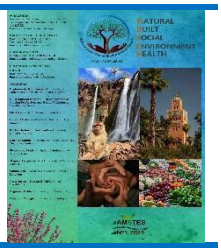
Natural Built Social Environment Health

ISSN 3085-461X

www.nbseh.org



Advances in Bioprotection of Plants Against Diseases, edited by *Shashi Sharma and Minshad Ansari, (Sawston,* Cambridge*: Burleigh Dodds Science Publishing), 2025, 400 pp., £145.00 (hardback), ISBN: 978-1-80146-728-5; eISBN: 978-1-80146-728-5.*

When reading about plant bioprotection, one almost cannot help but ask: *to whom does this subject* belong? To everyone. We all depend on food security [1]. Pests cause loss in yields. Curbing their effects without microbial resistance and ecological harm supports public health [2]. If chemical residues can be reduced, then their persistence in food and soil is reduced., Benefit to human populations and the environment then follow [3].

Bioprotection offers a sustainable alternative — replacing harmful Plant Protection Products (PPPs) with those that are safe. If we promise to choose life, not poison, we transform fear of loss into confidence by renewal. Bioprotection unites the farmer striving to save his field, the grower seeking quality, the family hoping to eat safely, and the environmental scientist exploring to discover.

Everyone is involved.

At its core, is a shared hunger — for the future, for health, and for dignity.

The tests on bumblebees, conducted at three hierarchical levels — laboratory, semi-natural, and field (pp. 12–13) — demonstrate that bioprotection carries the promise of safeguarding these sentinels of biodiversity (pp. 2–3).

These pollinators stand at the centre of the sixth extinction now unfolding [4], comparable to the great biological crises of the past, and the wrong choice of PPPs deepens that crisis (pp. 7–8).

In the first chapter, Records, exemplifies the broader spectrum of actors working in bioprotection; introducing bacteria (*Bacillus, Pseudomonas*) and fungi (*Trichoderma, Gliocladium*) as invisible allies of the plant, the farmer, and the environment (p. 1). Alongside

them, viruses (e.g., *Baculovirus*) and nematodes (*Steinernema*, *Heterorhabditis*) (p. 1) appear as natural weapons against pests.

Records also highlights the concept of a sustainable microbial consortium (pp. 17–18): a stable biological system capable of protecting plants and supporting a resilient form of agriculture. Each example shows that these organisms concern not only microbiologists or zoologists but also farmers, agronomists, and field practitioners, all working in service of crops, harvests, and environmental balance.

Beside these living agents, natural extracts and microbial derivatives — secondary metabolites, antibiotics, and volatile compounds — act as genuine biopesticides, offering a credible alternative to synthetic molecules, with fewer toxic residues and greater respect for climate, health, and the environment. Finally, Records presents the modern analytical tools (pp. 5–13, 17–18) that reveal these hidden allies of life: sequencing, genomics, omics analyses, bioinformatics, and high-throughput screening. Together, they illuminate what once escaped observation and uncover unsuspected biological potential.

In the second chapter, McCord and Bach focus on the European regulatory framework (Regulation (EC) No 1107/2009, EFSA, etc.). This chapter takes a critical view of the governance of risk and sustainability. The authors explain how Europe structures the regulation of plant protection products, drawing upon the role of EFSA, the precautionary principle, and the criteria for risk evaluation. McCord and Bach highlight a gradual transition — the movement from conventional chemical products towards biological or low-risk alternatives — without limiting the discussion to a single category of approach.

It is indeed true that the word “bio” has entered many disciplines reassuringly; e.g., bioprotectants, biofertilizers, biochars, biostimulants, and biocontrols — all fields surrounded by a positive aura [5-7]. Yet the label “bio” does not always guarantee excellence. Without a strong scientific foundation or rigorous regulatory oversight, some products may generate unforeseen ecological effects, or even risks to health. Gerke, in Chapter 3 (pp. 63–134), takes up the challenge and brings together public law and private law. The first imposes and regulates, whereas the second translates these principles into practice through voluntary standards and certification systems.

Gerke is right to underline that, where regulation defines the boundaries, standards bring flexibility. They stimulate innovation and open the way to a form of sustainability that is chosen

rather than imposed — where compliance becomes a lever for improvement rather than a constraint. Gerke gives stakeholders the means to go further: to address ethical, traceability, and sustainability challenges within their own scope of action.

Gerke demonstrate that ecological and agricultural transition does not depend solely on legislation, but also on the choices and responsibilities of those working in the field. The distinction between the two approaches is clear: the regulatory framework is coercive, whereas the voluntary framework relies on incentives — commercial advantages, reputation, market access — and on the positive pressure exerted by consumers and NGOs.

Chapter 3 concludes with two major annexes that form its scientific and normative backbone. The first (pp. 80–122) outlines the OECD requirements for the evaluation of chemical substances and their commercial formulations: composition, purity, toxicity, stability, and environmental behaviour. The second (pp. 123–133) focuses on microbial products, establishing criteria adapted to the living nature of biopesticides — viability, genetic stability, and ecological interactions. Far from being "secondary", these annexes strengthen the practical relevance and coherence of the chapter, by defining a clear international framework for the rigorous and responsible assessment of bioprotectants.

The second part of the book functions as a genuine modern apothecary, bringing together a collection of natural remedies. It presents three categories of bioprotective agents: The Actinobacteria, the protective fungi, and the beneficial oomycetes — a trio of natural remedies in which the bacteria prepare, the fungus heals, and the oomycete immunizes.

The Actinobacteria, described by Thatcher and Gallart (Chapter 4, pp. 139–163), are the micro-engineers of the soil. They secrete natural antibiotics, lytic enzymes, and secondary metabolites capable of regulating the root microbiome and stimulating the defences of cultivated plants — maize, tomato, rice, or soya. By restructuring microbial life in the soil, they establish a lasting biological balance that favours plant health.

This underground preparation meets the strategy of the protective fungus Clonostachys rosea, presented by Scott and Punja (Chapter 5, pp. 173–204). This mycoparasite of remarkable ecological plasticity acts as competitor, predator, and protective symbiont through its enzymatic and hormonal arsenal — chitinases, glucanases, and modulation of the jasmonic and salicylic acid defence pathways (pp. 169–172). Scott and Punja also reveal a fascinating innovation: the application of the fungus through pollinating bees (pp. 181–183), which carry its spores to the very heart of flowers — nature becomes the messenger of its own protection.

The sequence grows even more captivating and reaches its height in chapter 6 by Yang, Niu, Yu, Li, and Jing (pp. 219–237), devoted to *Pythium oligandrum*, a beneficial oomycete positioned at the frontier between fungus and alga. It shares with *C. rosea* the mechanisms of mycoparasitism, competition, and immune induction, yet differs through the protein-based nature of its molecular signals. P. oligandrum secretes elicitins, oligandrins, POD-1/2, and NLP-like proteins (pp. 228–233) that activate intracellular defence pathways — MAPK phosphorylation, lignification, and strengthening of cell walls — establishing it as a true natural vaccine of the plant world.

Table 3 (pp. 225–227) illustrates its agronomic significance.

P. oligandrum proved effective on tomato, the model plant for systemic defence studies; on vine, a perennial species facing complex pathosystems; on ginger, a tropical crop highly sensitive to soil pathogens; on soya, a legume with microbial symbiosis; on pepper and cucumber, emblematic of horticultural crops; and on carrot, representative of open-field vegetables.These microorganisms embody a genuine co-operative intelligence of life, in which microbial networks ensure phytosanitary resilience and the functional durability of agro-ecosystems — a model of regenerative bioprotection, able to preserve plant health while maintaining the integrity of soils.

Yet such an approach cannot remain theoretical. The effectiveness of a biological agent varies with the type of crop, soil structure, microbiome composition, climate, and the plant's growth cycle. A microorganism that performs well under controlled conditions may behave differently when confronted with the complexity of real agro-ecosystems.

This is why the authors chose to bring science into the field, devoting three applied chapters to the major families of global crops:

– The vine (pp. 241–278), a perennial plant of high value dominated by foliar and trunk diseases, for which more than 2,400 international studies are listed (p. 243): downy mildew (*Plasmopara viticola*), powdery mildew (*Erysiphe necator*), grey rot (*Botrytis cinerea*), and trunk diseases (*Esca*, *Eutypa dieback*).

– Cereals (pp. 289–307), extensive annual crops exposed to successive soil- and leaf-borne pathogens.

– The potato (pp. 317–340), a tuber crop particularly vulnerable to root and post-harvest infections.

These three chapters (7–9) form the experimental core of the book. They reflect the three dimensions of world agriculture: quality with the vine, food security with cereals, and sustainability with the potato. Their sequence illustrates the book's internal coherence — identifying dominant diseases, presenting effective biological agents, explaining their mechanisms of action, and then assessing their real behaviour within agro-ecosystems. The book does not merely describe models; it guides the reader towards practical solutions. By linking major diseases to their protective agents, by explaining the mechanisms of action, and by presenting authorized biopesticides already available on the market, it connects research with practice.

From grape to wheat, and from wheat to potato, this harmonious progression leads the reader step by step towards an agriculture reconciled with nature — one that balances productivity, quality, and environmental health. The vine demands precision and regularity in protection; cereals require broad-coverage strategies to ensure food security; and the potato calls for durable and accessible solutions capable of adapting to highly diverse agricultural contexts.

This imaginative book also serves as a professional directory of biocontrol and a compass for living systems, guiding the reader towards proven solutions already on the market. Table 3 (pp. 326–327) provides a clear illustration: *Actinovate*®, *Serenade*®, *RootShield*®, *Regalia*® — well-established names that confirm biocontrol as both a technological and economic reality, now firmly embedded in agricultural practice.

After the antibacterial and antifungal agents (Chapters 4–9), the final chapter (pp. 353–369) turns to bioherbicides, a still young yet promising family of bioprotective products.

This section lists, in a comprehensive table, several bioherbicides already on the market or officially tested across various countries.

The authors emphasize that China, the United States, and Australia currently lead in both research and the marketplace, whereas more than half of existing formulations remain at an experimental stage.

Chapter 10 concludes by opening a new path — that of biological control against weeds.

Until now, bioprotection had been directed at combating pathogens; it now turns towards regulating the competition between plants.The adversary is no longer microbial, but botanical.

The authors present bioherbicides as a response to the crisis of chemical herbicides, which have caused resistance, erosion of biodiversity, and long-lasting pollution. They describe their mechanisms of action: inhibition of photosynthesis, disruption of cell growth, and the activity

of natural metabolites produced by microorganisms or plant extracts. Table 1 (p. 356) provides a true world map of biocontrol: *DeVine®*, *Collego®*, *BioMal®*, *StumpOut®*, *Di-Bak®*, *MBI-014®* — formulations born of research that has now crossed the boundary from laboratory to marketplace.

Pages 362, 356, and 357 reveal the diversity of biological sources, microbial and non-microbial alike — essential oils from *Eucalyptus* and *Artemisia*, phenolic compounds, fatty acids, polysaccharides, and allelopathic molecules released by plants themselves.

The authors emphasize that bioprotection is not a battle but an art of balance.

Even a weed, often seen as harmful, contributes to soil vitality and to the resilience of the ecosystem; it only needs to be regulated when it disrupts harmony.

Thus, bioprotection becomes a language of cohabitation, in which every form of life — cultivated plant, weed, microbe, or insect — plays its part in the great cycle of the field.

The book argues that, after biofungicides, bioinsecticides, and bioherbicides, the future may well belong to bioharmony — an agriculture that no longer fights against nature but draws inspiration from it in order to serve it better.

Like a physician or a veterinarian, this book establishes a genuine biological diagnosis and an ecological prescription. It observes, analyses, and guides, not towards the domination of plants, but towards their healing through natural means. As a true manual of phytosanitary bioprotection, it stands as a reference for researchers, agronomists, and producers who seek to identify plant pathologies and to select suitable biological treatments. It is a vade-mecum for cultivated plants, as it unites scientific rigour with an authentic sensitivity to life.

Yet beyond protocols and methods, this book conveys an essential message: sustainability is not born of domination, but of listening. To listen to nature is already to collaborate with it.

Bioprotection is a dialogue between human knowledge and the intelligence of living systems — an alliance between science and wisdom. *The earth returns to each according to the care it receives.*

References

[1] Ehrlich, P. R., Ehrlich, A. H., & Daily, G. C., 1993, Food security, population and environment. *Population and development review*, 1-32. https://doi.org/10.2307/2938383

[2] Qiu, D., Ke, M., Zhang, Q., Zhang, F., Lu, T., Sun, L., & Qian, H., 2022, Response of microbial antibiotic resistance to pesticides: An emerging health threat. *Science of the Total Environment* **850**, 158057. https://doi.org/10.1016/j.scitotenv.2022.158057

[3] Ali S., Ullah M. I., Sajjad A., Shakeel Q., & Hussain A., 2021, Environmental and Health Effects of Pesticide Residues. In: Inamuddin, Ahamed M. I., Lichtfouse E. (eds) *Sustainable Agriculture Reviews 48: Pesticide Occurrence, Analysis and Remediation* (pp. 311–336). (Cham : Springer International Publishing). https://doi.org/10.1007/978-3-030-54719-6_8

[4] Boutaleb, N., 2025, Before They Vanish: Saving Nature's Populations—and Ourselves, edited by Paul R. Ehrlich, Gerardo Ceballos, and Rodolfo Dirzo, Johns Hopkins University Press, 2024, 320 pp., $29.95 (hardback), ISBN: 978-1-4214-4969-2. *Natural Built Social Environment Health* **1**(1), 187–189. https://doi.org/10.63095/NBSEH.25.780208

[5] Jmaili, K., Bahlaouan, B., Silkina, A., Lahrairi, M., & Boutaleb, N., 2025, Functional dynamics of Plant Growth-Promoting Bacteria (PGPB) in Adaptation to Abiotic Stress and Enhancement of Crop Productivity. *Natural Built Social Environment Health* **1**(3), 125–157. https://doi.org/10.63095/NBSEH.25.103623

[6] Mahmoudi, M., Asbai, Z., Foughal, T., Mabicka Obame, R. G., Ognalaga, M., Malounghou Bounangnan, J. D., Bahlaouan, B., & Boutaleb, N.**,** 2025, *Biofertilizers for sustainable and environment-friendly agriculture*. *Natural Built Social Environment Health* ***1***(5). https://doi.org/10.63095/NBSEH.25.934721

[7] Asbai, Z., Bahlaouan, B., El Antri, S., Brett-Crowther, M., & Boutaleb, N., 2025, Innovations in Organo-mineral Fertilizers: A Comprehensive Review of Sustainable Practices, Controlled Nutrient Release, and Coating Strategies. *Natural Built Social Environment Health* **1**(3), 67–99. https://doi.org/10.63095/NBSEH.25.458899

nadia.boutaleb@fstm.ac.ma

How to cite this article

Boutaleb, N., 2025, ***Advances in Bioprotection of Plants Against Diseases,*** edited by *Shashi Sharma and Minshad Ansari, (Sawston,* Cambridge*: Burleigh Dodds Science Publishing), 2025, 400 pp., £145.00 (hardback), ISBN: 978-1-80146-728-5; eISBN: 978-1-80146-728-5*. *Natural Built Social Environment Health* **1**(6), 129-135. DOI: 10.63095/NBSEH.25.560730