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Mapping biotic stressors across mediterranean cropping systems: Current distributions and climate-driven future projections

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Abstract

Biotic stressors, including pests, weeds, and diseases, are major constraints on agricultural productivity and the economic viability of farming systems. In Mediterranean regions, where high-value crops such as olive and tomatoes play a globally significant role, yield losses attributable to these stressors are substantial. Increasing evidence suggests that climate change is intensifying their impacts by accelerating proliferation, shifting geographical distribution, and altering phenology. As a result, crop losses are becoming severe, including in areas previously considered low risk.

This study examines nine Mediterranean countries (France, Italy, Greece, Turkey, Lebanon, Jordan, Egypt, Tunisia, and Morocco) and three major cropping systems (olive-based, tomato-based, and cereal-legume based cropping systems). The objectives are to identify key biotic stressors, characterise their current distributions, and predict their future distribution across the broader Mediterranean basin. We conducted a systematic literature review to identify frequently reported biotic stressors, and applied species distribution modelling approach using maximum entropy to estimate their current and future distributions.

A synthesis of 1,550 peer-reviewed articles shows that research is heavily skewed towards cereal-legume systems, with weeds emerging as the most frequently reported stressor type (59.7%). *Sinapis arvensis* L. and *Anagallis arvensis* L. are the most commonly documented weed species. The dominant weed families were Asteraceae and Poaceae, while the predominant pest families include Thripidae, Tetranychidae, and Aleyrodidae. Geographically, the literature is disproportionately concentrated in Italy, highlighting regional research imbalances.

Model projections under a business-as-usual climate scenario indicate yield losses across three cropping systems. These findings underscore the urgency of implementing agroecological interventions, including integrated pest management strategies and the use of service crops for weed suppression. Overall, this study provides evidence that is directly relevant to farmers, extension officers, and policymakers to support the scaling of agroecological transitions, thereby enhancing the resilience and sustainability of Mediterranean farming systems.

Keywords: Agroecology, cereal-legume, olive, pests, predict, tomatoes, weeds