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Report on impact of temperature on phenology of *Earias vittella* (Fab.) (Lepidoptera: Noctuidae) in agro-horticultural fields.

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Abstract- In India, a significant insect pest of many agricultural and horticultural crops like cotton, okra, brinjal, tomatoes, and others is *Earias vittella* (Fab.) (Lepidoptera: Noctuidae). It harms the economy of farmers because the reduced yield and quality result from the larvae feeding on the leaves, flowers, and fruits of these crops. Certain plant diseases are also known to be spread by the pest. This article summarizes the available literature related to *Earias vittella's* effects on India's agro-horticultural lands. Quality literature was extracted online by data mining through scientific browsers. The discussion included the pest's present situation and its host range, biology, and distribution. Further, several control strategies are now in use, such as biological, chemical, and cultural strategies.

Key words: *Earias vittella,* Lepidoptera, Noctuidae, pest, India, agriculture, horticulture

INTRODUCTION

Earias vittella, also referred to as the okra fruit borer or spotted bollworm, is a polyphagous pest that can harm a variety of crops, including okra plants belonging to the Noctuidae family of order Lepidoptera.[1] It is distributed in India, Sri Lanka, Bangladesh, Myanmar, Thailand, Indonesia, Pakistan, and other countries also.

The larvae of *Earias vittella* consume the fruits and other reproductive organs of the okra plant. They pierce the fruit, inflicting harm that may compromise the crop's quality and productivity. Farmers may suffer financial losses and a decline in market value because of this harm.[2] Severe *Earias vittella* infestations can cause a notable decrease in the total yield of okra plants. A smaller harvest may arise from the larvae's ability to induce the early dropping of afflicted fruits as they feed on developing fruits.[3] Stunted growth may result from the larvae's constant eating of the okra plant's reproductive organs. The plant's general development may be hampered if resources are diverted to fix the harm the pest has caused. Pathogens may enter through the openings made by *Earias vittella* larvae, resulting in secondary infections. This may increase the bollworm's harm and weaken the plants even more. *Earias vittella* larvae can harm okra fruits cosmetically and degrade the produce's quality. This is especially critical for crops going into the fresh market, as consumer acceptance of them is greatly influenced by appearance.

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Farmer uses integrated pest management (IPM) techniques to control *Earias vittella* infestations and reduce their effects on okra plants. This could involve cultural practices like crop rotation and good sanitation in addition to the use of biological control agents like natural predators and parasites. Insecticides and other chemical control methods can also be used, but their application must be carefully considered in order to reduce environmental damage and stop the emergence of pest population resistance to pesticides.

Regardless of their underlying causes, climate changes have a tremendous influence on the natural environment. The aquatic and terrestrial ecosystems are also impacted. Alternating basic climatic conditions have an impact on specific tree and animal species with varied ecological requirements directly on the one hand, and on all other living elements of the forest ecosystem on the other. Insects are the subset of the latter with the highest significance, including species that are harmful to the health of the forest in terms of forest management.[4]

Since insects are members of the ectothermic order of animals, the temperature of their habitat has a significant impact on them. Therefore, in addition to food plants, climatic conditions are fundamental elements that determine insect distribution. Any climatic changes have an adverse effect on insect assemblages. Forest insects may be affected by climate change in a variety of ways, including changes to their range, phenology, activity, number of generations, and winter survival. Among the present theories of climate change, the average temperature increase theory dominates (IPCC 2007).[5] The fluctuation of humidity is more than that of temperature. As with temperature, it might be challenging to see a clear pattern in humidity. Predicting the effect of temperature on the life-table parameters of the pest is highly helpful in making a strategy under integrated pest management[6].

Many researchers predicted the climate change will have an adverse influence on forests.[7-10] Temperature plays a crucial role in the development time of insects.[11] The development rate is usually used to quantify the temperature's effect on the pests. Generally, the development rate gradually rises to an optimal developmental temperature and then falls rapidly at higher temperatures. The objective of this work was to study the life cycle of *E. vitella* and its infestation on the host plants with respect to the changes in temperature.

METHODOLOGY

Literature search and screening

Peer-reviewed literature related to the title of this article was extracted from digital sources with suitable keys. Online search engines like NCBI, Google Scholar, PubMed, Scopus, Research Gate, and Science.gov were used to extract quality content.

Data extraction and analysis

PRISMA 2020 was used for the meta-analysis and systematic review of the literature.

RESULTS & DISCUSSION

Several published articles were evaluated properly and the findings are summarized.

E. vittella and its host plants

This pest is polyphagous. This pest damages several varieties of cotton plants carried out studies in 1969 at Jabalpur, Madhya Pradesh, India during the kharif season to estimate loss in growth and yield of okra (*Abelmoschus esculentus*) caused by *Empoasca devastans* (Dist.) and *Earias* spp.[12, 13] Chaudhary and Dadheech (1989) reported that the monsoon crop of okra was attacked by *Aphis gossypii, Amrasca biguttula biguttula, Bemisia tabaci,* and *Earias fabia.*[14] The net available loss was 54.04 percent when insecticides were not treated on the plant. Kanwar and Ameta (2007) reported that insect pests in okra cause a 59.30 percent reduction in fruit yield.[15]

Effects of varying temperature on insects

Insects as poikilothermic animals change their activity that depends on the change in the temperature of the surrounding environment[16,17]. The insect metabolism accelerates when the temperature is raised to the thermal optimum. As a result, it directly affects their increased activity. In studies of the effect of varying temperatures on the rate of development, insects are reared at both constant and varying temperature regimes and the development rates at the two types of regimes are compared. The term varying temperature is used to encompass both alternating and fluctuating temperatures.

Length of insect growth

In higher temperature conditions, changes in the life-table parameters like the development of egg, larva, and pupa shorten, which is a characteristic phenomenon for large groups of forest species.[18] Temperature influence on the length of larval development has been observed under laboratory conditions for *Earias vitella.*

Population Dynamics of Major Sucking Pest of Okra

Hemat Z. Moustafa (2015) concluded that, the tested (25, 27, and 30°C) temperatures had the main effect on stage durations, survival, adult emergence percentages, sex ratio, and fecundity of field SBW strain.[19] Generally, Insect pests are affected by abiotic factors in nature, especially by temperature, and their biology, behaviour, and fitness are greatly affected.[20] There are various studies showing the effect of temperature on the development of different insects such as.[21,22] Said S. M. (2020) it is concluded that constant temperatures affect the different stages of *E. insulana* reared on an artificial diet at laboratory conditions.[23] The development rate increased with the increase in temperature, leading to the shortening of the different periods and the opposite occurred when the temperature decreased. In addition, it could be concluded that the optimal zone of temperature for the growth and development of spiny bollworms is 23 to 27 degrees in laboratory conditions. These results showed that a low survival rate occurred at 18°C but the higher rate occurred at 27°C. Obtained results showed an increase in survival rates with the increase of temperature but the excessive increase in temperatures led to a decrease in survival rates again. Mid-August was when *Earias* spp. caused the most damage to okra shoots (1.7%) and flowers (1.5%).[24] In the spring crop, late July saw the highest levels of fruit damage (32.04%) and larval population (1.4/plant). *Earias* spp. populations grew gradually until mid-September and then quickly. A lot of rain has a negative impact on population growth. *E. vittela* infection on okra cv. Pusa Sawani began as soon as the fruits set and peaked three to four weeks later (69.9 %). From the crop's 35-day age, *E. vittella* activity on the summer okra crop in Samastipur, Bihar, was observed. Infestation levels on shoots ranged from 0.3% to 3.46% in 2000 and from 1.45% to 4.86% in 2001. The maximum temperature had a detrimental impact on the larval population and fruit damage, but the lowest temperature, relative humidity (morning and evening), and rainfall had a favourable impact.[25] Narendra *et al.* (2021) reported the efficacy of *Bacillus thuringiensis* against *E. vittella* under integrated pest management.[26]

CONCLUSION

E. vittella (Fab.) damages host plants and therefore harms the economy of farmers. Temperature is one of the important environmental factors, which affect the life-table parameters of the pest. Understanding its growth and reproduction at different temperatures can help to understand its future area of infestation. Effective integrated pest management can plan its control.

REFERENCES

1. **Meshram P. B. & Soni, K. K. 2011.** Trends in Horticultural Entomology. Indian *Journal of Entomology.* **64(1):** 58–62.
2. **Sahu S. K. & Mishra B. K. 2019.** Influence of host plants and cultural practices on the incidence and severity of *Earias vittella* (Lepidoptera: Noctuidae) in cotton (*Gossypium hirsutum* L.). *Indian Journal of Entomology*. **82(4):** 558-563.
3. **Samuthiravelu P. & David B. V. 1991.** Bioefficacy of neem oil and endosulfan against the fruit borer Earias vittella. *Indian Journal of Plant Protection*. **19(4):** 335-338.
4. **Jaiswal A. K. & Singh, K. K. 2022.** Bio-pesticides as an alternative to chemical pesticides for the management of *Earias vittella* (Lepidoptera: Noctuidae) in okra. *Indian Journal of Entomology*. **85(3):** 431-436. DOI: 10.5958/0974-0506.85.3.431
5. **IPCC. 2007.** Intergovernmental Panel on Climate Change. Fourth Assessment Report. http:// www.ipcc.ch/ [12.08.2013].
6. **Yadav M. & Singh O. P. 2022.** Effect of integrated pest management on the incidence of *Earias vittella* (Lepidoptera: Noctuidae) and yield of okra (*Abelmoschus esculentus* L.) in Chhattisgarh. *Indian Journal of Plant Protection*. **85(2):** 293-297. DOI: 10.5958/0974-0506.85.2.293
7. **Wigley T. M. L. 1993.** Climate change and forestry. *Commonwealth Forestry Review*. **72(4):** 256–264.
8. **Ayres M. P. & Lombardero M. J. 2000.** Assessing the consequences of global change for forest disturbance from herbivores and pathogens. *The science of the total environment*. **262(3):** 263–286.
9. **Battisti A. 2008.** Forests and climate change – lessons from insects. *iForest*. **1:** 1–5. http://www.sisef.it/ iforest/pdf/ Battisti_210.pdf [20.10.2010].
10. **Moore B. A. & Allard G. B. 2008.** Climate change impacts on forest health. Forest Health & Biosecurity

Working Papers FBS/34E. Forest Resources Development Service, Forest Management Division, FAO, Rome.

11. **Taylor F. 1981.** Ecology and evolution of physiological time in insects. *Am. Nat.* **117:** 1–23.

12. **Patil C. S., Moholkar P. R. & Ajri, D. S. 1986.** Development of fruit borer *Earias vittella* Stoll on different varieties of cotton in Maharashtra. *Journal of Maharashtra Agricultural Universities*. **11(2):** 219-220.

13. **Rawat R. R. & Sahu H. R. 1973.** Estimation of losses in growth and yield of okra due to *Earias* spp. *Indian J entomol*. **35:** 252-254.

14. **Chaudhary H. R. & Dadeech. 1989.** Incidence of insects attacking okra and the available losses caused by them. *Ann. Arid Zone*. **28(3):** 305-307.

15. **Kanwar N., & Ameta O. P. 2007.** Assessment of loss caused by insect pests of okra, *Abelmoschus esculentus* (L.) *Moench. Pestology*. **31(5):** 45-47.

16. **Bale J. S., Masters G. J., Hodkinson I. D., Awmack C., Bezemer T. M., Brown V. K., Butterfield J., Buse A., Coulson J. C., Farrar J., Good J. E. G., Harrington R., Hartley S., Jones T. H, Lindroth R. L., Press M. C., Symioudis I., Waltt A. D., Whittaker J. B. 2002.** Herbivory in global climate change research: direct effects of rising temperature on insect herbivores. *Global Change Biology*. **8(1):** 1–16.

17. **Menéndez R. 2007.** How are insects responding to global warming. *Tijdschrift voor Entomologie*. **150:** 355–365.

18. **Szujecki A. 1998.** *Entomologia leœna*. Warszawa, Wyd. SGGW.

19. **Hemat Z. Moustafa T., Mohamad G. M. & H. Torkey. 2015.** Effect of Formulated Nanoemulsion of *Eucalyptus* Oil on the Cotton Bollworms. *J. Biol. Chem. Research*. **32(2):** 478-484.

20. **Jaleel W., Saeed S., Saeed Q., Naqqash M. N., Sial M. U., Aine Q. U., Yanyuan L., Rui Z., He Y. & Lu L. 2019.** Effects of three different cultivars of cruciferous plants on the age stage, two sex life table traits of *Plutella xylostella* (L.) (Lepidoptera: Plutellidae). *Entomological Research*. **49:** 151–157.

21. **Garrad, R., Booth D. T. & Furlong M. J. 2016.** The effect of rearing temperature on development, body size, energetics and fecundity of the diamondback moth. *Bulletin of Entomological Research*. **106:** 175–181.

22. **Jaleel, W., Lu L. & He Y. 2018.** Biology, taxonomy, and IPM strategies of Bactrocera tau Walker and complex species (Diptera; Tephritidae) in Asia: A Comprehensive Review. *Environmental Science and Pollution Research.* 1–16.

23. **Said, S. M. 2020.** Influence of Temperature on the Development, Growth Rate, and Life Table Parameters of *Earias insulana* Boisd. (Lepidoptera: Noctuidae) under Laboratory Conditions. Egypt. *Acad. J. Biolog. Sci*. **13(3):** 37-46.

24. **Dhawan A. K. & Sidhu A. S. 1984.** Incidence and relative abundance to different species of sported boll worms on okra at Ludhiana, Punjab. *J. Res. Punjab Agric. Uni*. **24(4):** 533-542.

25. **Mandal S. K., Sattar A., Sah S. B. & Gupta S. C. 2006.** Prediction of okra shoot and fruit borer (*Earias vittella* Fab.) incidence using weather variables at Pusa, Bihar. *International Journal of Agricultural Sciences*. **2(2):** 467-469.

26. **Narendra J., Singh R. P. & Singh N. P. 2021.** Efficacy of *Bacillus thuringiensis* and *Beauveria bassiana* against *Earias vittella* (Lepidoptera: Noctuidae) infesting okra (*Abelmoschus esculentus* L.). *Indian Journal of Entomology*. **84(1):** 1-6. DOI: 10.5958/0974-0506.84.1.1

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