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Short Communication

Spring rapeseed and mustard crops: Employing chemical defenses against cruciferous pests

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The cruciferous bug complex is composed of 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 cabbage bug is the most prevalent species, although the mustard bug held dominance solely in 2007 and has been absent from records since 2012. These bugs are widely distributed throughout Ukraine, causing damage to crops in both their adult and larval stages. They employ their proboscis to puncture leaf surfaces and floriferous shoots, extracting plant juices. This feeding activity leads to the formation of light spots, tissue decay, and eventual loss of tissue, resulting in irregularly shaped holes. Additionally, the presence of these bugs adversely affects seed quality, as damaged seeds result in dropped flowers and ovaries, ultimately leading to reduced seed quality. Notably, the bugs' harm becomes significantly more pronounced during periods of dry and hot weather.

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

Introduction

During the winter months, juvenile bugs seek refuge beneath fallen leaves, typically found along forest edges, gardens, parks, slopes of embankments, and roadsides. As April and May arrive, these bugs emerge from their overwintering locations. Initially, they feed on cabbage weeds, but as cultivated cabbage plants, sprouts, and seedlings begin to appear, the bug population shifts its attention towards them. Female bugs lay their eggs in clusters of 12, often arranged in two rows on the undersides of leaves. A single female can lay as many as 300 eggs. These eggs undergo an embryonic development period lasting from 6 to 12 days. As larvae, they consume plants for a period of 25 to 40 days before maturing into adult insects. Subsequently, a second generation emerges in July and August following an additional feeding phase. Both adult bugs and larvae cause damage to crops by using their proboscises to puncture leaf surfaces and floriferous shoots, extracting plant juices. This feeding activity results in the formation of pale spots, tissue deterioration, and the emergence of irregularly shaped holes. Seed damage leads to the shedding of flowers and ovaries, ultimately reducing seed quality. The economic harm threshold is typically reached when 2-3 bugs are present per plant (Hooks, C.R., et al., 2003; Mayanglambam, S., et al., 2021).

Description

We conducted observations on the development of cruciferous bugs within entomological enclosures constructed from agricultural fiber, employing established counting techniques. To manage cruciferous bug populations during the vegetation phase, we applied insecticides in plots where pest numbers exceeded the economic harm threshold. The application of these insecticides followed consistent agro-technical practices and plant development stages. Our experiments took place at the "Research Field" Educational, Research, and Production Centre of Kharkiv National Agrarian University (Finch, S., Collier, R.H., 2000).

For the spraying treatments, we utilized a "Lemira-SP-202-01" brand knapsack sprayer at an approximate rate of 250 L/ha. In 2014, the treatment groups 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, we implemented protective measures to safeguard spring oilseed cabbage plants from the detrimental impact of cruciferous bugs on our experimental crops at the "Research Field" Educational, Research and Production Centre. This protective measure involved applying systemic Biscaya insecticide in a 24% oily dispersion form during the yellow bud phenophase, with a control plot treated with water instead. The aim was to counter the damage caused by cabbage and rape bugs, cabbage aphids, and rape blossom beetles, all of which had previously resulted in yield and quality reductions (Zhang, J., et al., 2021).

The experimental plots dedicated to spring rape and mustard, where we tested the cruciferous bug-controlling insecticide, covered a total area of 5 m^2, replicated in triplicate. We conducted post-spraying assessments at intervals of 3, 7, and 14 days, examining a 1 m^2 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, we observed that the spraying effectively protected spring rape and mustard crops from cruciferous bug infestations. Our research provided valuable insights into the technical efficacy of the spraying procedure, as evidenced by the data. The tables presented underscore the significant toxic effects of Biscaya's oily dispersion (24%) on cabbage and rape bugs.

Cruciferous bugs (*Eurydema spp*.) present a formidable challenge within the context of cabbage crop reproductive organs in the Eastern Forest-Steppe region of Ukraine. These bugs comprise 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 2012 and 2014, the Biscaya preparation, in the form of a 24% oily dispersion, demonstrated significant technical effectiveness when applied to spring rape. In the 3-day post-spraying window, it achieved an efficiency of 87.7%, followed by 58.4% at 7 days and 47.9% at 14 days. Likewise, white mustard displayed technical efficiencies of 92.2%, 83.0%, and 69.5% for the respective timeframes, while Chinese mustard yielded comparable figures with efficiencies of 92.4%, 83.1%, and 66.7%. In contrast, the insecticides Mospilan (20% soluble powder) and Nurelle D (55% emulsion concentrate) exhibited relatively lower technical efficiencies when compared to the Biscaya insecticide (24% oily dispersion). Depending on the cultivated crop, the technical efficiencies for Mospilan ranged from 77.4% to 83.6% over a 3-day period, 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 "Research Field" Educational, Research, and Production Centre, the application of Biscaya insecticide led to substantial preservation of yields 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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