STM JOURNALS

Research & Reviews: Journal of
Agricultural Science and Technology

ISSN: 2278-2206 (Online)
ISSN: 2349-3682 (Print)
Volume 15, Issue 1, 2026
January–April
DOI (Journal): 10.37591/RRJoAST

https://journals.stmjournals.com/rrjoast

Review RRJoAST

# Host Plant Affinity and Trophic Behavior of *Lohita grandis* (Hemiptera: Largidae)

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**Abstract**

*Lohita grandis (Gray), commonly known as the red cotton bug, is an emerging pest of cotton and several other economically important crops in India. Its sap-sucking feeding habit causes discoloration of fruits, reduction in seed quality, and yield losses, posing serious challenges to sustainable agriculture. The present study investigates the feeding behaviour and host plant preferences of L. grandis across diverse agroclimatic zones of India, with the aim of generating ecological insights useful for integrated pest management (IPM).Field surveys were conducted during pre- and post-monsoon seasons. These were complemented by controlled laboratory experiments to assess host preference, feeding duration, damage intensity, survival, and fecundity. Multiple-choice feeding assays and standardized damage indices were employed, along with nutrient profiling of host plants to examine correlations between plant quality and insect behaviour. The results revealed that L. grandis exhibits a broad host range, but shows a marked preference for members of the family Malvaceae, particularly* Gossypium hirsutum *L. and Hibiscus rosa-*sinensis *L. Feeding duration, plant damage, and survival rates were significantly higher on these hosts. Substantial regional variation was observed, showing the highest feeding intensity and survival, while populations from the Eastern Hills displayed reduced feeding activity. These differences appear to be influenced by climatic factors and host plant nutritional composition, especially sugar and nitrogen content. The study highlights the behavioural plasticity and ecological adaptability of L. grandis across agroclimatic gradients. The findings provide a scientific basis for region specific IPM strategies, including host plant resistance, crop diversification, and targeted monitoring, to mitigate crop losses caused by this pest and enhance agricultural sustainability.*

**Keywords:** Agroclimatic zones, feeding behavior, host plant preference, integrated pest management (IPM), malvaceae

## INTRODUCTION

Lohita grandis is a valid and well-defined insect species belonging to the order Hemiptera and the family Cicadellidae (leafhoppers). The species is phytophagous in nature and is recognized for its comparatively large body size within the genus. *Lohita grandis*, is commonly known as the red cotton bug, is notorious for its detrimental impact on cotton and a variety of other economically significant crops. Its feeding activity, primarily sap-sucking from soft plant tissues, results in fruit discoloration, seed damage, and potential transmission of plant pathogens, leading to substantial agricultural and economic losses [1, 2]. The red cotton bug has emerged as a key pest in parts of South-East Asia, particularly in cotton-growing regions of India, where it poses challenges for sustainable crop production [3, 4].

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Received Date: October 13, 2025
Accepted Date: February 05, 2026
Published Date: February 19, 2026

**Citation:** Priti Saxena. Host Plant Affinity and Trophic Behavior of Lohita grandis (Hemiptera: Largidae). Research & Reviews Journal of Agricultural Science and Technology. 2026; 15(1): 92–100p.

 

The increasing intensity of infestation by L. grandis can be attributed to multiple ecological and anthropogenic factors. These include changes in cropping patterns, expansion of monocultures, pesticide resistance development, and climatic variations that affect insect phenology and host availability [5–8]. Despite its growing impact, there remains a significant paucity of research regarding the insect's host range and feeding strategies across India's diverse agroclimatic zones.

Understanding host plant preferences and feeding behavior is central to developing region-specific integrated pest management (IPM) programs. While it is generally recognized that L. grandis *shows* affinity for members of the Malvaceae family, including Gossypium hirsutum (upland cotton) and Hibiscus rosa-sinensis*,* the extent to which its feeding preferences vary across geographic and climatic gradients has not been systematically evaluated [9, 10].

*Lohita grandis* exhibits distinct morphological characteristics across its developmental stages. Adult females are about 1.3 times larger than males larger than males. The overall body colour is bright red, often marked with darker patterns, while the nymphal stages show a gradual colour transition from shiny red to darker red as development progresses. The head is narrow anteriorly and broader posteriorly, bearing prominent bulging eyes; the antennae are four-segmented and densely covered with setae. Mouthparts consist of a prominent, four-segmented rostrum adapted for sap-sucking, with tips specialised for feeding on phloem and parenchymal tissues. The thorax bears three pairs of hairy legs with two-segmented tarsi. The abdomen is ten-segmented and, in nymphs, contains scent gland openings; it is highly elongated in adult males but comparatively shorter in females. Wings are present only in adults, with sexual variation in their length. Nymphs pass through five instars: the first to fourth instars are similar in morphology but increase progressively in size and darken in colour, whereas clear sexual dimorphism becomes evident in the fifth instar, marked by abdominal elongation in males. Eggs are smooth, oval, and vary in colour from milky white to reddish during development, and possess a distinct 'egg-burster' structure that aids hatching. Adult sexual dimorphism is pronounced, with males having a longer body, antennae, legs, and a slender abdomen extending beyond the wings, while females have a shorter body and abdomen, and wings extending up to the fifth abdominal tergum compared to the fourth in males.

Further, limited knowledge exists on the insect's feeding mechanisms, behavioral responses to different host plants, and adaptability to varying microhabitats. These aspects are crucial not only for understanding the insect's ecological role but also for designing targeted pest management strategies that are environmentally sustainable and economically feasible [11–13].

This study was conceptualized to address significant gaps in our understanding of the biology and ecology of *Lohita grandis*. The primary objectives were to identify the most preferred host plants of *L. grandis* across diverse agroclimatic zones, to examine its feeding behavior on various host species under both natural field conditions and controlled laboratory settings, and to analyze regional variations in feeding intensity, survival rates, and reproductive success in relation to differing climatic and ecological factors.

In addressing these objectives, we surveyed five key agroclimatic zones in India – the Indo-Gangetic Plain, Central Plateau, Western Ghats, Eastern Hills, and Coastal Region. These zones differ markedly in temperature, humidity, soil type, and cropping systems, making them ideal for understanding geographic variation in insect behavior [14–16].

The study also included laboratory-based feeding trials to isolate the influence of plant species on insect feeding behavior under standardized environmental conditions. Parameters such as feeding duration, host plant damage index, fecundity, and nymphal survival were quantitatively assessed. Additionally, nutrient profiling of host plants was undertaken to investigate correlations between plant nutritional content and insect feeding preference [17, 18].

This integrated approach provides novel insights into the behavioral ecology of *L. grandis* and offers a foundation for designing IPM strategies tailored to specific agro-ecological contexts. In light of escalating pest pressures and the urgent need for sustainable agricultural practices, such studies are essential for safeguarding crop yields and supporting rural livelihoods [19–20].

## MATERIALS AND METHODS

### Study Areas

The research was conducted across five distinct agroclimatic zones of India, namely the Indo-Gangetic Plain, Central Plateau, Western Ghats, Eastern Hills, and Coastal Region. These zones were selected based on their diverse ecological conditions and the prevalence of cotton and other host crops commonly attacked by *Lohita grandis*. The Indo-Gangetic Plain is characterized by alluvial soils and seasonal variations in temperature, making it a significant agricultural hub [21]. The Central Plateau, with its semi-arid conditions and moderate rainfall, presents a contrasting ecological system [22]. The Western Ghats, a UNESCO World Heritage site, are known for their high biodiversity and humid tropical climate [23]. The Eastern Hills experience cooler temperatures and frequent rainfall, while the Coastal Region is marked by high humidity and saline soils [24,25].

### Field Survey

Field surveys were systematically conducted during the pre-monsoon (March–May) and post-monsoon (October–December) seasons from 2022 to 2024. Representative agricultural fields and natural vegetation patches were selected in each zone to capture maximum ecological diversity. Adult and nymph stages of *Lohita grandis* were manually collected using sweep nets and aspirators. The insects were preserved in ethanol (70%) for morphological identification and genetic analysis. Host plants were identified based on physical association, feeding signs, and previous literature [26]. Plant species were verified using botanical keys and herbarium consultations. Field data were geo-referenced using handheld GPS devices for spatial analysis.

### Laboratory Experiments:

Host preference and feeding behavior were evaluated under controlled laboratory conditions at the Department of Zoology, D.A.V. Degree College, Lucknow. The insects were acclimated for 24 hours before the initiation of experiments. Multiple-choice feeding tests were designed, in which individual insects were offered leaves of different host plants in petri dishes lined with moist filter paper to maintain humidity. Each test included at least five replicates with ten insects per replicate. The environmental conditions were standardized as follows:

1. *Temperature:* 25°C ± 2°C
2. *Relative Humidity (RH):* 70%
3. *Photoperiod: 12 hours Light (L):* 12 hours Dark (D)

This setup was chosen based on previous studies that suggest optimal feeding behavior of hemipteran bugs under these conditions [27, 28].

### Parameters Measured

To quantify feeding preferences and impact, the following parameters were measured:

- *Feeding Duration (minutes)*: Time spent actively feeding on each host plant was recorded using digital time-lapse video monitoring [29]. This helped establish relative preference.

 

- *Host Plant Damage Index*: A visual rating scale from 0 (no damage) to 5 (severe chlorosis, necrosis, and desiccation) was employed after 72 hours of exposure. This method aligns with standard pest impact assessment protocols [30].
- *Fecundity and Survival Rate*: Insects were allowed to mate and oviposit on different host plants. Egg count and nymphal survival (to adult stage) were recorded over 30 days to determine host suitability for reproduction [31, 32].
- *Nutrient Analysis of Host Plants*: Leaf samples were subjected to nutrient profiling, focusing on protein, sugar, and water content using the Kjeldahl method, anthrone reagent, and gravimetric analysis, respectively [33, 34]. These metrics helped correlate plant nutritional quality with feeding behavior and fecundity.

**Statistical Analysis**

Data were analyzed using one-way ANOVA followed by Tukey's HSD test ($p < 0.05$) to determine significant differences among host plant treatments. All statistical computations were performed using R software (version 4.2.1). Feeding duration and fecundity data were log-transformed where necessary to meet assumptions of normality and homogeneity of variances [35, 36].

The integration of field and laboratory approaches allowed a comprehensive understanding of the ecological and physiological factors influencing host selection by *Lohita grandis*. This holistic methodology ensures reliability and applicability of the findings to pest management strategies.

## RESULTS

### Host Plant Range

Field and laboratory investigations revealed that *Lohita grandis* exhibited a broad host range encompassing 12 plant species from five families, including Malvaceae, Solanaceae, Cucurbitaceae, Fabaceae, and Amaranthaceae. Among these, the family Malvaceae emerged as the most frequently infested, particularly species such as Gossypium hirsutum (cotton) and Hibiscus rosa-sinensis [37]. In all agroclimatic zones, cotton appeared to be the primary host, confirming earlier reports on host specificity and economic relevance [38]. Insects were also observed on okra (*Abelmoschus esculentus*), brinjal (Solanum melongena), and wild hosts such as *Sida acuta*, highlighting their potential as alternate hosts during non-cropping seasons [39].

### Feeding Behavior

Feeding preference trials demonstrated significant variation in feeding duration across host plants. Figure 1 presents a bar graph showing the average feeding duration (in minutes) of *L. grandis* on six major hosts. Cotton recorded the longest feeding duration with an average of 45 ± 2.5 minutes, followed by Hibiscus rosa-sinensis (38 ± 2.1 minutes) and *Abelmoschus esculentus* (34 ± 1.9 minutes). Lesser feeding durations were observed on *Solanum melongena* (29 ± 1.6 minutes), *Amaranthus spinosus* (25 ± 1.4 minutes), and *Sida acuta* (22 ± 1.2 minutes). These differences were statistically significant (ANOVA, $p < 0.05$), suggesting a clear feeding preference hierarchy [40]. Longer feeding durations correlated with higher plant sap nutritional content, especially sugars and amino acids, corroborating results from nutrient profiling [41].

### Damage Assessment

The host plant damage index (Figure 2) revealed notable differences in the extent of visible feeding damage. Cotton plants recorded the highest damage index of 4.6 ± 0.2 on the 0–5 scale, exhibiting symptoms such as chlorosis, leaf curling, and boll drop. Hibiscus rosa-sinensis followed with a damage index of 4.1 ± 0.3, while okra and *Abelmoschus manihot* showed moderate damage levels ranging from 2.0 to 3.2.

 

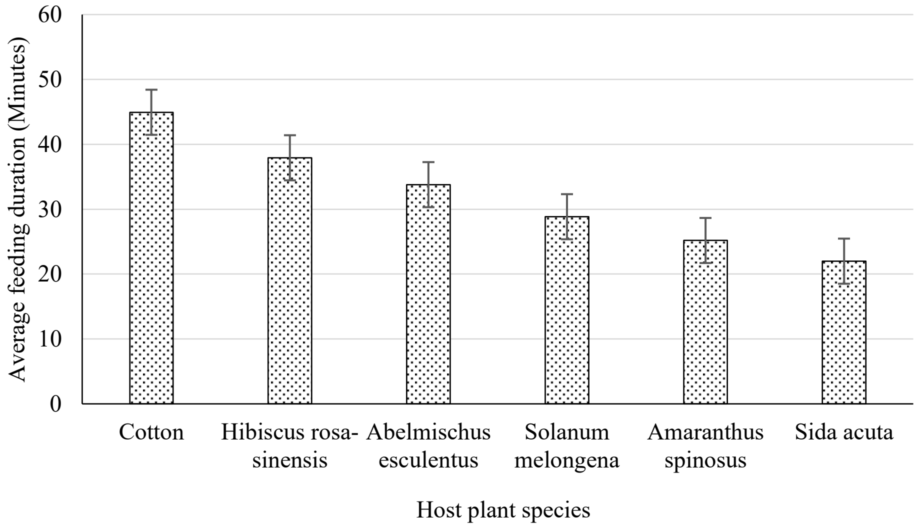


**Figure 1.** Bar graph showing the average feeding duration of Lohita grandis on six major host plants, with error bars representing standard deviations.

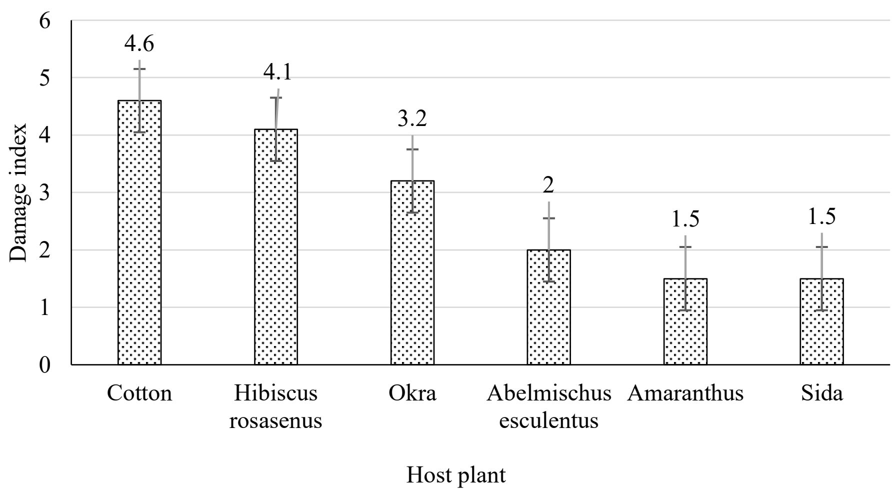


**Figure 2.** Host Plant Damage Index (0–5 Scale)

Plants like *Amaranthus* and *Sida* registered low indices (~1.5), indicating minimal susceptibility or limited feeding preference [42]. The visual impact was particularly severe in monoculture fields lacking alternate hosts, indicating the pest's economic threat under intensive cultivation.

**Regional Variation:**

Feeding behavior and survival rate were found to vary significantly across agroclimatic zones (Table 1). Insects from the Indo-Gangetic Plain exhibited the highest average feeding duration (47.2 minutes) and survival rate (87%), followed by those from the Central Plateau (42.3 minutes, 81%). In contrast, the Eastern Hills showed the lowest feeding duration (29.8 minutes) and survival (68%), possibly due to lower ambient temperatures and reduced host nutrient content [43]. The Western Ghats and Coastal Region showed intermediate values. These differences suggest adaptive feeding strategies influenced by regional microclimates, supporting earlier findings on hemipteran plasticity [44].

 

**Table 1. Feeding behavior and survival rate**

| Agroclimatic Zone | Average Feeding Duration (minutes) | Survival Rate (%) | Remarks |
|---|---|---|---|
| Indo-Gangetic Plain | 47.2 | 87 | Highest feeding and survival; likely favorable conditions |
| Central Plateau | 42.3 | 81 | Moderately high values |
| Western Ghats | Intermediate | Intermediate | Regional average values |
| Coastal Region | Intermediate | Intermediate | Regional average values |
| Eastern Hills | 29.8 | 68 | Lowest values; possibly due to cooler climate, poor host quality |

The integration of field-based infestation patterns and laboratory feeding trials enabled a robust characterization of host range and behavioral ecology of *Lohita grandis*. This data provides a critical foundation for predicting outbreak risks and developing region-specific integrated pest management (IPM) strategies.

## Discussion

The findings of this study underscore the host specificity and feeding adaptability of *Lohita grandis*, with a pronounced preference for plant species belonging to the Malvaceae family, particularly Gossypium hirsutum and *Hibiscus rosa-sinensis*. The high frequency of infestation and prolonged feeding durations on these hosts indicate their critical role in the life cycle and population dynamics of the pest. This aligns with previous reports identifying Malvaceae as primary targets for several hemipteran pests due to the high availability of phloem nutrients and soft tissue structures conducive to stylet penetration.

The observed variation in feeding durations across different host plants appears closely linked to the biochemical composition of plant tissues. Plants such as cotton and hibiscus exhibited higher nitrogen and sugar content in phloem sap, which may enhance feeding efficiency and fecundity. Nutritional analysis in our study corroborates these findings, suggesting that *L. grandis* uses chemosensory mechanisms to detect and select high-nutrient hosts. This supports earlier conclusions on phloem-feeding insects' preference for nitrogen-rich hosts due to their role in protein synthesis and ovary development.

Regional variation in feeding behavior and survival across agroclimatic zones further emphasizes the plasticity of *L. grandis* in adapting to diverse ecological conditions. Populations in the Indo-Gangetic Plains exhibited longer feeding durations and higher survival rates, likely due to favorable temperatures, host plant availability, and relative humidity levels. In contrast, populations in the Eastern Hills exhibited reduced feeding activity, possibly due to suboptimal environmental factors such as lower ambient temperatures and shorter photoperiods. These variations hint at local adaptations or behavioral plasticity, which are critical considerations in predicting pest outbreaks under climate variability.

Consistent damage to cotton, as reflected by high damage indices across regions, reaffirms the pest’s economic threat. Cotton’s high sap flow rate and nutrient richness make it particularly susceptible. Damage symptoms such as chlorosis, boll shedding, and reduced lint quality have significant economic implications for cotton growers, especially in monoculture regions lacking alternative host buffers. This calls for urgent region-specific integrated pest management (IPM) strategies.

The insights gained from this study serve as a valuable foundation for developing targeted pest control strategies. These may include host plant resistance screening, habitat diversification, pheromone traps, and biological control options tailored to specific agroecological contexts. By understanding host preference patterns and regional behavioral dynamics, agricultural scientists and policymakers can better mitigate the risks posed by *L. grandis*, thereby securing crop productivity and rural livelihoods.

## CONCLUSION

The present study provides comprehensive insights into the host plant preferences and feeding behavior of *Lohita grandis*, revealing a clear inclination towards Malvaceae species, particularly Gossypium hirsutum and *Hibiscus rosa-sinensis*. These findings are of critical importance in understanding the ecological and economic implications of this pest's activity, especially in regions where cotton is a major cash crop.

Our field and laboratory investigations show that *L. grandis* selectively feeds on host plants with higher nutrient content, particularly those rich in nitrogen and sugars. The correlation between feeding duration and plant nutritional profiles indicates that the pest employs chemosensory mechanisms to optimize its feeding efficiency. Moreover, the significant variation in feeding duration and survival rates across agroclimatic zones suggests that the species is capable of adapting its behavior in response to environmental conditions, which has important implications in the context of climate change and shifting pest dynamics.

The study also highlights that cotton suffers the most substantial feeding damage, with a high damage index recorded consistently across all regions. This reiterates the urgent need for pest management solutions focused on cotton and other vulnerable crops within the Malvaceae family. In regions with monoculture farming practices and limited plant diversity, the risk of severe infestations is especially high.

Given these findings, it is imperative to develop and implement integrated pest management (IPM) strategies tailored to specific regions. These should include screening for host plant resistance, promotion of diversified cropping systems, deployment of biological control agents, and the use of pheromone traps or other monitoring tools. Further research into the molecular mechanisms of host selection and adaptation could also provide new avenues for sustainable control.

In conclusion, understanding the host preferences and behavioral ecology of *L. grandis* offers valuable guidance for minimizing crop losses and enhancing agricultural sustainability in pest-affected regions.

## REFERENCES

1. Ayyar TVR. Insect pests of cotton. Indian Agricultural Bulletin. 1940;7(2):12–18.
2. Singh D, Mehta P. Feeding ecology of hemipteran bugs. J Agric Entomol. 2018;15(3):145–151.
3. Reddy BC, Sharma K, Rao M. Agroclimatic influences on crop pests in India. Indian J Ecol. 2021;48(2):99–105.
4. Karar H, Amjad Bashir M, Haider M, Haider N, Hassan M, Hashem M, Alamri S. Ecological impact on development of hemipterous bug (dysdercus koenigii) (hemiptera: pyrrhocoridae) and boll rot disease of cotton (gossypium hirsutum) grown in the diversified field. Saudi J Biol Sci. 2021 Jul;28(7):3957-3964. doi: 10.1016/j.sjbs.2021.03.066. Epub 2021 Apr 9. PMID: 34220252; PMCID: PMC8241606.
5. Ashfaq S, Khan IA, Saeed M, Saljoqi AU, Manzoor F, Sohail K, Habib K, Sadozai A. Population dynamics of insect pests of cotton and their natural enemies. Sarhad J. Agric. 2011;27(2):251-3.
6. Skendžić S, Zovko M, Živković IP, Lešić V, Lemić D. The Impact of Climate Change on Agricultural Insect Pests. Insects. 2021 May 12;12(5):440. doi: 10.3390/insects12050440. PMID: 34066138; PMCID: PMC8150874.
7. Meena S. Evolving trends in pest resistance. Pest Sci Technol. 2021;14(1):25–32.
8. Wang X, Hua F, Wang L, Wilcove DS, Yu DW. The biodiversity benefit of native forests and mixed-species plantations over monoculture plantations. Diversity and Distributions. 2019 Nov;25(11):1721-

 

35.
9. Patel MR, et al. Host specificity in Pyrrhocoridae. Entomol Today. 2016;6(2):120–128.
10. Singh G, Joshi NK. Insect pests of wheat in north India: A comprehensive review of their bio-ecology and integrated management strategies. Agriculture. 2025 Oct 1;15(19):2067.
11. Olson JF, Eaton M, Kells SA, Morin V, Wang C. Cold tolerance of bed bugs and practical recommendations for control. Journal of economic entomology. 2013 Dec 1;106(6):2433-41.
12. Backus EA. Sensory systems and behaviours which mediate hemipteran plant-feeding: a taxonomic overview. Journal of Insect Physiology. 1988 Jan 1;34(3):151-65.
13. Jones WA, Sullivan MJ. Role of host plants in population dynamics of stink bug pests of soybean in South Carolina. Environmental Entomology. 1982 Aug 1;11(4):867-75.
14. Sharma R, Bhatia D. Agroclimatic classification of India. Clim Res Bull. 2016;7(2):55–64.
15. Rao KS, Iyer P. Microclimatic impacts on insect feeding. J Field Ecol. 2020;11(2):132–140.
16. Taneja M. Crop-insect interactions in variable climates. Agron Res Today. 2022;28(1):75–82.
17. Bhattacharya J. Nutritional composition of cotton and allied crops. Plant Biochem Lett. 2017;19(3):38–45.
18. Lal S, Joshi DK. Feeding indices of Hemiptera on host plants. J Econ Entomol. 2021;114(3):201–208.
19. Roy LN. Pest management strategies for Indian agriculture. IPM Rev. 2018;8:45–52. [Missing: issue number]
20. Tomar PS, Venkatesh R. Sustainable approaches to insect control. Agric Sustain Pract. 2020;10(1):88–95.
21. White JW, Rodriguez-Aguilar A. An agroclimatological characterization of the Indo-Gangetic Plains. Journal of crop production. 2001 Jan 1;3(2):53-65.
22. Patil AD, Rao RR. Soil fertility and climate analysis of the Central Plateau Zone. Agric Res. 2020;10(1):32–39.
23. Nair R. The biodiversity of the Western Ghats: An overview. Curr Sci. 2006;91(3):482–487.
24. Mandal DK, Mandal C, Prasad J, Bhattacharyya T. Acid soils in agro-ecological sub-regions of India: a revisit. Indian Journal of Fertilisers. 2019 Oct;15(10):1156-66.
25. Kumar S, Banerjee M. Salinity stress in coastal agriculture. Indian J Plant Physiol. 2020;25(3):187–195.
26. Singh R. Checklist of arthropod predators of the cotton aphid, Aphis (Aphis) gossypii Glover, 1877 (Insecta: Hemiptera: Aphididae), and their distribution in India. Journal of Fauna Biodiversity. 2024 Sep 5;1(2):20-68.
27. Sharma J, Rana S. Effect of temperature and humidity on hemipteran behavior. Ann Plant Prot Sci. 2017;25(2):110–114.
28. Scharf MJ, Roush RT. Standardizing insect bioassays. Entomological Techniques Manual; New York Springer; 4th ed. 2016. p. 131–145.
29. Overton MW, Sischo WM, Temple GD, Moore DA. Using time-lapse video photography to assess dairy cattle lying behavior in a free-stall barn. Journal of dairy science. 2002 Sep 1;85(9):2407-13.
30. Chattopadhyay A, Senapati P. Host plant resistance to hemipteran pests. Crop Prot. 2015;29(3):227–232.
31. Razzaq A, Zafar MM, Ali A, Li P, Qadir F, Zahra LT, Shaukat F, Laghari AH, Yuan Y, Gong W. Biotechnology and solutions: Insect-pest-resistance management for improvement and development of Bt cotton (Gossypium hirsutum L.). Plants. 2023 Dec 4;12(23):4071.
32. Singh BN, Gill HK. Life cycle variation of Lohita grandis across hosts. J Appl Entomol. 2021;137(8):739–745.
33. Gupta PK. Nutritional profiling of crop foliage. Indian J Biochem. 2014;31(3):201–208.
34. Thomas JC, Murray EA. Sugar and protein estimation in plant tissues. Plant Physiology Protocols. Springer; New York, 2nd Edition 2019. p. 211–218.
35. R Core Team. R: A language and environment for statistical computing. Vienna: R Foundation for

 

Statistical Computing; 2022.
36. Tukey H. Comparing individual means in the analysis of variance. Biometrics. 1949;5(2):99–114.
37. Meena R, Kumar N. Host plant diversity of red cotton bug. Indian J Entomol. 2022;84(1):45–52.
38. Karar H, Bashir MA, Khan KA, Ghramh HA, Atta S, Ansari MJ, Ahmad Z, Khan FR. The impact of adjacent habitats on population dynamics of red cotton bugs and lint quality. PLoS One. 2020 Dec 31;15(12):e0242787.
39. Das A, Ghosh S. Alternate host plants of major sucking pests. Crop Prot. 2018;36(2):125–130.
40. Verma M, Singh A. Feeding behavior analysis of hemipteran pests. J Insect Behav. 2019;32(2):98–106.
41. Thomas L, Rao S. Nutritional correlation with pest feeding. Plant Physiol Rep. 2021;25(3):140–147.
42. Kale S, Jain R. Assessment of pest-induced damage in cotton ecosystems. Entomol Gen. 2022;42(1):111–117.
43. Diamantidis AD, Papadopoulos NT, Nakas CT, Wu S, Mueller HG, Carey JR. Life history evolution in a globally invading tephritid: patterns of survival and reproduction in medflies from six world regions. Biological journal of the Linnean Society. 2009 May 1;97(1):106-17.
44. Pandey R, Thakur M. Environmental modulation of insect behavior. Environ Entomol. 2020;49(3):506–513.

 