, the efficiencies stood between 52.8% and 74.5% for Mospilan and 68.0% to 75.5% for Nurelle D. After 14 days, the efficiencies were 49.1% to 65.5% for Mospilan and 49.0% to 62.0% for Nurelle D.

At the Educational, Research and Production Centre "Research Field," the application of Biscaya insecticide led to substantial yield preservation for spring rape (up to 0.249 t/ha), white mustard (0.133 t/ha), and Chinese mustard (0.201 t/ha). Employing Mospilan insecticide on spring rape resulted in yield preservation of 0.317 t/ha, while white mustard and Chinese mustard were conserved at levels of 0.125 t/ha and 0.273 t/ha, respectively. Notably, spraying with Nurelle D (55% emulsion concentrate) contributed to yields of 0.344 t/ha, 0.093 t/ha, and 0.261 t/ha for spring rape, white mustard, and Chinese mustard, respectively.

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