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Influence of host plants on biological aspects of the citrus mealybug *Planococcus citri* (Hemiptera: Pseudococcidae) under laboratory

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Abstract:

Planococcus citri (Risso) (Hemiptera: Pseudococcidae)) is a highly polyphagous and has been reported on over 200 host plant species belonging to 191 genera and 82 families and can seriously damage many crops, particularly citrus and glasshouse tomatoes. Biological studies were carried out in Scale Insects and Mealybugs Laboratory, Plant Protection Research Institute, Kafer EL-Sheikh, Egypt during 2018 to study duration periods of immature and mature stages of *P.citri* on three different host plants [Two varities of potato (*Solanum tuberosum* var. spunta and *Solanum tuberosum* var. cara) and sweet potatoes (*Ipomoea batatas*)] and the effects of host plant on the development, longevity and reproduction of *P. citri* . This study showed that a highly significant difference between the mean duration of *P. citri* adult female and male on three host plant (spunta, cara and sweet potatoes). There was a highly significant difference between the mean number of eggs laid per female of *P. citri* on aforementioned host plants .

Introduction

The citrus mealybug *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) is an important piercing sucking insect pest attacking several crops . It attacks new shoots and leaves of a wide range of crops including citrus, apple, avocado, ficus, gardenia, jasmine, oleander and persimmon (Angeles-Martinez *et al.*, 1991; Correa *et al.*, 2008 and Ahmed and Abd-Rabou, 2010). It has piercing sucking mouth parts that remove plant fluids so plant damage is caused by loss of sap extracted by high numbers of mealybugs resulting in wilted, distorted and yellowed (chlorotic) leaves, premature leaf drop, stunted growth and occasionally death of infested plants or plant parts. The sticky sugary fluid excreted by mealybugs is called honeydew which provides a medium for the growth of black sooty mold fungi. Black sooty mold fungi are detrimental to plants because they cover leaves, thus reducing photosynthesis and inducing plant stress (Hill, 1983; Al-Ali, 1996; Smith *et al.*, 1997; Serrano *et al.*, 2001 and Heinz *et al.*, 2004). The citrus mealybug is also known as a vector of some important plant viruses (Kubiriba *et al.*, 2001 and Watson and Kubiriba, 2005).

Its life cycle (egg to egg laying adult) duration ranges from 20 to 44 days (Ortu *et al.*, 2002). Asiedu *et al.* (2014) mentioned that, development, longevity and total number of eggs laid by *P. citri* are influenced by yam variety and the order of preference of *P. citri* for development, longevity and oviposition is *Dioscorea rotundata* var. pona followed by *D. rotundata* var. labreko, *D. rotundata* var. muchumudu then *D. alata* var. matches and the least being *D. rotundata* var. dente.

The goal of this study, was to determine the relative susceptibility of the two varities of potato (*Solanum tuberosum* var. spunta and *Solanum tuberosum* var. cara L.) and sweet potatoes (*Ipomoea batatas* L.) to *P. citri* biology. The specific objectives were studied the determination of incubation period, development, longevity and reproduction parameters of *P. citri*.

Materials and Methods

The stock culture of the citrus mealybug *P. citri* used in this study was originally collected from citrus orchard citrus, Kafer EL-Sheikh Governorate, Egypt. Potato tubers, (*S. tuberosum* var. spunta and *S. tuberosum* var. cara) and sweet potatoes (*I. batatas*) were washed in water and put on moistened plastic dishes 30 cm. Water was sprinkled daily to keep the plastic dishes moistened to encourage sprouting. After 28-30 days potatoes produced sprouts of 5-7 cm long while the sweet potatoes produced sprouts of 25-35 cm. Then the insects were transferred with the aid of camel hairbrush to the potatoes sprouts and sweet potatoes reared in laboratory conditions. The mealybug females settled on potatoes sprouts started to egg laying. The crawlers emerged out and started feeding and developed to adults. The newly adult females were separated and placed on new potato sprouts kept with the help of fine camel hairbrush. Biological studies were started from the egg stage which was laying from the second generation females. A total of 40 eggs laid from different females on the same day were observed and followed to study the biological aspects. The crawlers were observed daily in the morning by a stereomicroscope (X 15) to determine the nymphal instars duration with checking for exuvia which were visible through the loose waxy filaments. The preoviposition, oviposition and postovipostion periods for female were calculated. Longevity, life cycle and generation periods were also registered. The eggs laid by mealybug females were examined under binocular microscope and counted for calculating fecundity. The number of males out of the total population that survived to adult stage was calculated. Data were statistically analyzed of variance (ANOVA) using (SAS Institute, 1998). Means were compared using least significant difference (LSD) test.

Results and discussion

The study was carried out in Scale Insects and Mealybugs Laboratory, Plant Protection Research Institute, Kafer EL-Sheikh, Egypt during 2018 to study duration periods of immature and mature stages of *P. citri* on three different host plants were two varieties of potatoes (*S. tuberosum* var. spunta and *S. tuberosum* var. cara) and sweet potatoes (*I. batatas*) and the effects of host plant on the development, longevity, reproduction and some biological parameters of *P. citri*. Effect of host plants on biological aspects of *Planococcus citri* showed that in Tables (1and 2).

1. Females:

1.1. Egg incubation period:

Results tabulated in Table (1) showed that the mean incubation periods of female eggs (eggs that developed into females) on potato tubers (spunta and cara) and sweet potatoes 10.00 ±0.88, 11.11±0.81 and 10.26±0.93 days, respectively. There was significant difference among the mean incubation periods of *P. citri* female eggs on sweet potatoes and potato sprouts.

1.2. Nymphal instars:

Results presented in Table (1) showed that the first nymphal instar duration of *P. citri* female was longer on potato sprouts cara (9.05±0.71days) then on sweet potatoes (8±0.82 days) while the shortage duration was on potato sprouts spunta (7.47± 0.90

days). There was a highly significant difference between the mean duration of *P. citri* female first nymphal instar on potato sprouts (spunta and cara) compared with sweet potatoes. The mean duration of *P. citri* second nymphal instar of female was shortage on potato sprouts spunta with values of (6.21± 0.85 days) after that on sweet potatoes (7.05± 0.97 days), potato sprouts cara (7.84±0.50 days), consecutively. There was significant difference among the mean duration of *P. citri* second nymphal instar of female on three host plants (spunta, cara and sweet potatoes). The duration of *P. citri* female third nymphal instar on potato sprouts (spunta and cara) and sweet potatoes the same trend of first and second instar nymphal stage.

There was a highly significant difference between the mean duration of *P. citri* female third nymphal instar on three host plant (spunta, cara and sweet potatoes). Immature nymphal stage also, showed that a highly significant difference between the mean duration of *P. citri* female on three host plant (spunta, cara and sweet potatoes).

1.3.Adult:

Results illustrated in Table (1) mentioned that the mean duration of adult female was shorter on potato sprouts cara (13.35±1.31days) and the highest on potato sprouts spunta (15.16±1.17days). There was a highly significant difference between the mean duration of *P. citri* adult female period on (spunta, cara and sweet potatoes). The mean number of eggs laid per female (fecundity) was a high number 497.58±14.95 eggs/female on potato sprouts spunta while the less number was 434.42±45.11 eggs/female on potato sprouts cara. There was a highly significant difference between the mean number of eggs laid per female of *P. citri* on (spunta, cara and sweet potatoes).

This result was similar with that obtained by Awmack and Leather (2002) who reported that host plant quality is a key determinant of the fecundity of herbivorous insects. Components of host plant quality such as carbon, nitrogen and defensive metabolites affect potential and achieved herbivore fecundity. The adult female postoviposition period ranged from 3 to 7 days and 4 to 7 days on pumpkin fruits and potato sprouts, respectively.

Table (1): Developmental durations (mean ± SE) in days of *Planococcus citri* female reared on potato sprouts (spunta and cara) and sweet potatoes under laboratory.

Biological parameter	Spunta	Cara	sweet potatoes	P	LSD
Egg incubationperiod	10.00 ±0.88b	11.11±0.81a	10.26±0.93a	0.0007	0.57
1st instar	7.47± 0.90b	9.05±0.71a	8±0.82b	0.0001	0.53
2nd instar	6.21± 0.85c	7.84±0.50a	7.05± 0.97b	0.0001	0.52
3rd instar	8.68± 0.58b	10.26±0.87a	9.16±0.83b	0.0001	0.50
Total immature	32.37± 2.01c	38.26±1.11a	34.47± 2.59b	0.0001	1.34
Adult female	15.16±1.17a	13.35±1.31b	15.11±0.66a	0.0001	0.70
Egg /female	497.58±14.95a	434.42±45.11c	461.21±31.58b	0.0001	21.43

2. Males:

2.1.Egg incubation period:

Results arranged in Table (2) showed that the mean incubation periods of male eggs (eggs that developed into males) on potato tubers (spunta and cara) and sweet potatoes 11.44 ±0.51, 11.70±0.72 and 11.04 ±0.81 days, respectively. There was significant difference among the mean incubation periods of *P. citri* male eggs on sweet potatoes and potato sprouts.

2.2.Nymphal instars:

Results presented in Table (2) showed that the first nymphal instar duration of *P. citri* male was longer on potato sprouts cara (8. 50±0.74days) then on sweet potatoes (8.00± 0.93 days) while the shortage duration was on potato sprouts spunta (7.09± 0.75 days). There was a highly significant difference between the mean duration of *P. citri* female first nymphal instar on potato sprouts (spunta and cara) compared with sweet potatoes. The mean duration of *P. citri* second nymphal instar of male was shortage on potato sprouts spunta with values of (6.76± 0.54 days) after that on sweet potatoes (7.29± 0.64 days), potato sprouts cara (8.00±0.71 days), consecutively. There was significant difference among the mean duration of *P. citri* second nymphal instar of male on three host plant (spunta, cara and sweet potatoes).

2.3. Prepupa and pupa:

The duration of *P. citri* male prepupa on potato sprouts (spunta and cara) and sweet potatoes were (2.15± 0.37, 3.00±0.32 and 2.60± 0.50 days), respectively. There was a highly significant difference between the mean duration of *P. citri* male prepupa on three host plant (spunta, cara and sweet potatoes). Male pupal stage, showed that a highly significant difference between the mean duration of *P. citri* male on three host plant (spunta, cara and sweet potatoes).

2.4. Adult:

Results illustrated in Table (2) mentioned that the mean duration of adult male was shorter on potato sprouts cara (1.36±0.50 days) and the highest on potato sprouts spunta (2.47±0.51 days). There was a highly significant difference between the mean duration of *P. citri* adult male period on (spunta, cara and sweet potatoes).

Table (2): Developmental durations (mean ± SE) in days of *Planococcus citri* male reared on potato sprouts (spunta and cara) and sweet potatoes under laboratory.

Biological parameter	Spunta	Cara	sweet potatoes	P	LSD
Egg incubationperiod	11.44 ±0.51a	11.70±0.72a	11.04 ±0.81b	0.0001	0.45
1st instar	7.09± 0.75b	8. 50±0.74a	8.00± 0.93a	0.0001	0.50
2nd instar	6.76± 0.54c	8.00±0.71a	7.29± 0.64b	0.0001	0.41
Pre pupa	2.15± 0.37c	3.00±0.32a	2.60± 0.50b	0.0008	0.25
pupa	2.74± 0.45b	3.26±0.45a	2.89± 0.32b	0.0001	0.28
Adult male	2.47±0.51a	1.36±0.50c	1.84±0.37b	0.0001	0.30

This result was confirmed by the findings of **Asiedu *et al.* (2014)** who studied the biology of *P. citri* on five yam varieties (*Disocorea* species) and reported that adult male lived for two to four days after the final nymphal molt. Also, **Mahmoud *et al.* (2017)** mentioned that developmental time, longevity, life cycle and generation period of *P. citri* affected when fed on different host plants.

It is concluded that the results is useful information for mass rearing for this pest to be a host to the natural enemies mass production in designing a comprehensive pest management program.

References

Ahmed, N.H. and Abd-Rabou, S. (2010): Host plants, geographical distribution, natural enemies and biological studies of the citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae). Egypt. Acad. J. Biolog. Sci., 3 (1): 39- 47.

Al-Ali, A.S. (1996): The breeding of *Planococcus citri* (Homoptera: Pseudococcidae) on sprouting potato. Proc. Roy. Ent. Soc. Lond., 44 (A): 45-47.

Angeles-Martinez, M.D.; Mestre, N. and Fraga, N. (1991): Bioecology of *Planococcus citri* (Risso) (Homoptera: Pseudococcidae). Revista de Prot. Veg., 6 (1): 37-42.

Asiedu, E.; Afun, J.V.K. and Kwoseh, C. (2014): Biology of *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) on five yam varieties in storage. Advances In Entomology, 2:167-175.

Awmack, C.S. and Leather, S.R. (2002): Host plant quality and fecundity in herbivorous insects. Annu. Rev. Entomol., 47:817-844.

Correa, L.R.B.; Santa-Cecilia, L.V.C. ; Souza, B. and Cividanes, F.J. (2008): Heat requirements of the white mealybug *Planococcus citri* (Risso, 1813) (Hemiptera: Pseudococcidae) on coffee plants. Arquivos do Instituto Biologico Sao Paulo, 75 (1): 53-58.

Heinz, K.M.; Driesche, R.G.V. and Parrella, M.P. (2004): Biocontrol in Protected Culture. Ball Publishing, Batavia.

Hill, D.S. (1983): *Planococcus citri* (Risso) in Insect Pests of the Tropics and their Control, 2nd Ed. Cambridge Univ. Press.

Kubiriba, J.; Legg, J.P.; Tushemereirwe, W. and Adipala, E. (2001): Vector transmission of banana streak virus under greenhouse conditions in Uganda. Ann. Appl. Biol., 139 : 37-49.

Mahmoud , H. T.; Nabil, H. A. ; Shahein, A.A. and Mohamed, Z.A. (2017): Biological studies on the citrus meaybug Planococcus citri (Risso) (Hemiptera: Pseudococcidae) under laboratory conditions. Zagazig J. Agric. Res., 44 (3):1097-1106.

Ortu, R.; Pollini, K. and Kobbe, C. (2002): Mealybugs Identification and Behavior. Aspen Publishers Inc., Gathersburg, p. 210

SAS Institute (1998): SAS user's guide. Statistics SAS Institute, cary, N.C.

Serrano, M.S.; Lapointe, S.L. and Meyerdirk, D.E. (2001): Attraction of males by virgin females of the malybug *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae). Environ. Entomol., 30: 339-345.

Smith, D.; Beattie, G.A.C. and Broadley, R. (1997): Citrus pests and their natural enemies: integrated pest management in Australia. Queensland Dept. Prim. Industries Series Q197030.

Watson, G.W. and Kubiriba, J. (2005): Identification of mealybugs (Hemiptera: Pseudococcidae) on banana and plantain in Africa. African Entomol., 13 (1) : 35-47.