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CONVENTIONAL PESTICIDES AND BIOPESTICIDES IN MAIZE PROTECTION: EFFECTS ON BENEFICIAL ARTHROPODS AND RELEVANCE FOR SUSTAINABLE AGRICULTURE

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Abstract: The aim of this paper is to examine the differences between conventional pesticides and biopesticides with regard to their impact on beneficial arthropod communities in maize crops, while also considering the relevance of these approaches for sustainable crop protection in Romania. The review is based on the analysis of scientific papers indexed in international databases, focusing on studies that address non-target effects, pesticide selectivity, and the role of beneficial fauna in maize agroecosystems.

Introduction

Maize has a central place in Romanian agriculture, both because of the large cultivated area and because of its importance for feed, food, and the wider agricultural economy. Recent Romanian reviews describe maize as the main crop by cultivated surface in the country, usually around 2.3-2.5 million hectares, and show that its production is increasingly challenged by a broad range of insect pests, whose importance may become even greater under changing climatic conditions (TOADER ET AL., 2024; HORGOS AND GROZEA, 2020). Under these conditions, crop protection remains essential for maintaining stable production, and conventional pesticides are still widely used because they offer rapid and predictable pest suppression. At the same time, their role can no longer be assessed only through short-term control of target species.

Material and method

This paper was conceived as a focused narrative review addressing the impact of conventional pesticides and biopesticides on beneficial arthropods associated with maize crops. The chosen approach was intended to allow a comparative discussion of the most relevant categories of evidence, rather than to provide an exhaustive inventory of all active substances or all pest management situations reported in the literature. Such a format was considered suitable because studies dealing with non-target effects in crop protection differ considerably in scope, test conditions, assessed organisms, and biological endpoints (LISI ET AL., 2025).

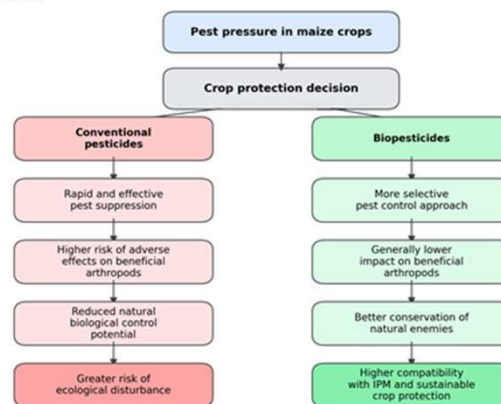
The selection of references was guided mainly by thematic relevance to the objectives of the paper. Studies were retained when they addressed at least one of the following aspects: the presence and ecological role of beneficial arthropods in maize systems; the lethal, sublethal, or indirect effects of conventional pesticides on non-target organisms; the compatibility of biopesticides with predators and parasitoids; or the contribution of selective protection tools to integrated pest management. More recent publications were favored in order to reflect current scientific understanding, while a limited number of earlier review papers were also included when they provided important conceptual support for the interpretation of non-target effects and crop protection selectivity.

Results and discussions

Beneficial arthropods in maize agroecosystems

Field-based work in maize has shown that beneficial arthropods may act as indicators of how strongly management practices disturb biological regulation. This means that pest control should be evaluated not only by its immediate capacity to reduce a target species, but also by its effects on the organisms that contribute to longer-term pest suppression. Their abundance, ecological role, and contribution to pest suppression are also influenced by crop management and by the way beneficial arthropods are monitored and interpreted in agroecosystems (MCCRABY, 2018; PULIGA ET AL., 2024).

Conceptual comparison between conventional pesticides and biopesticides in maize protection, highlighting differences in selectivity, effects on beneficial arthropods, and ecological compatibility



A comparative overview of the main differences between conventional pesticides and biopesticides in relation to beneficial arthropods in maize is presented in Table 1.

Criterion	Conventional pesticides	Biopesticides
Mode of action	Often rapid; many products have broad-spectrum activity	Usually more selective, depending on active substance and target pest
Effect on beneficial arthropods	Frequently associated with lethal, sublethal, or indirect effects on non-target arthropods	Generally considered less disruptive, although adverse effects may still occur
Persistence in the environment	Often longer persistence, depending on compound and application regime	Usually lower persistence, but influenced by formulation and environmental conditions
Compatibility with biological control	May interfere with predators and parasitoids when selectivity is low	Usually more compatible with biological control and IPM strategies
Field performance	Often rapid and reliable under high pest pressure	Can be variable under field conditions and influenced by temperature, humidity, UV exposure, and timing
Risk for ecological balance	Greater risk of disturbing trophic interactions and natural pest regulation	Lower ecological burden in many cases, but not automatically harmless
Practical limitations	Risk of non-target effects, resistance development, and repeated dependency	Variable efficacy, narrower spectrum, and sometimes higher dependence on application conditions
Relevance for sustainable maize protection	Still important in practice, but requires careful selectivity and timing	Promising option for more sustainable and ecologically compatible crop protection
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Conclusions

The reviewed literature indicates that conventional pesticides and biopesticides differ not only in their mode of action, but also in the extent to which they affect beneficial arthropods in maize crops. Conventional pesticides remain effective tools for rapid pest control, but they are more likely to disturb predators and parasitoids involved in natural pest regulation. By contrast, biopesticides are generally more selective and better suited to integrated pest management, although their effectiveness and ecological safety may vary depending on the product and field conditions.

References (selective)

CAMERINI, G., MAINI, S., LIMONTA, L., 2024 - Impact of Chemical Insecticide Application on Beneficial Insects in Maize. *Insects*, 15 (4): 224, Switzerland.
 LISI, F., SISCARO, G., BIONDI, A., ZAPPALÀ, L., RICUPERO, M., 2025 - Non-target effects of bioinsecticides on natural enemies of arthropod pests. *Current Opinion in Environmental Science & Health*, 45: 100624, Netherlands.
 SÁNCHEZ-BAYO, F., 2021 - Indirect Effect of Pesticides on Insects and Other Arthropods. *Toxics*, 9 (8): 177, Switzerland.
 SOARES, A.P. ET AL., 2026 - The Overlooked Impact of Botanical Pesticides on Non-Target Organisms. *Plants*, 15 (6): 917, Switzerland.
 PULIGA, G.A., SPRANGERS, T., HUITING, H., DAUBER, J., 2024 - Management practices influence biocontrol potential of generalist predators in maize cropping systems. *Entomologia Experimentalis et Applicata*, 172: 132-144, Netherlands, doi: 10.1111/eea.13395.