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Impact of Climate Change on Agricultural Pests

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ABSTRACT

Climate change refers to the phenomenon that is causing the earth to become warmer which means that our climate and our weather systems are changing. Induced climate change arising from increasing levels of atmospheric greenhouse gases would likely to have a significant effect on agricultural pests. Changes in climate may trigger changes in geographical distribution, increased overwintering, changes in population growth rate, increases in the number of generations, changes in crop-pest asynchrony, changes in interspecific interactions, pest biotypes activity and abundance of natural enemies. Insects are poikilothermic animals and therefore they are highly sensitive to their surrounding climate particularly the temperature. Temperature influences on insect behaviour, distribution, development, survival and reproduction. Every species has a particular threshold of temperature above which development occurs, below which development ceases. Precipitation and drought increases the frequency of flooding of fields which could suppress some soil dwelling insect populations. Exposure to excessive moisture will be lethal and may reduce normal development and feeding activity. There may be the possibility of evolutionary adaptation in insects for changing environment. Therefore climate change might change population dynamics of insect pests differently in different agro-ecosystem and ecological zones.

Keywords: climate, change, pest, precipitation, temperature

I. INTRODUCTION

Climatic changes have a significant effect on the structure of insect communities, the compounds of regional fauna and the seasonal coecological changes in the state of certain local habits (micro habitats, biotypes). Weather has a direct impact through phenological and population dynamics processes, which will indirectly affect the changes in area and biodiversity. Changes in climate may trigger changes in geographical distribution, increased over wintering, changes in population growth rate, increase in the number of generations, changes in crop-pest asynchrony, changes in interspecific interactions, pest biotypes activity and abundance of natural enemies. In general it has been reported that insect pest activity may increase under climate change [1,2,3]. Moreover, the direct effect of climate change, changes in pest activity may occur quickly and dramatically and these issues need to be understood before reasonable estimates of climate change impacts may be assessed. The

authors have reviewed several research papers to summaries how climate change might change population of pests in different agro-ecosystems.

II. EFFECT OF CHANGED TEMPERATURE PATTERN ON PESTS

Increased temperatures can potentially affect insect survival, development, geographic range, and population size [4]. Temperature can impact insect physiology and development directly or indirectly through the physiology or existence of hosts. Depending on the development "strategy" of an insect species, temperature can exert different effects. Increased temperature is reported to change gender ratios of some pest species such as thrips potentially affecting reproduction rates [5]. Insects that spend important parts of their life histories in the soil may be more gradually affected by temperature changes than those that are above ground simply because soil provides an insulating medium that will tend to buffer temperature changes more than the air. Increased temperature could decrease pest/ insect populations indirectly affecting others factors [6] like host plants which are closely tied to a specific set of host pests. Due to increase in temperature, the cropping patterns are also affected. As such farmers do not to grow the host crop any longer which may decrease the populations of insect pests specific to those crops. The balance between the population of natural enemy and its host is thus affected because the changed environmental factors that impact pest insects can impact their insect predators and parasites as well as the disease organisms that infect the pests, resulting in increased attack on insect populations. Change in temperature is reported to affect the behaviour of insects. This is illustrated well in case of aphids where the responsiveness of aphids to alarm pheromone is reduced at high temperature. Alarm pheromone is normally released when aphids are under the attack of insect predators and parasitoids so it may be concluded that the potential predation of aphids is increased as a result of increased temperatures. Entomologists have also predicted additional generations of important pest insects in temperate climates as a result of increased temperatures e.g. in European red mites probably necessitating more insecticide applications to maintain populations below economic damage thresholds.

III.EFFECT OF PRECIPITATION ON INSECTS

There are fewer scientific studies on the effect of precipitation on insects than temperature. The appearance and the distribution of some pests however, is more dependent on precipitation rather than on temperature as observed for coffee white stem borer [7]. Some insects are sensitive to precipitation and are killed or removed from crops by heavy rains and in some north eastern US states, this consideration is important for management options for onion thrips [8]. More frequent and intense precipitation events forecasted with climate change tend to have a negative impact on insects viz; pea aphids which are not tolerant to drought and are severely affected by increased precipitation [9]. For some insects overwintering in soil, such as the cranberry fruit worm and other cranberry insect pests, flooding the soil has been used as a control measure owing to their sensitivity to moisture fluctuations [10]. As with temperature, precipitation changes can impact insect pest predators, parasites, and diseases resulting in a complex dynamic. Fungal pathogens of insects are favoured by high humidity and their

incidence would be increased by climate changes that lengthen periods of high humidity and reduced by those that result in drier conditions.

IV.EFFECT OF CO_2 ON PESTS

Generally CO_2 impacts on insects are thought to be indirect - impact on insect damage results from changes in the host crop. Some researchers have found that rising CO_2 can potentially have important effects on insect pest problems. Recently, free air gas concentration enrichment (FACE) technology was used to create an atmosphere with CO_2 and O_2 concentrations similar to what climate change models predict for the middle of the 21st century. During the early season, soybean grown in elevated CO_2 atmosphere had 57 per cent more damage from insects (primarily Japanese beetle, potato leafhopper, western corn rootworm and Mexican bean beetle) than those grown in today's atmosphere, and crop grown under such conditions required an increased insecticide treatment.the possible reason for increased attack of pests was the basic change in the physiology of the plant wherein, the increased levels of simple sugars in the soybean leaves was believed to stimulate the additional insect feeding [11]. It is also believed that insects tend to feed more on leaves that have a lowered nitrogen content in order to obtain sufficient nitrogen for their metabolism [12,13]. On the other hand, increased CO_2 level also lead to an increase in carbon to nitrogen (C:N) ratios in plant tissue resulting in the slow insect development and increase the length of life stages vulnerable to attack by parasitoids thereby enhancing the effectiveness of bio-control agents [12]. Thus there is a two way effect of elevated CO_2 levels on insect pest population.

V.CONCLUSION

The precise impacts of climate change on insects is somewhat uncertain because some factors of changed climate may favour insects while others may inhibit a few insects. However, it is necessary to mention that climate change has not only the direct impact on the population of pests but can affect them in indirect way by influencing the conditions and agents which are inter related with these pests in an agro- ecosystem.

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