Chapter 18
Monitoring and Detection of Insect Pests Using Smart Trap Technologies

Aqsa Aslam
Department of Zoology, Wildlife and Fisheries, Faculty of Sciences, University of Agriculture, Faisalabad, Pakistan

Muhammad Umar Ijaz
Department of Zoology, Wildlife and Fisheries, Faculty of Sciences, University of Agriculture, Faisalabad, Pakistan

Muhammad Talha Aslam
https://orcid.org/0009-0000-0630-1961
Key Laboratory of Crop Physiology, Ecology, and Genetic Breeding, Ministry of Education/College of Agronomy, Jiangxi Agricultural University, Nanchang, China

Muhammad Umer Chattha
Department of Agronomy, Faculty of Agriculture, University of Agriculture, Faisalabad, Pakistan

Imran Khan
Department of Agronomy, Faculty of Agriculture, University of Agriculture, Faisalabad, Pakistan

Muhammad Zeeshan Gulzar
Department of Environmental Science and Engineering, University of Science and Technology of China, Hefei, China

Maham Mehmood
Department of Zoology, Wildlife and Fisheries, Faculty of Sciences, University of Agriculture, Faisalabad, Pakistan

Faiza Ali
Department of Zoology, Wildlife and Fisheries, Faculty of Sciences, University of Agriculture, Faisalabad, Pakistan

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ABSTRACT

Despite all the strategies of integrated pest management (IPM), insecticides are still frequently used in its cultivation. The frequent spread of invasive species and unexpected pest outbreaks are serious problems posed by climate change that influence pest phenology. The latest reviews suggested that the current monitoring strategies of IPM need to be revised. Automated pest-monitoring systems are sophisticated, accurate, and efficient monitoring techniques. For this, several systems have been designed to improve IPM in precision agriculture. This comprises the latest methods and scientific state of the art of the use of sensors for automatic detection and monitoring of insect pests. Further, the advanced strategies for the identification of pests based on infrared detectors, audio sensors, and image-based classification, presenting the different systems available, their applications and recent developments, including machine learning and the Internet of Things are given with future trends of automatic traps and decision support systems.

INTRODUCTION

The advancements in the fields of chemistry, genetics and robotics have progressed agricultural practices (Grammatikis et al., 2020). However, fresh water sources and arable lands are becoming increasingly scarce (Wang, 2022). Unsustainable agricultural practices jeopardize both crop yields and environmental integrity while also contributing to climatic change. Moreover, these activities further complicates production and consumption demand (Loures et al., 2020). Simultaneously, the escalating challenges of climate change are progressively affecting the numerous aspects of agricultural production. Climate change has a direct impact on crop yield, harvesting times, agricultural methods, as well as the prevalence of agricultural pests (Alatalo et al., 2021; Skendzi´c et al., 2021). Artificial intelligence (AI) is an appropriate way to deal with the problems mentioned above and play an essential role in improving the agricultural sector (Fraser, 2019).

Further, it has recently been used in precision agriculture (PA) to support crop production, content recording of soil, irrigation, crop and pest monitoring, and weed detection and its management (Stafford, 2000; Mulla, 2013; Talaviya, 2020). Precision agriculture is defined as the application of technologies and principles to regulate every aspect of the farming industry to maximize crop yield and protect the environment by using high-technology tools (Karunathilake et al., 2023). This comprehensive approach represents an essential agricultural control system that integrates robotics and high technology sensors, weather modelling, advanced GNSS (Global Navigation Satellite Systems) and GPS (Global Positioning Systems), drones