THU-SSS-AMT&ASVM-01

INTEGRATED PEST AND DISEASE MANAGEMENT IN RAPESEED (CANOLA) CULTIVATION

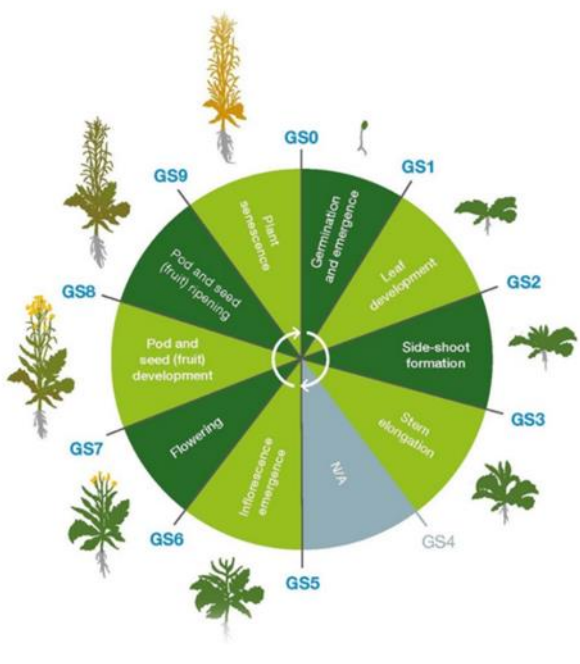
Durim Verrija – Student
Technical University of Moldova
168 Ștefan cel Mare Blvd.,
Chișinău, Moldova, MD-2004

Petya Angelova, PhD
Department Agriculture machinery,
University of Ruse "Angel Kanchev"
Tel.: +359 082 888 288
E-mail: pangelova@uni-ruse.bg

Abstract: *Integrated Pest and Disease Management in rapeseed (canola) is a balanced approach that combines three types of methods. Agronomic practices (such as crop rotation and resistant varieties) create an unfavourable environment for the development of problems. Biological methods encourage the natural enemies of pests, while chemical controls are used precisely and only when necessary to preserve their efficacy and minimize environmental impact. The goal of this comprehensive approach is sustainable and economically viable production.*
Keywords*: canola, pest, disease.*

INTRODUCTION

Brassica napus L., commonly known as rapeseed or canola, is a globally significant oilseed crop, prized for its high-quality vegetable oil and protein-rich meal. Its cultivation, however, is consistently challenged by a diverse array of fungal pathogens, insect pests, and viral diseases that can cause substantial yield losses and economic damage. Conventional crop protection has historically relied heavily on the prophylactic application of synthetic pesticides. While often effective in the short term, this approach has led to unintended consequences, including the development of pesticide resistance in pest populations, the disruption of beneficial arthropod and microbial communities, and growing environmental and food safety concerns.



 Copyrights© 2025 ISBN 978-954-712-978-8 (Print); e-ISBN 978-954-712-979-5

Fig 1. Main Growth Stages of Winter and spring rapeseed

In response to these challenges, Integrated Pest and Disease Management (IPDM) has emerged as the cornerstone of sustainable canola production. IPDM is not a single tactic, but a holistic, knowledge-based strategy that synergistically combines multiple control measures. This approach aims to maintain pest and disease populations below economically damaging thresholds while minimizing harmful effects on human health and agroecosystems. The core pillars of IPDM are agronomic (cultural) practices, biological control, and the judicious use of chemical pesticides.

This report will provide a comprehensive overview of the modern IPDM framework for rapeseed cultivation. It will detail the specific agronomic strategies designed to suppress pest pressures, explore the role of biological control agents, and outline the principles for the rational and targeted use of chemical interventions. By integrating these methods, producers can enhance crop resilience, ensure long-term productivity, and align with the principles of agricultural sustainability

EXPOSURE

The cultivation of rapeseed (Brassica napus L.), particularly its canola variant, is a cornerstone of global oilseed production. However, its agronomic success is perpetually challenged by a complex of fungal pathogens, insect pests, and viral diseases that threaten yield stability and economic viability. For decades, reliance on synthetic pesticides served as the primary line of defense. While effective in the short term, this approach has unveiled significant drawbacks, including the accelerated evolution of resistant pest strains, the detrimental disruption of beneficial ecosystems, and mounting environmental concerns. In response to these challenges, Integrated Pest and Disease Management (IPDM) has emerged as the paradigm of modern, sustainable agriculture. IPDM is a dynamic and knowledge-intensive strategy that moves beyond singular solutions, instead advocating for a synergistic integration of agronomic, biological, and chemical methods. The overarching goal is not the eradication of pests and diseases, but rather their sustainable management below economically damaging thresholds, thereby ensuring long-term crop productivity, environmental health, and farm profitability.

The foundation of any successful IPDM program in rapeseed is built upon robust agronomic, or cultural, practices. These methods are primarily preventative, designed to create an environment inherently suppressive to pests and diseases while promoting crop vigor. The most critical of these practices is extended crop rotation. By rotating canola with non-host crops such as cereals or legumes for a minimum of three to four years, the life cycles of host-specific pathogens like Plenodomus lingam, the causal agent of Blackleg, and Sclerotinia sclerotiorum, responsible for Sclerotinia stem rot, are effectively broken. This practice drastically reduces the inoculum potential present in soil and infected crop residues. Complementing rotation is the strategic deployment of genetically resistant varieties. Plant breeding has developed cultivars with both qualitative resistance, based on single major genes, and more durable quantitative resistance, which is polygenic and partial. The use of such varieties, especially when combined with other practices, provides a highly effective and low-input form of control. Furthermore, meticulous attention to sowing practices—such as optimizing sowing date to avoid pest peaks, ensuring shallow sowing in optimal soil conditions for rapid emergence, and using high-quality seeds - establishes a uniform and competitive crop stand that is more resilient to initial pressures.

Building upon this agronomic foundation, biological control methods introduce a layer of natural regulation into the cropping system. This pillar of IPDM involves the conservation and augmentation of living organisms to suppress harmful populations. A key aspect is the preservation of naturally occurring beneficial arthropods, such as predatory ground beetles and parasitoid wasps, which act as natural enemies to common pests like the cabbage stem flea beetle and pollen beetle. Conservation is achieved by minimizing the impact of broad-spectrum insecticides and by enhancing biodiversity on farm margins, for instance through the establishment of flowering strips that provide nectar and habitat. Beyond macrobials, microbial biocontrol agents offer targeted solutions. Commercially available formulations of beneficial fungi like Trichoderma spp. or bacteria like Bacillus subtilis can be applied as seed treatments or soil amendments to protect against damping-off and soil-borne diseases through competition and antibiosis. Additionally, the practice of biofumigation, which involves growing and incorporating specific mustard species that release natural biocidal compounds (glucosinolates) into the soil, provides a potent tool for reducing the load of soil-borne pathogens and weeds.

Within the IPDM framework, chemical methods are not abandoned but are instead employed as a precision tool of last resort, guided by the principles of necessity and selectivity. The prophylactic and calendar-based spraying is replaced by a decision-making process rooted in continuous monitoring. The application of insecticides and fungicides is triggered only when scouting data and established economic thresholds indicate that the cost of damage by the pest or disease will exceed the cost of control. This threshold-based approach prevents unnecessary applications, thereby conserving beneficial insect populations and delaying the development of resistance. Furthermore, the strategic use of insecticide- and fungicide-treated seeds exemplifies a targeted chemical intervention, protecting the vulnerable seedling stage with a minimal environmental footprint. When in-season chemical applications are unavoidable, strict anti-resistance strategies are paramount. These include the conscientious rotation of active ingredients from different mode of action (MoA) groups and the use of pre-approved mixture partners to mitigate the selection pressure on pest and pathogen populations, thereby preserving the efficacy of existing chemistries for the future.

During the growing season, rapeseed is attacked by diverse groups of pests. Flea beetles (Phyllotreta spp.) cause characteristic holes in leaves, reducing photosynthetic activity. Pollen beetles (Brassicogethes aeneus) damage flowers and negatively affect pollination and pod formation. The cabbage aphid (Brevicoryne brassicae) weakens plants by sucking plant sap and transmitting viral infections. Cutworms (Agrotis segetum) and diamondback moths (Plutella xylostella) damage stems, leaves, and pods, with their larvae posing particular danger. The hairy rose chafer (Tropinota hirta) acts during sunny days during flowering, damaging petals and stamens.

Significant economic losses are also caused by disease pathogens. Phoma stem canker (Leptosphaeria maculans) appears in early development stages and leads to stem base infection and plant lodging. Alternaria leaf spot (Alternaria brassicae) causes dark spots on leaves and pods, which deteriorates seed quality. White mold (Sclerotinia sclerotiorum) and gray mold (Botrytis cinerea) develop under high humidity conditions and damage stems, flowers, and pods. Powdery mildew (Erysiphe cruciferarum) forms a characteristic white coating on leaves and reduces photosynthesis intensity.

The application of integrated protection systems involves combining agronomic, biological, and chemical methods. Among agronomic practices, the most important are crop rotation, selection of resistant varieties, and adherence to optimal sowing dates and rates. Biological control includes using natural enemies such as parasitic wasps (Braconidae) and predatory beetles (Carabidae), as well as applying microbial preparations based on Bacillus thuringiensis and Trichoderma spp.

Chemical protection is applied targetedly and when necessary, following integrated management principles. Fungicides such as Folicur and Amistar are used against main rapeseed diseases, with treatment timing strictly linked to crop phenological phases. Insecticides like Sherpa and Fastac are applied when economic thresholds are reached, considering their impact on beneficial entomofauna. The growth regulator Moddus reduces lodging risk and improves plant stability.

 Copyrights© 2025 ISBN 978-954-712-978-8 (Print); e-ISBN 978-954-712-979-5

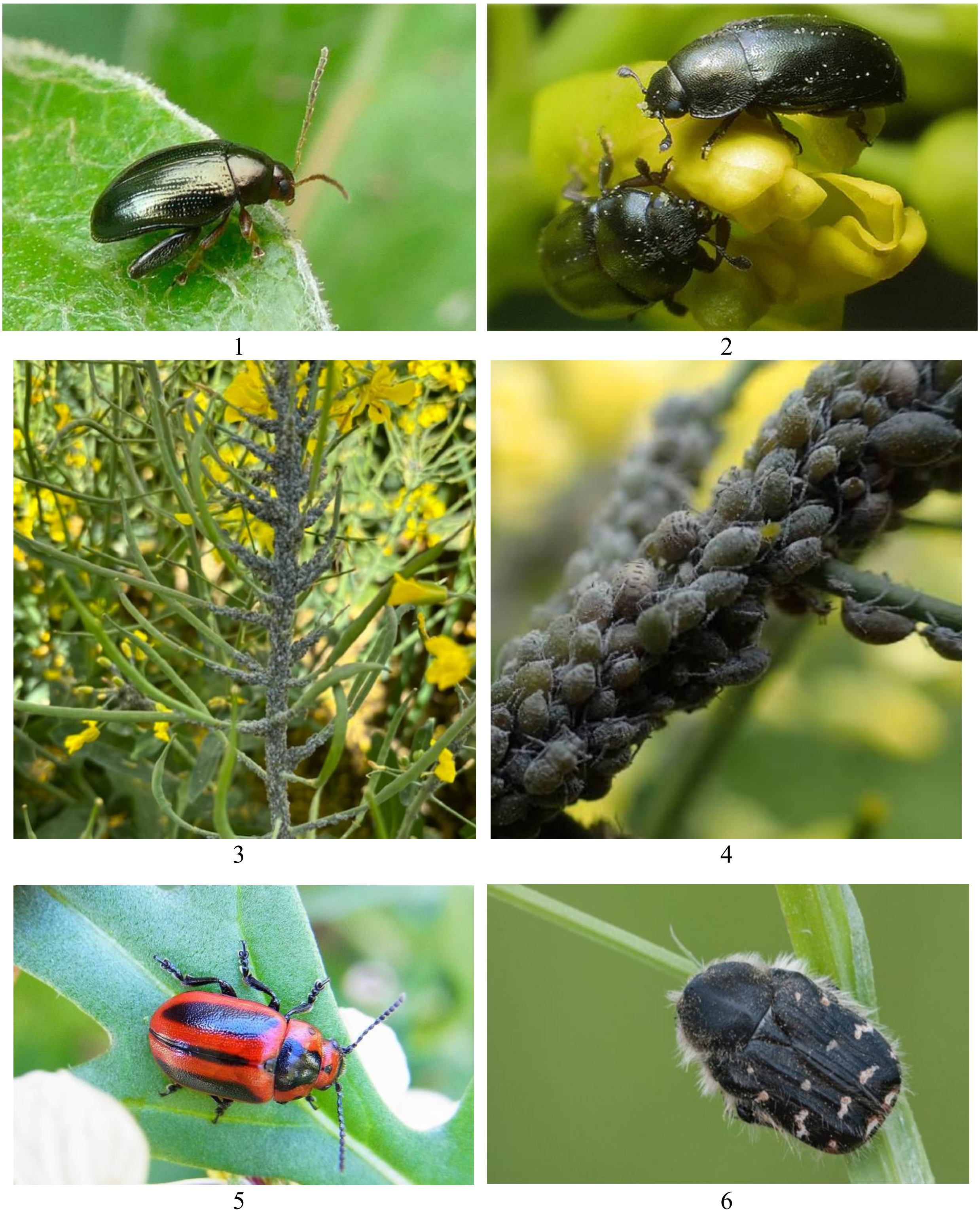


Fig 2. The major insect pests of canola: 1) Phyllotreta atra L.; 2) M.aeneus; 3 и 4) A dense colony of cabbage aphid on the inflorescence apex; 5) Entomoscelis adonidis 6) T. hirta

Fig. 3. Rapeseed Diseases: Phoma and Alternaria

Effective rapeseed protection requires balanced application of all these methods, considering specific farm conditions and the dynamics of pest and disease development. The comprehensive approach ensures achievement of high and stable yields while maintaining ecological balance in agroecosystems.

In conclusion, Integrated Pest and Disease Management in rapeseed cultivation represents a sophisticated and holistic philosophy. Its efficacy is derived not from the isolated application of any single tactic, but from the strategic synergy between its core components.

Agronomic practices establish a resilient and suppressive foundation, biological control introduces self-regulating stability, and chemical interventions provide a calibrated, emergency response. By embracing this integrated approach, producers can navigate the challenges of rapeseed cultivation towards a future that is not only productive and profitable but also environmentally sound and sustainable.

CONCLUSION

The successful cultivation of rapeseed requires an integrated approach to pest and disease management that combines agronomic, biological, and chemical methods in a balanced system.

The main pests - flea beetles, pollen beetles, cabbage aphids, cutworms, and diamondback moths - cause significant damage to different plant organs during various growth stages, requiring timely monitoring and intervention.

Diseases such as Phoma stem canker, Alternaria leaf spot, white and gray mold, and powdery mildew can lead to substantial yield losses and quality deterioration, especially under favorable weather conditions.

Agronomic practices, particularly crop rotation and selection of resistant varieties, form the foundation of protection by creating unfavorable conditions for pest and pathogen development.

Biological control methods using natural enemies and microbial preparations provide an environmentally friendly alternative that helps maintain ecological balance in agrocenoses.

Chemical treatments should be applied judiciously, based on economic thresholds and with strict adherence to application timing, while implementing anti-resistance strategies.

The integration of all protection methods, adapted to specific growing conditions and pest dynamics, ensures sustainable rapeseed production with high economic indicators while minimizing environmental impact.

Continuous monitoring and implementation of modern scientific developments remain crucial elements for effective rapeseed protection and yield optimization..

REFERENCES

Alford, D.V. (2019). Pest and Disease Management of Oilseed Rape. Wiley-Blackwell.

 Copyrights© 2025 ISBN 978-954-712-978-8 (Print); e-ISBN 978-954-712-979-5

Buntin, G.D. (2017). Integrated Pest Management of Rapeseed and Canola. CRC Press.

Cerkauskas, R. and Stobbs, L. (2018). Management of Alternaria Leaf Spot in Canola. Plant Disease Journal, 102(3), pp. 445-456.

Fitt, B.D.L., et al. (2020). Worldwide Importance of Phoma Stem Canker in Oilseed Rape. European Journal of Plant Pathology, 156(4), pp. 841-853.

Gossen, B.D., et al. (2021). Recent Advances in Sclerotinia Management in Canola. Canadian Journal of Plant Pathology, 43(sup1), pp. S125-S142.

Ivanov A., P. Angelova. Non-Specific Physiological Diseases in Rapeseed, (Oilseed Rape). IN: Proceedings of University of Ruse 2021, volume 60, book 1.2, Ruse, Publishing House University of Ruse "Angel Kanchev", 2021, pp. 216-219, ISSN 1311-3321

Juran, I. and Ivić, S. (2022). Monitoring and Control of Pollen Beetle in Oilseed Rape. Journal of Applied Entomology, 146(3), pp. 234-245.

Korbas, M. and Mrówczyński, M. (2019). Integrated Protection of Rapeseed Against Pests. Institute of Plant Protection.

Latunde-Dada, A.O. (2020). Advances in Biological Control of Rapeseed Diseases. Biological Control, 144, 104221.

Nault, B.A. and Huseth, A.S. (2021). Flea Beetle Management in Canola Production Systems. Annual Review of Entomology, 66, pp. 205-223.

Peng, G., et al. (2023). Chemical Control Strategies for Major Rapeseed Diseases. Crop Protection, 165, 106164.

Raza, M.M., et al. (2022). Economic Thresholds for Pest Management in Canola. Agricultural Systems, 195, 103305.

Ulber, B., et al. (2020). Conservation Biological Control in Oilseed Rape. Bio Control, 65(2), pp. 129-143.

Vasilev, A.A. and Angelova, P.R. (2021). Bulgarian Experience in Rapeseed Protection. Bulgarian Journal of Agricultural Science, 27(4), pp. 678-685.

Williams, I.H. (2018). The Major Insect Pests of Oilseed Rape and Their Management. Springer.

Zhelyazkov, I., et al. (2022). Growth Regulators in Modern Rapeseed Production. Field Crops Research, 278, 108447.