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Relative Food Preference of Phenacoccus Solenopsis Tinsley (*Hemiptera: pseudococcidae*) to Different Host Plant Species in Punjab, Pakistan

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Abstract 25 plant species were screened for food preference of cotton mealybug, Phenacoccus solenopsis Tinsley, using a multi-choice experiment under laboratory conditions maintained at 25 ± 1ºC, 55 ± 5% relative humidity with a 16 h light: 8 h dark photoperiod. The proportion of 1st, 2nd and 3rd nymphal instars was recorded on 24 plant species at 2, 4, 8, 12 and 24 hours after release as compared with Chinese rose as control. The proportion of 1st and 3rd instar of P. solenopsis was maximum on cotton, but highest proportion of 2nd instar was recorded on weed plants including hazardani, qulfa and itsit as compared with control (Chinese rose). In contrast proportion of nymphal instars of P. solenopsis on other tested weeds i.e., loosen booti, tandla and krund.

Keywords: *feeding preference, cotton mealy bug, Host-Pest Interaction, multiple feeding, weed plants*

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1. Introduction

The cotton mealybug, *Phenacoccus solenopsis* Tinsley is major pest of cotton that was first time reported as a pest of cotton in Texas. Presently it has appeared as major pest of cotton in Pakistan [1] and many other countries like from the Eastern region of Sri Lanka and China [2,3].

Damage pattern of cotton mealybug is sucking in nature i.e., suck cell sap from the plants. Female and nymphal instars injure crop excluding male that never cause damage to the crop and is short lived. Female in turn also emits honey dews leading to sooty mould development that influences photosynthetic activity of plants. Fully damaged plants shed their leaves that appear like sprayed with defoliator.

P. solenopsis is a polyphagous insect pest that feed on variety of plant species. According to Arif et al. [4] near about 154 plant species serve as alternative host plants of P. solenopsis throughout the year. During winter these host plant species help as carryover of pest to the next crop [5]. These situations provide feeding and breeding link to P. solenopsis. Pest has attained the status of major insect pest of cotton, that remains active throughout the season on different plants but activity remain to its peak during the month of September [6].Therefore it is the possibility that pest attack may further increase with the passage of time in future [4].

Food preference of herbivorous insect pest is highly influenced with host plant resistance mechanism. This resistance may be due to the provision of physiomorphic traits of plants, primary and secondary metabolites / allelochemicals or imbalanced nutrients. Keeping in view the it was imperative to study about the food preference or antixenotic behavior of *P. solenopsis* toward various host plants by using multichoice experiment under laboratory conditions to recommend any intervention strategy in the field.

2. Materials and Methods

The present studies were undertaken at Integrated Pest Management Laboratory, Department of Agri. Entomology, University of Agriculture Faisalabad, during 2008.

2.1. Plant material

A total of 25 host plant species commonly available in the agro- climate of Faisalabad, Punjab, Pakistan viz., Lantana (*Lantana camara*) Verbenaceae, Krund (*Chinopodium morale*) Chenopodiaceae, chinese rose (*Hibiscus rosa-sinensis*) Malvaceae, Lehli (*Convolvulus arvensis*) Convulvulaceae, peeli dhodak (*Launea nudicaulis*) Euphorbiaceae, Aksun (*Withania somnifera*) Solanaceae, Janglihaloon (*Coronopus didimus*) Brassicaceae, Hazardani (*Euphorbia prostrate*) Euphorbiaceae, Loosen booti (*Conyza bonariensis*) Asteraceae, Brinjal (*Solamum melongena*) Solanaceae,

Okra (*Abelmoschus esculentus*) Malvaceae, Leh (*Cirsium arvense*) Asteraceae, Bathu (*Chenopodium album*) Chenopodiaceae, Cotton (*Gossypium hirsutum*) Malvaceae, Chilli (*Capsicum frutescens*) Solanaceae, Cholai (*Amaranthus spinosus*) Amaranthaceae, Gardenia (*Clerodendron inerme*), Itsit (*Trianthema portulacastrum*) Aizoaceae, Qulfa (*Portulaca oleracea*) Portulacaceae, Bakhra (*Tribulus terrestris*) Zygophyllaceae, Tandla (*Digera arvensis*) Amaranthaceae, Daryaibooti (*Eclipta prostrate*) Asteraceae, Parthenium (*Parthenium hysterophorus*) Asteraceae, Puthkanda (*Achyranthes aspera*) Amaranthaceae and Sunflower (*Helianthus annuus*) Asteraceae were tested against cotton mealy bug following multi choice experiment under laboratory conditions maintained at temperature of 25 ± 2°C and relative humidity 65 ± 5%.

2.2. Host Feeding Preference of Mealybug in the Laboratory

The fully developed leaves from each plant were collected, cleaned, washed and placed in a circular wooden cage of 2.5ft with central arena (6 cm). The plants were spread in the wooden cage at an equal distance from the arena to check out feeding preference of *P. solenopsis* at different intervals. The nymphal food preference was tested in different stages, (stage I, II and III). The quantity of pest released was 350 coherent pairs for each instar. Pest populations were released with the help of sterilized camel hair brush in the marked centre of the cage. The whole wooden cage was covered with the muslin cloth except door on one side. The food preference of *P. solenopsis* among all tested plant species were compared with Chinese rose (kept as control treatment) and proportion of mealy bug was determined. Instar wise proportion of mealy bug preference amongst above staid tested plant species was observed after 2, 4, 8, 12 and 24 hours of release.

2.3. Statistical Analyses

Data regarding feeding preference of *P. solenopsis* among tested plant species in the laboratory were analyzed through ANOVA technique and means were compared following Tuckey's test at Probability level of 5% [7].

3. Results and Discussions

The proportion of all nymphal instars varied significantly with respect to plants species and observation intervals (P value = 0.05).

Table 1. Means ± S.E regarding instar wise proportion of cotton mealybug on various plant species as compared with Chinese rose observed at different intervals after release

Plant species	First instar				Second instar				Third instar			
	2 hours	4 hours	8 hours	24 hours	2 hours	4 hours	8 hours	24 hours	2 hours	4 hours	8 hours	24 hours
Lantana	0.19ab	0.22a	0.25a	0.31a	0.16ab	0.21a	0.27a	0.33a	0.19a	0.22a	0.25a	0.31a
Krund	0.06c	0.09c	0.13bc	0.16bc	0.01c	0.05c	0.05c	0.1bc	0.06c	0.09c	0.13bc	0.16bc
Lehli	0.19ab	0.22a	0.28a	0.34a	0.1ab	0.14	0.18a	0.24a	0.19a	0.22a	0.28a	0.34a
Peelidhodak	0.13bc	0.16bc	0.19ab	0.22a	0.01c	0.02c	0.05c	0.08c	0.13bc	0.16bc	0.19a	0.22a
Aksun	0.19ab	0.22ab	0.25ab	0.28a	0.1ab	0.14bc	0.16bc	0.2a	0.19bc	0.22a	0.25a	0.28a
Janglihaloon	0.03c	0.06c	0.09c	0.13bc	0.08c	0.1bc	0.13bc	0.16bc	0.03c	0.06c	0.09c	0.13bc
Hazardani	0.22a	0.28a	0.31a	0.31a	0.24a	0.27	0.35a	0.4a	0.22a	0.28a	0.31a	0.31a
Loosen booti	0.00c	0.02c	0.03c	0.05c	0.01c	0.01c	0.04c	0.08c	0.00c	0.02c	0.03c	0.05c
Brinjal	0.19ab	0.25a	0.28a	0.31a	0.19a	0.21a	0.24a	0.27a	0.19a	0.25a	0.28a	0.31a
Okra	0.13bc	0.16bc	0.19ab	0.25a	0.13bc	0.14bc	0.2a	0.21a	0.13bc	0.16bc	0.19a	0.25a
Leh	0.06c	0.13bc	0.13bc	0.16bc	0.01c	0.03c	0.05c	0.08c	0.06c	0.13bc	0.13bc	0.16bc
Bathu	0.13bc	0.16bc	0.19ab	0.22a	0.03c	0.03c	0.02c	0.08c	0.13a	0.16a	0.19a	0.22a
Cotton	0.25a	0.31a	0.34a	0.38a	0.2a	0.24a	0.33a	0.35a	0.25a	0.31a	0.34a	0.38a
Chilli	0.13bc	0.16bc	0.22ab	0.25a	0.1ab	0.14	0.2a	0.21a	0.13a	0.16a	0.22a	0.25a
Cholai	0.13bc	0.16bc	0.19ab	0.22a	0.14bc	0.14bc	0.2a	0.21a	0.13a	0.16a	0.19a	0.22a
Gardenia	0.06c	0.13bc	0.16bc	0.22a	0.1bc	0.14bc	0.16bc	0.2a	0.06c	0.13a	0.16a	0.22a
Itsit	0.22a	0.28a	0.31a	0.34a	0.24a	0.33a	0.38a	0.4a	0.22a	0.28a	0.31a	0.34a
Qulfa	0.19ab	0.22a	0.28a	0.31a	0.2a	0.27a	0.35a	0.42a	0.19a	0.22a	0.28a	0.31a
Bakhra	0.06c	0.13bc	0.16bc	0.16bc	0.04c	0.05c	0.08c	0.14bc	0.06c	0.13bc	0.13bc	0.16bc
Tandla	0.00c	0.02c	0.04c	0.06c	0.01	0.01	0.02	0.03	0.00	0.02	0.04	0.06
Daryaibooti	0.16bc	0.19ab	0.22ab	0.25a	0.04	0.1	0.13	0.2	0.16	0.19	0.22	0.25
Parthenium	0.19ab	0.22ab	0.28a	0.31a	0.1	0.16	0.2	0.24	0.19	0.22	0.28	0.31
Puthkanda	0.06c	0.09c	0.13bc	0.16bc	0.02	0.03	0.05	0.08	0.06	0.09	0.13	0.16
Sunflower	0.16bc	0.28a	0.34a	0.31a	0.14	0.2	0.22	0.24	0.16	0.28	0.34	0.31

¶ Means sharing similar letters did not differ significantly from each other.

It is clear from the results that ratio of first instar of P. solenopsis ranged from 0 to 0.25 among tested plant species as compared with control (Chinese rose) at two hours after release. Minimum proportion of instar mealy bug occurred on loosen booti and tandla, whereas highest figure was found on cotton (0.25) followed by Hazardani and itsit (0.22). Proportion variation ranged from 0.02 to 0.28 at four hours after release on different plant species, i.e., tandla and bathu, possessed least population proportion than highest on hazardani, itsit and sunflower (0.28) followed by brinjal (0.25). Occurrence of first instar ratio 0.03 to 0.34 as compared with Chinese rose at eight

hours after release. Minimum part of first instar mealy bug was found on loosen booti, whereas highest amount on sunflower. Twenty four hours after release proportion of first instar on different plant species ranged from 0.05 to 0.38 on tandla and cotton respectively.

It is obvious from the results that preference of second instar among tested plant species ranged from 0.01 to 0.24 at two hours after release. Least proportion occurred on krund, peelidhodak, loosen booti, leh and tandla whereas greatest number on hazardani and itsit. Four hours after release proportion ranged from 0.01 to 0.33 on loosen booti and itsit respectively. Pest proportion at eight hours of release ranged from 0.02 to 0.38 as compared with Chinese rose. Minimum proportion occurred on tandla and bathu but highest crowed occurred on itsit. Twenty four hours after release existence of second instar on tested plant species ranged from 0.01 to 0.35. Minimum part was found on krund but maximum on cotton.

Magnitude of third instar on different plant species ranged from 0.0 to 0.25 as compared with Chinese at two hours after release. Lowest level was found on loosen booti and tandla but highest was found on cotton. Four hours after release proportion of third instar among different plant species ranged from 0.02 to 0.31. Minimum was found on loosen booti and tandla but maximum again on cotton. Eight hours after release ratio of third instar on different plant species ranged from 0.03 to 0.34 on loosen booti and sunflower respectively. Twenty four hours after release occurrence of third instar on different plant species ranged from 0.05 to 0.38 as compared with Chinese rose. Minimum was found on loosen booti but was highest on cotton.

Amongst the tested host plants, weed plants including lantana, itsit, lehli, aksun, hazardani, itsit, qulfa and parthenium possessed the maximum level of all instars of P. solenopsis at all observed intervals. These results are supported by [4] who reported such results under field conditions. Most of the tested host plants are perennial and remain in the field through out the year; they also support the plants for carry over of pest during winter. Contribution of host plants in over wintering of whitefly has also been argued by Rafiq et al. [8]. Similarly among the available host plants majority of the preferred host plants belong to summer season. Similar results have been confirmed by Buter et al. [9] who reported that spring crops and vegetables serve as major source of infestation of whitefly.

The level of incidence of P. solenopsis among the existing plant species was variable. It might be due to food preference of P. solenopsis, because insect pest selection and utilization process is a valuable step in insect preference for food and oviposition [10]. Basically preference or acceptance of food depends upon the quality and quantity of macro and micronutrients, volatile compounds, secondary metabolites, phenology, tissue hardness and defense mechanisms [11]. Based on results of present study it was found that cotton, Chinese rose, brinjal and lantana were most preferred by P. solenopsis, these results are supported by [4].

Moreover from the results, it is also observed that settlement of all mealy bug stages arithmetically increased with the passage of time i.e., after 2, 4, 8 and 24 hours of release among all tested plant species. It is still to be explored that when mealy bug inject its proboscis and starts feeding on any plant it remains fixed on the same plant therefore its number arithmetically increased with the passage of time in future.

4. Conclusion

It was concluded that P. solenopsis is a key pest of economic & uneconomic crops (weeds), as well as vegetables and fruits. Further it is essential to keep deliberation on major and minor host plant species of P. solenopsis throughout the year in order to avoid pest insertion and mitigate its damaging problems for the economic crops. Understanding of food preference attitude of *P. solenopsis* will be helpful in pre and post management strategies.

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