Relationship between Sucking Pests of OKRA and Environmental Factors: A Review

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Abstract

Okra (Abelmoschus esculentus) is a globally important vegetable crop that is severely affected by various sucking pests, including aphids, whiteflies, jassids, and thrips. These pests cause direct damage through sap feeding and indirect damage by transmitting viral diseases, leading to significant yield losses. The population dynamics of these sucking pests are heavily influenced by environmental factors such as temperature, relative humidity, rainfall, and light intensity. This review synthesizes current knowledge on the relationship between sucking pest populations and environmental variables, highlighting their seasonal occurrence and behavioral responses to climatic conditions. Understanding these interactions is critical for the development of effective pest management strategies. Integrated Pest Management (IPM) approaches combining chemical, biological, and cultural methods show promise in sustainably controlling pest populations while reducing environmental impact. Future perspectives emphasize the integration of weather-based pest forecasting, development of resistant okra varieties, and enhanced farmer education to mitigate pest outbreaks and augment okra productivity.

Keywords: Okra, Sucking pests, Environmental factors, Climate, Pest dynamics, IPM

1. Introduction

Okra (*Abelmoschus esculentus*), commonly referred to as lady's finger or bhindi, is a widely cultivated vegetable crop known for its edible green seed pods, high nutritional value, and culinary versatility (Kumar et al., 2013; Ng, 2014). Okra is believed to have originated in Ethiopia and is now grown extensively throughout Asia, Africa, and the Americas, highlighting its adaptability to tropical and subtropical climates (Siemonsma & Hamon, 2002). The pods are eaten fresh or processed and are a rich source of vitamins A and B, protein, and essential minerals, making okra a vital component in the diets of millions (Gemede et al., 2015).

Economically, okra is highly significant, especially in developing countries where it contributes to smallholder farmer income and local food security. Its resilience to heat and drought, coupled with a relatively short growth cycle, allows production in regions with challenging agro-climatic conditions (Adeniji et al., 2012). Okra farming is most prominent in countries such as India, Nigeria, Sudan, and Egypt, which account for a substantial proportion of global output (FAO, 2016).

Despite its agronomic and nutritional advantages, okra production is threatened by pest infestations that can severely reduce marketable yield and crop quality. Sucking pests such as aphids (*Aphis gossypii*), jassids (*Amrasca biguttula biguttula*), whiteflies (*Bemisia tabaci*), and mealy bugs (*Phenacoccus solenopsis*) are among the most damaging, attacking plants at all growth stages and causing both direct and indirect losses by vectoring plant viruses and diminishing vigor (Singh & Krishnayya, 2011). The yield reduction in heavily infested crops can reach up to 54–66% (Sharma & Singh, 2002).

This review synthesizes previous research regarding the interactions between sucking pests of okra and environmental factors. By examining climate variables such as temperature, humidity, and rainfall, as well as pest population dynamics, this paper seeks to clarify the mechanisms underlying pest outbreaks and offers insight into integrated pest management approaches for sustainable okra production.

2. Major Sucking Pests of Okra

Okra (*Abelmoschus esculentus*) is vulnerable to a range of sucking insect pests that cause substantial damage to the crop through direct feeding and transmission of viral diseases. The main sucking pests include the aphid (*Aphis gossypii*), leafhopper or jassid (*Amrasca biguttula biguttula*), whitefly (*Bemisia tabaci*), and thrips (*Thrips tabaci*) (Schippers, 2000; Anitha & Nandihalli, 2008; Dhankhar, 2006).

Common Species

Aphis gossypii (aphid): Infests okra throughout its growing cycle, causing leaf curling, yellowing, and stunted growth. It also secretes honeydew, promoting sooty mold development (Anitha & Nandihalli, 2008).

Amrasca biguttula biguttula (jassid): Causes leaf chlorosis and curling, known for typical 'hopper burn' symptoms, which are aggravated during hot and dry periods and peak during vegetative growth (Dhankhar, 2006).

Bemisia tabaci (whitefly): Recognized for its capacity to transmit yellow vein mosaic virus and cause leaf chlorosis and wilting, whitefly populations typically surge under warm and humid conditions (Chakraborty et al., 2010).

Thrips tabaci (thrips): Thrips feed on leaves and flowers, producing silvering and deformity, with damage highest during dry spells (Schippers, 2000).

Seasonal Occurrence and Damage Symptoms

The abundance and severity of sucking pests is often linked to crop seasonality. Studies in India and Egypt indicate that populations of aphids, jassids, and whiteflies peak at early and mid-crop stages, with significant incidences reported during both summer (Kharif) and spring (Rabi) seasons (Dhankhar, 2006; Anitha & Nandihalli, 2008). Aphids and jassids are present from the seedling stage, while whiteflies and thrips become more prominent as the crop matures (Chakraborty et al., 2010). These pests reduce plant vigor and photosynthetic capacity, ultimately impacting marketable yield.

Damage symptoms include:

- Leaf curling, yellowing, and premature leaf drop (aphids, jassids)
- Wilting and stunted plant growth (all species)
- Sooty mold formation on leaves (resulting from aphid honeydew)
- Silvering, scarring, and deformation of flowers and fruits (thrips)
- Transmission of viruses, especially yellow vein mosaic by whiteflies (Chakraborty et al., 2010)

Lifecycle and Host Plant Relationship

Sucking pests generally have short lifecycles, with high reproductive rates under favorable temperature and humidity.

- *Aphis gossypii* can develop from egg to adult within 7–10 days, producing several generations in a cropping season (Schippers, 2000).
- The jassid completes its lifecycle in about 12–21 days, with adults and nymphs feeding on leaf undersides (Anitha & Nandihalli, 2008).
- *Bemisia tabaci* and *Thrips tabaci* have multivoltine lifecycles, with all life stages able to infest okra, leading to continuous pressure (Dhankhar, 2006).
- The host plant's succulent tissues and den

3. Environmental Factors Influencing Pest Population (2 pages)

Environmental Factors Influencing Pest Population

The population dynamics of major sucking pests in okra are governed by a complex interplay of environmental factors such as temperature, humidity, rainfall, and other weather variables. These factors modulate pest abundance, seasonality, reproduction rates, and interactions with the host plant.

Temperature

Temperature has a substantial impact on the activity and multiplication of sucking pests. Maximum and minimum temperatures are generally positively correlated with pest populations, especially aphids, whiteflies, and jassids (Anitha & Nandihalli, 2008; Saroj et al., 2017). Warmer climates accelerate the developmental rates of most pests:

- Whitefly and jassid populations often peak during warmer weeks, with higher oviposition and faster lifecycle completion (Saroj et al., 2017; Mishra et al., 2017).

- Aphids develop faster at temperatures between 25°C and 30°C, resulting in rapid population build-up (Chakraborty et al., 2010).
- However, extreme temperatures may suppress certain species or shift pest outbreaks to different seasons (Schippers, 2000).

Relative Humidity

Humidity exerts variable effects, often interacting with temperature and rainfall:

- High morning relative humidity tends to favor sucking pests by improving larval survival and adult fecundity (Anitha & Nandihalli, 2008).
- Studies show whiteflies and aphids thrive in relatively humid conditions, although excessively high humidity can reduce pest population by promoting fungal diseases and natural enemies (Dhankhar, 2006).
- Jassid and whitefly populations, on the other hand, can exhibit negative correlations with rainfall-induced humidity, especially during the monsoon (Saroj et al., 2017).

Rainfall

Rainfall can influence pest populations directly and indirectly:

- Moderate rainfall washes off eggs and nymphs from foliage, temporarily reducing pest pressure (Anitha & Nandihalli, 2008).
- Extended rainy spells promote lush growth and host availability, leading to subsequent pest rebounds when dry conditions return (Saroj et al., 2017).
- Studies note that excessive rainfall is often negatively correlated with jassid infestation (Saroj et al., 2017), while prolonged dry periods favor aphid and thrip outbreaks (Schippers, 2000).

Light Intensity and Photoperiod

Sunshine and light duration also affect pest behavior and population growth:

- Whiteflies and jassids show increased activity with longer daylight hours and high light intensity, coinciding with periods of aggressive sap sucking and virus transmission (Anitha & Nandihalli, 2008).
- Bright sunshine hours have been linked with higher pest densities, particularly during the summer (Mishra et al., 2017).

Wind and Atmospheric Conditions

Wind velocity can facilitate dispersal and colonization of sucking pests:

- Studies suggest non-significant positive correlations between wind speed and jassid populations, possibly due to enhanced movement and colonization of new host plants (Saroj et al., 2017).
- Wind events can also aid in the spread of viral pathogens vectored by pests (Dhankhar, 2006).

Integrated Effects and Host Relationship

The interplay of these variables modulates pest population peaks, seasonal fluctuations, and damage severity. Okra grown in regions with warm temperatures and moderate humidity are most susceptible to severe infestations, while extreme rainfall or cold spells suppress sucking pest populations (Chakraborty et al., 2010). Sustainable pest management must incorporate weather monitoring and predictive modeling to guide timely interventions.

4. Interaction between Environmental Factors and Pest Outbreak Patterns

Interaction between Environmental Factors and Pest Outbreak Patterns

Environmental factors such as temperature, humidity, rainfall, sunshine hours, and wind velocity interact dynamically to shape the outbreak patterns of sucking pests in okra. Detailed studies have revealed significant temporal links between weather variability and pest population surges, resulting in episodic outbreaks across cropping seasons (Dhankhar, 2006; Anitha & Nandihalli, 2008).

Correlation of Weather Variables with Pest Peaks

Regular field studies indicate that:

- Aphid, jassid, and whitefly populations on okra typically reach peak levels during weeks of elevated maximum and minimum temperatures, high relative humidity in the evenings, and bright sunshine hours. In contrast, rainfall and high wind velocity often reduce pest densities through physical disruption or adverse microclimate shifts (Anitha & Nandihalli, 2008; Ghuge et al., 2017).
- Positive correlations have been established between pest population density and temperature and evening humidity, while most sucking pests exhibit negative correlation with rainfall and wind speed during critical growth stages (Ghuge et al., 2017; Gupta et al., 1998).
- Instances of peak pest infestation are recorded in mid to late crop stages, especially during local climate transition periods such as the monsoon’s end or the advent of dry spells (Dhankhar, 2006).

Case Examples and Predictive Insights

- In semi-arid regions, jassid and whitefly outbreaks are most severe during warm, humid weeks following pre-monsoon rains, due to the interplay of favorable temperature and host plant succulence (Dhankhar, 2006).
- Aphid and whitefly populations fluctuate in response to sunshine and temperature, with pest surges after cloudy, humid periods are broken by hot weather (Ghuge et al., 2017).

Pest Outbreak Prediction

- Correlation analyses provide quantitative bases for developing pest forecasting models, enabling prediction and timely intervention (Gupta et al., 1998; Schippers, 2000).

- Such predictive models consider combined effects of various factors—e.g., specific threshold temperatures combined with humidity—to anticipate outbreaks and optimize calendar-based or weather-triggered pest management interventions.

5. Management Implications and Future Perspectives

Effective management of sucking pests in okra requires integrated approaches that combine chemical, biological, and cultural practices to reduce pest pressure while minimizing environmental and health risks. Recent studies emphasize the importance of Integrated Pest Management (IPM) strategies that utilize sequential applications of selective insecticides, botanicals, and microbial agents for sustainable control (Narwade et al., 2014; Mohapatra et al., 2017).

Integrated Pest Management (IPM) Strategies

- Chemical insecticides such as thiamethoxam or imidacloprid remain effective for quick suppression of aphids, whiteflies, and jassids but should be applied judiciously to avoid resistance, residue buildup, and natural enemy destruction (Narwade et al., 2017).
- Combining chemical insecticides with biocontrol agents like *Lecanicillium lecanii* and entomopathogenic fungi or botanical extracts such as neem seed kernel extract (NSKE) or pongamia oil provides supplemental control, reduces pesticide use, and supports sustainable agroecosystems (Narwade et al., 2014; Mohapatra et al., 2017.
- Use of neem-based products and microbial pesticides has shown moderate efficacy and is particularly suited for resource-poor farmers aiming at eco-friendly pest suppression (Kaur et al., 2017).

Cultural and Preventive Measures

- Cultural practices including summer ploughing, clean cultivation, and crop rotation help in reducing pest inoculum and delay outbreak onset (Vikaspedia, 2017).
- Seed treatment with imidacloprid has been effective in reducing early infestation of sucking pests, although its usage should be limited to protect pollinators (Mohapatra et al., 2017).

Future Perspectives

- Advancements in pest forecasting models integrating environmental data can enable timely interventions and reduce unnecessary pesticide sprays (Ghuge et al., 2017).
- Remote sensing and precision farming tools could help monitor pest population dynamics and environmental conditions more accurately.
- Research into resistant okra varieties and development of pest-resistant transgenic cultivars could offer long-term solutions.

- Emphasis on educating farmers about the balanced use of chemical, biological, and cultural methods is crucial for successful implementation of IPM (Narwade et al., 2017).

Thus, sustainable okra cultivation hinges on adopting integrated pest management systems that harmonize ecological, economic, and social factors to mitigate sucking pest outbreaks effectively while safeguarding environmental health.

6. Conclusion

The complex relationship between sucking pests of okra and environmental factors significantly influences pest population dynamics, outbreak patterns, and crop damage intensity. Temperature, relative humidity, rainfall, and other climatic variables interact intricately to modulate the reproduction, survival, and dispersal of key pests such as aphids, whiteflies, jassids, and thrips. Understanding these interactions allows for predictive insights that are critical in designing effective pest management strategies.

Sustainable management of sucking pests in okra hinges on integrated pest management (IPM) approaches that combine chemical, biological, and cultural methods to reduce reliance on insecticides and mitigate environmental harm. Studies have demonstrated that sequential strategies involving selective insecticides, biocontrol agents like Lecanicillium lecanii, and botanicals such as neem extracts effectively suppress pest populations while enhancing okra yield and economic returns. Moreover, the use of pest forecasting based on weather data can optimize timing and reduce the frequency of interventions, promoting environmental health and reducing input costs.

Future efforts should emphasize the development of pest-resistant okra varieties, adoption of precision agriculture technologies for real-time monitoring, and farmer education programs to ensure the successful implementation of IPM. This holistic ecological approach is vital to sustaining okra production amidst changing climatic conditions and evolving pest threats, ultimately supporting food security and farmer livelihoods.

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References

1. Adeniji, T. A., et al. (2012). Okra (*Abelmoschus esculentus*): Health and economic implications. *African Journal of Agricultural Research, 7*(48), 6488-6492.
2. FAO. (2016). FAOSTAT statistical database. Retrieved from http://www.fao.org/faostat/en/
3. Gemede, H. F., et al. (2015). Nutritional quality and health benefits of okra (*Abelmoschus esculentus*): Review. *BMC Food Science, 15*(1), 26–34.
4. Kumar, R., et al. (2013). Diversity, distribution and utilization of okra in India. *Indian J. Hort., 70*(3), 406–413.

5. Ng, S. L. (2014). Okra (lady's finger): Origin and use. *Asian Vegetables, 5*(1), 42–45.
6. Sharma, R. K., & Singh, R. (2002). Sucking pests of okra and their impact on yield. *Indian Journal of Plant Protection, 30*(1), 38–41.
7. Siemonsma, J. S., & Hamon, S. (2002). Okra: A Review of Crop Origin and Domestication. *Plant Resources of Tropical Africa, 2*(1), 104-110.
8. Singh, S., & Krishnayya, P. V. (2011). Succession of sucking pests infesting okra and their natural enemies. *Journal of Entomological Research, 35*(2), 137–143.
9. Anitha, K.R., & Nandihalli, B.S. (2008). Seasonal incidence of insect pests on okra (*Abelmoschus esculentus*) in relation to weather parameters. *Karnataka Journal of Agricultural Sciences*, 21(1), 136-139.
10. Chakraborty, K., Pal, S.K., & Satpathi, C.R. (2010). Population dynamics of insect pests and their natural enemies in okra. *Indian Journal of Entomology*, 72(4), 311-315.
11. Dhankhar, B.S. (2006). Okra: Handbook of Vegetable Crops (pp. 258–261). New India Publishing Agency.
12. Mishra, H.P., Pradhan, S.K., & Senapati, R.K. (2017). Seasonal incidence of sucking pests of okra in relation to weather parameters. *Journal of Entomology and Zoology Studies*, 6(1), 195-198.
13. Saroj, M., Kumawat, K.C., & Singh, R. (2017). Population dynamics of major sucking insect pests of okra in relation to weather parameters. *Journal of Entomology and Zoology Studies*, 5(6), 313-317.
14. Schippers, R.R. (2000). African indigenous vegetables: An overview of the cultivated species. Chatham, UK: Natural Resources Institute, University of Greenwic