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Effect of Humidity on Insect Abundance

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SUMMARY

Insects occupy every ecological niche from herbivore to predator to decomposer to farmer. They occur mostly in all terrestrial habitats, excepting the most extreme. Different humidity is present which affect the insect abundance. The range of moisture required is not as wide as in the case of temperature. Most of the insect species are capable of maintaining their body water at constant levels while living under varying conditions. Relative humidity was negatively correlated with whitefly, jassid and thrips i.e. the correlation of humidity with whitefly, Thrips and Jassid.

INTRODUCTION

Insects are the most diverse, and ecologically important terrestrial animals numbering over 1,000,000 species insects were the first organisms to successfully colonize land. Insects occupy every ecological niche from herbivore to predator to decomposer to farmer. They occur mostly in all terrestrial habitats, excepting the most extreme (the arctic, Antarctic, and peaks of the highest mountains). The biological classification of insects is important as it helps in denoting ecological and evolutionary commonalties among species. Insects occupy every ecological niche from herbivore to predator to decomposer to farmer. The nonliving components of a system, such as temperature, relative humidity, wind, mineral, nutrients, water, soil type, sunlight, and air pollutants affect insect population. The insect abundance is related to dispersal which includes immigration, emigration and migration. Such movements generally take place during unfavorable conditions from the original areas to other areas where conditions are favorable. Migratory movements are common among locusts, butterflies, aphids, coleopteran and hemiptera. The insect abundance are generally categorized into pest occurrence, incidence, outbreak and succession.

Humidity

Different humidity is present which affect the insect abundance. The absolute humidity is the total amount of water vapor in a given amount of air is referred to as absolute humidity. However, for the purpose of the ecological study relative humidity is taken into consideration. Relative humidity is the amount of water vapor present in comparison with the amount required to produce saturation at the same temperature and pressure. Specific humidity is the ratio of the weight of water vapor to the weight of humid air that contains it. Dew point is the temperature of saturation of air by water vapor. With falling temperature, condensation begins at the dew point. Moisture equilibrium is when the percentage of water content in the body of an animal is equal to the RH of the atmosphere; the animal is described as being in moisture equilibrium.

The range of moisture required is not as wide as in the case of temperature. Most of the insect species are capable of maintaining their body water at constant levels while living under varying conditions. For most of the species, food in the shape of plant of its products is the source of water, and they have the adaptation to cope with conditions of excessive moisture and shortage of water. The other sources of gaining moisture are direct drinking of water or absorbing through the integument. The loss of water from the body is prevented by insect cuticle having waxy layer. A number of adaptations, morphological, biological and physiological in nature, help insect populations in overcoming unfavorable conditions of excessive moisture or aridity. The various factors of humidity are discussed below.

The intake of water from the surroundings

Terrestrial insects obtain water in their food and some also drink water. The bees and butterflies are commonly seen at the edges of pools, sipping water. The longevity and fecundity of some Lepidoptera are reduced when free water is not available. Most insects which live on dry food, such as grain meal; dried fruit etc. live without drinking.

The injurious influence of exceptionally dry air

The prevailing temperature influences the humidity preference. Exceptionally dry air may prove lethal because some insect species may not survive the loss of even a small percentage of body water without adverse effects. However, those in aestivation or diapause lose a high proportion of body water without any ill effect, even though the state of inactivity may last for weeks or months.

The injurious influence of excessive moisture

The condition of exposure to excessive moisture can prove harmful to the insect populations in the following ways: a) By encouraging disease-causing microorganisms such as fungi, bacteria and mycoplasma, and thereby causing mortality among insects. b) By adversely affecting the normal development and feeding activities of insects. Silkworms do not pupate in moist air. c) Excessive moisture in the insect body during winter reduces its capability to withstand exposure to low temperature and in a way leads to an adverse effect on its cold hardiness.

Lethal influence of excessive moisture

Many grasshoppers and locusts are limited by excessive moisture. Excessive moisture may simply drown (die or go down) the insects. In wet years, large numbers of over wintering pupae of the *Helicoverpa armigera* die from drowning.

Role of humidity on the development and fecundity

Moisture influences the speed of development and fecundity of most insect species. In some species, these activities are accelerated by excessive moisture, while in others they get retarded. The black bug of sugarcane multiplied more rapidly at high humidity (90% R.H.), whereas relative humidity above 70% was harmful for the multiplication of cotton jassids. For eggs and pupae of spotted bollworm (*Earias insulana*) both very high (around 100%) and low (40%) relative humidity were not conductive for the development of these stages. Likewise, the *Callosobruchus chinensis* has been found to develop most rapidly at 90% RH with marked reduction in its larval period. The pupa of Tachnid parasite is so vitally affected at 0% RH that the parasites fail to achieve complete development. Broadly speaking, humidity vitally affects developmental cycle, water balance and general metabolism and certain aspects of behavior in insects.

Role of Soil moisture on the developmental cycles in locust

The number of eggs laid by a female increases as the humidity increases up to about 70 per cent RH and declines again at 90 per cent. The percentage of moisture present in the soil has been known to influence the percentage of hatching as well as the duration of incubation. The desert locust *Schistocera gregaria* lays its eggs in soils, and 80 per cent moisture content at temperatures of 32.5±0.50ºC appears optimum for development from the viewpoint of viability cum hatchability percentage. Soils as well as lower levels of moisture have the effect of prolonging incubation and this has a direct bearing on the type of hatching , i.e., either into solitaria or gregaria; low moisture (3.5 percent) giving rise to solitaria and higher contents to gregaria. In *Locusta migratoria*, at an RH of 70 per cent the nymphal development is at a minimum, increasing at lower and higher humidity.

Role of humidity on water balance or metabolism

It has been reported by the several scientist that low humidity causes drying out of the body fluids in the insects and higher humidity dilutes these fluids. Both are dangerous and detrimental to the insect's life.

Role of humidity on certain aspects of behaviour

Variations in atmospheric moisture have been found to influences certain aspects of behaviour such as (1) feeding (2) orientation and (3) oviposition in insects. 1) Feeding: A characteristics example to indicate the influence of humidity through the moisture content of the diet and the feeding of insects is that of the larvae and adults of *Tribolium castaneum* which feed most on wheat flour containing 14% moisture content and less on same diet above or below this value. 2) Orientation: Termites are a group of insects for which atmospheric humidity is important ecological factor. They usually move towards a zone of high humidity when subjected to the slightest

desiccation. The orientation response was greater with a high hygro-positive response when *Micoceroterms beesoni* were subject to preconditioning in dry air. The workers of the species showed a humidity referendum of 90-95 per cent RH and they lived longer at 100 per cent RH under starved conditions.3) Oviposition: The number of eggs laid by a female of locust increases as the humidity increases up to about 70 per cent RH and declines again at 90 per cent.

Survival value of insects in response to different humidity

The experimental evidences show how some insects, which usually live in moist places, have become adapted to recognize quite small differences in humidity and to move away from places where dryness might become a danger.

Effect of humidity in maize crop pests:-

The population of leaf hoper was found highest at relative humidity 68%. The lowest population was observed relative humidity at 75%. The population of jassid was found highest with relative humidity at 68% and lowest population was found at relative humidity at 70%. The infestation of *Chilo partelous* was found highest at relative humidity 68% and lowest infestation of *chilo partellous* found at the relative humidity at 50%.

Incidence of *Amrasca devastans* (Distant) in Cotton in Relation to humidity.

Incidence of *Amrasca devastans* (Distant) in cotton leafhopper population on cotton plants under different levels of protection revealed positive influence of relative humidity on the nymphal population on plants that were treated during vegetative phase alone; while on untreated plants relative humidity had the positive influence. However, on plants protected during reproductive phase and on plants under complete protection weather parameters had no influence on the nymphal population of *A.devastans.*

CONCLUSION

Relative humidity showed greater influence on the pest incidence. Relative humidity was negatively correlated with whitefly, jassid and thrips i.e. the correlation of humidity with whitefly, Thrips and Jassid. Swarming pattern of *Odontotermes obesus* observed relative humidity had positive correlation. On rice, population of GLH has Positive influence of rainfall and relative humidity on the light trap catches.

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