



Alternative Natural Resources in Plant Pathology and Microbiology for Sustainable Future and Protection of Important Ecological Regions: A Case Study from the Caucasus Region

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DESCRIPTION

Many studies on plant diseases, especially those in plant pathology and microbiology, contribute significantly to the understanding of the functional behavior of plants. These constitute an important structural component of ecosystems and help in the maintenance of ecosystem health. Plants with an economic potential, especially in terms of food security, constantly face biotic and/or abiotic stresses during their life cycle, depending on the ecological conditions of the environment [1].

One of the popular topics in recent years is climate change. In this context, changes in temperature and precipitation also affect the distribution and virulence of microorganisms, especially plant pathogens. Increases in temperature associated with climate change may extend the growing season of plant pathogens and allow them to move easily to different environments and develop in different plants. As a result of the potential biotic/abiotic stresses affecting ecosystem health, the negative impacts on plants vary. Recently, studies have been undertaken, particularly in the fields of ecology, genetic engineering and biotechnology, to develop crop varieties with increased resistance to multiple stresses such as drought, heat and pathogens, particularly with regard to climate resilience [2].

Moreover, another issue that has a high potential to threaten ecosystem health is the overuse and misuse of chemical pesticides. The biological control mechanisms stand out as an environmentally friendly option in terms of natural alternative disease control methods. As per the latest data, approximately 175 bio pesticides have been registered internationally. In addition to this, due to the bioactive compounds present in various parts of many plants with antimicrobial characteristics, there are studies on their potential use as medicines [3]. It has also been emphasized that bioactive compounds isolated from many medicinal plants can be used as bio pesticides as an alternative option, especially for diseased plants.

The unique climatic conditions of the Caucasus, as well as its geological and geomorphological diversity, have led to the development of vegetation of exceptional importance for nature conservation. This region is home to almost 7000 plant species, 1700 of which are endemic to the area. This area has been identified by the International Union for Conservation of Nature (IUCN), the World Bank (WB) and the Global Environment Facility (GEF) as one of the "25 most important terrestrial ecoregions" in terms of biodiversity, as well as one of the most endangered area. This area is located in the "Colchian" section of the Euro-Siberian Floristic Region, known as the most important refuge and relict area of tertiary forests in Western Eurasia. It is the region where temperate deciduous forests have existed continuously since the tertiary period [4,5]. This region is home to the largest natural old-growth forest ecosystems in the vast geography encompassing Europe and Central Asia. The World Wildlife Fund (WWF) recognized the importance of the Caucasus for nature conservation in 1994, when it declared the temperate forests of the Caucasus to be one of the world's "200 Ecological Regions" in need of priority protection [6].

The ecologically important plants in the Caucasus region are of great significance. Their management will allow us to follow protection measures of the ecosystems inhabiting valuable species and will add to the future comparative detailed ecological studies in this region. *Betula medwediewii* Regel and *Epigaea gaultherioides* Takht. (relict woody species), and *Veratrum album* L. species are of economic as well as medicinal value.

Lately many investigations have been undertaken to identify plants that are resistant to multiple stresses like; drought, heat and pathogens. The climatic resistance criterion of these naturally distributed species in the Caucasus region are being evaluated to a large extent. Majority of these are relict, endemic and medicinally important. Same is the situation of other plants in this unique ecological region. As an environmentally friendly option, the use of these plants as bio pesticides in biological control mechanisms, especially in terms of alternative disease control methods, needs to be investigated [7,8]. In terms of both

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ecosystem health and public health, pharmacological studies should be carried out on different parts of these plants and evaluated at length as potential natural alternative sources as antimicrobial, antibacterial, antifungal and anti-infection agents.

CONCLUSION

The multidisciplinary collaborative studies in the fields of ecology, climatology, genetic engineering and biotechnology will enable us to identify the alternative natural plant resources which can be used in plant pathology and microbiology. This will contribute to a better understanding of plant-pathogen interactions. In this way, while protecting plant health, the productivity of many plants with natural distribution and economic potential, especially in the Caucasus and other ecologically important regions, will be ensured, making important contributions to local, regional and global food security.

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