ISSN NO: 2771-8840
Date of Publication: 06-11-2022

Review Article: Physiological effects of plants when infested with insect pests

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Abstract: Insect pests that may significantly reduce production are a persistent threat to plants. The use of "omic" technologies and their application in research on the interactions between plants and sap-sucking insects will be succinctly summarized in this article. We discuss recent findings in this area and propose that insect mutualists may play a more significant role than is currently recognized as 'hidden actors' in insect-plant interactions.

Key words: pests, plants, insects, the physical environment and the greenhouse environment.

Introduction

In a very short period of time, insects can multiply in number, which can lead to the overpopulation situation. Some insect species may become pests in urban areas due to a rapid rise in individuals within populations, which can have serious negative effects on the economy and public health. By devouring crops and attractive plants, grasshoppers and other herbivorous pests can cause significant economic concerns [1]. Insect pests that may significantly reduce production are a persistent threat to plants. Although insects with piercing-sucking mouthparts, including aphids, whiteflies, and leafhoppers, appear to physically harm tissues less, they nonetheless spread various plant-pathogenic viruses by sucking sap from the plant and piercing plant tissue. In order to counteract insect infestations, plants engage a variety of dynamic defensive mechanisms, including the quick reprogramming of the host cell processes. It is necessary to call for strategies that can simultaneously capture these dynamic changes in order to gain a comprehensive knowledge of the interactions between plants and sap-sucking insects. This capability has recently been developed using several "omic" technologies [2]. In the greenhouse, researchers looked at how commercial vermicomposts made from food scraps affected aphid, mealy bug, and cabbage white caterpillar infestations and damage [3].

While edaphic colonies feed underground on roots, arboreal colonies (Fig. 1) feed on the leaf axils, wounds, scars, and pruning cuts on the trunk and branches of apple trees. Trees with infestations of woolly apple aphids are more susceptible to perennia canker, and feeding by arboreal colonies may result in stem breaking and early defoliation (Fig. 2). Although it is impossible to predict the prevalence or severity of edaphic infestations from an arboreal infestation, feeding below ground can cause serious harm to apple trees [4].

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Fig.1: explained the woolly apple aphid populations that live in trees. [4].

Fig. 2: the early defoliation and stem splitting were explained [4].

The green stink bug, N. viridula L., which attacks soybean plants during pod development and setting, is another significant pest of legume pods in Egypt [5]. The detrimental effects of pest management measures on the environment must be lessened. increased worry about chemicals' possible health consequences, Changes in plant protection measures are also caused by a decrease in arable area per person and the evolution of pest complexes, which is anticipated to be exacerbated by climate change [6]. Although more than 540 bug species are resistant to synthetic pesticides, insecticides are still frequently utilized. Synthetic pesticides also have negative impacts on non-target species including subsequent pest outbreaks and resurgences. Due to this circumstance, there is a need for other control strategies, such as physical controls [7].

The worldwide "greenhouse effect" will cause climatic changes that will have an influence on the geographic distribution, vigor, virulence, and agricultural impact of weeds, insects, and plant diseases. interactions between weeds and crops, especially between species with different photosynthetic pathways (C_3 v C_4), may change, with rising CO2 favoring the C3 species [8]. Pest insect feeding habits may be impacted by physiological and biochemical changes brought about in host agricultural plants by increased CO2. It is possible for pest behavior to alter as a result of global warming and other climatic change, according to a compilation of climatic thresholds for phenological development of pest insects. It may be possible to shorten generation periods, allowing for more rapid population growth [9]. During the growing

ISSN NO: 2771-8840
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season, migration poleward might speed up. It will also change how plant diseases spread. In times of swift climate change and unpredictable weather, illness outbreak prediction will be more challenging. The inability of insecticides to effectively kill the intended pests or the increasing frequency of extreme weather events might both harm non-target creatures more severely. Biological control may be adversely or favorably impacted. Overall, pests will likely provide more of a threat to agriculture [10].

The control methods of the environment pests:

The physical habitat of the pest is altered using physical management methods such that the insects no longer threaten the crop. This can be accomplished by inducing states of stress ranging from agitation to death or by employing tools like physical barriers that keep pests away from plants or produce. Contrary to chemical approaches, which have well defined and constrained modes of action, many physical control methods focus on a collection of physiological and behavioral processes [6]. Mutualists allow insects to control plant physiology for their own gain while also affecting the range of host plants. The plant may also serve as a pathway for mutualistic bacteria to spread horizontally among their host insects. In such cases, selection for better transmission may lead the insect mutualist to harm the plant and develop into a plant disease. By altering how the plant interacts with its rivals and natural enemies, insect microbial partners can have an impact on ecological communities [11].

As a very promising method to manage insect vectors of plant diseases endangering greenhouse crops, new forms of ultraviolet (UV)-blocking materials, such polyethylene films and nets, have been created recently. UV-blocking materials have the capacity to filter UV light (280–400 nm) that interferes with insects' ability to see, which affects their behavior linked to mobility, host location, and population factors [12]. The greenhouse environment's partial UV light exclusion has a significant impact on the direction, movement, and transmission of viral infections carried by insects [13]. An efficient, cost-effective, and environmentally benign approach of pest management is host plant resistance (HPR). The most alluring aspect of HPR is that farmers almost never need any technical expertise for application methods, and there is no financial investment required of the resource-poor farmers. Significant progress has been achieved in identifying and creating crop cultivars that are resistant to the main pests in various crops [14].

Transferring resistance genes into high-yielding cultivars that can respond to various agroecosystems is necessary. One need for releasing varieties and hybrids for farmer cultivation should be resistance to insects [15]. The built environment (human-made physical areas including houses, hotels, camps, hospitals, parks, pavement, food factories, etc.) and agricultural fields depend on early insect identification and management. These insect control methods are currently manual, tiresome, dangerous, and labor-intensive. Several maintenance jobs may now be automated thanks to recent breakthroughs in artificial intelligence (AI) and the internet of things (IoT), which greatly enhances efficiency and safety [16].

The use of biological methods to eradicate insect pests is growing. An integrated pest management (IPM) plan includes biological control as one of its components. It is viewed as an IPM method that uses systems thinking. Natural enemies are said to reduce pest populations through biological control, which usually entails human involvement [17].

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ISSN NO: 2771-8840
Date of Publication: 06-11-2022

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