Biology of *Phenacoccus solenopsis* Tinsley on *Hibiscus rosa-sinenensis* in the urban landscape of Dezful, Southwest Iran

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(DOI): 10.22055/PPR.2020.16542

Received: 16 October 2020 Accepted: 1 February 2021

Abstract

Phenacoccus solenopsis Tinsley is a global pest which recently causing serious damage to various crops and ornamental plants such as hibiscus shrubs in southwestern Iran. The field biology of this pest was investigated in Dezful during 2015-2016 season. Results indicated that in Dezful, *P. solenopsis* passes 11 generations per year. The first generation begins from early March to early April, and the 11th generation ends in the mid-March. The mealybug activities did not stop during the winter. The 8th generation was the shortest one which lasted 28.71±1.39 days from the late September to the mid-October. The longest generation time was also the 2nd one (47.47±0.79 days), from early April to early May. The reproduction parthenogenetically occurred, and females produced eggs and crawlers. The highest fecundity was163.11±3.11 offspring per female with the highest ovipositional period (4.41±0.14days) in the 4th generation in summer. The lowest fecundity (1.67±0.12offspring) was in the 11th generation in winter. The female longevity was significantly different among various generations, from 13.79±2.03 days in 11thgeneration to 26.12±0.70 days in 2nd generation. Males lived in a short time (1 to 2 days). The present study confirms that *P. solenopsis* has a rapid development, high fecundity with a pattern of crawlers' production, and the ability to adapt to the unconditional warm and dry climate of Dezful. Unfortunately, due to lack of management, and a wide range of host plants, it could be a serious threat for farmlands, greenhouses, and urban areas in Khuzestan province.

Keywords: Cotton mealybug; Chinese hibiscus shrubs; generation time; fecundity

Associate editor: A. Rasekh (Prof.)

Introduction

The solenopsis or cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hem.: Pseudococcidae) originates from the southwest United States, it is observed worldwide in the tropical and subtropical regions (Tinsley, 1898; Ben-Dov et al., 2018; Hodgson et al., 2008), it is known as a severe pest of many cash crops, such as cotton (Abbas et al., 2005; Tanwar et al., 2007; El-Zahi and Farag, 2017; Gebregergis, 2018; Spodek et al., 2018), its host range is diverse and attacks numerous crops, weeds, ornamentals, and medicinal plants, belonging to 219 plant species more than 70 plant families (Arif et al., 2008; Abbas et al., 2010; Nagrare et al., 2011; Fallahzadeh et al., 2014; Mossadegh et al., 2015; Satpathy et al., 2016). The infestation by *P. solenopsis* and sucking sap from leaves, stems, flower buds, and roots of the plants, causes the leaves to dry, wilt, and turn pale yellow, young shoots curl and, bushy appearance of the plant with shortening stem inter nodes leading to stunted plant (direct damage). On the other hand, the nymphs and adult females excrete honeydew, on which the black sooty mold develops, which in turn affects the plant´s photo synthetic activity (indirect damage) (Dhawan et al., 2009; Nagrare et al., 2011).

This invasive pest was recorded with a high density for the first time in Hormozgan province in Iran in 2009 on Chinese hibiscus shrubs, *Hibiscus rosa-sinenensis* L. (Moghadam and Bagheri, 2010); subsequently spread over a wide area through 10 provinces of Iran. Khuzestan province in the southwest of Iran was the second province infected by pest (Mossadegh et al., 2012; Fallahzadeh et al., 2014; Mossadegh et al., 2015). In this region, a large amount of hibiscus shrubs is planted as an urban landscape. This beautiful ornamental plant is native to East Asia, which is adapted to tropical climate. Its large and showy flowers give a beautiful view of the urban landscape (Pourrahim et al., 2013; Fand and Suroshe, 2015). However, *P. solenopsis* invasion causes this plant to cut off in urban landscape (Mossadegh et al., 2015). Since the first report in Khuzestan, many attempts were made to gather the information about this pest and control it. The first report of host plants and natural enemies of this pest in Khuzestan province was made by Mossadegh et al. (2015). Later Forouzan et al. (2016) studied life tables of *P. solenopsis* on china-rose at different temperatures, noting that the best temperature for the development and reproduction of *P. solenopsis*, is 35°C, at laboratory condition. Seyfollahi et al. (2017) studied the field biology of *P. solenopsis*, on Chinese hibiscus shrubs in Ahvaz, and pointed out that this mealybug can develop which has high reproductive potential in unfavorable hot summers of Ahvaz. Tamoli et al. (2020) associated chalcidoidea (Hymenoptera) with *P. solenopsis* in the southwestern Iran.

The first report of *P. solenopsis* in Khuzestan province was from Dezful (Mossadegh et al., 2015). Regarding this city is an agricultural area in Khuzestan province, the infestation of aforementioned pest could be very dangerous for other agricultural products. This city is located in the North of Khuzestan province, a plain region with a different climate from Ahvaz. However, the features and biology of this mealybug have not been thoroughly investigated in this city. Field biology of *P. solenopsis* was carried out during the season 2015-2016 so that this study's results could be useful in the relevant pest management.

Materials and Methods

Study area

Field biology of *P. solenopsis* was studied from March 2015 to April 2016 at Dezful (32° 25′ N, 48° 41′ E), in the North of Khuzestan province. The sampled population consisted of six *H. rosa-sinenensis* shrubs with about 1.5 m tall, planted at a given urban site. The shrubs were 1m apart from each other. During the experiment, no pesticide application was carried out.

Stock culture of P. solenopsis

Phenacoccus solenopsis mealybugs were collected from *H. rosa-sinensis* shrubs, in the above-mentioned region, at the end of the winter 2015 and brought to the laboratory. Then, adult females were separated with the help of a soft camel hair brush and transferred on *H. rosa-sinensis* leaves, inserted by petiole in a glass containing water (7×3 cm). Glass and infested leaf put in a large ventilated case box (24 ×16 × 10 cm) to avoid mealybug migration. The leaves were replaced if needed. The box was placed at room condition (25 ± 5 °C, 50 ± 65% RH) for using in the experiment.

Life history studies

Since more parthenogenetic reproduction of *P. solenopsis* was observed under field conditions, we used individual neonate crawlers emerging from adult females to start the biology study. Thus, at the beginning of experiment in spring, we need a cohort of the 1st instar nymphs at the same age (<24h). The females from the stuck culture of *P. solenopsis*, one female *P. solenopsis* per leaf, were confined in plexi glass clip cages (3 ×1.5 cm), which were tightly covered by a fine mesh cloth net for ventilation. After 12 h, females were removed, and the 1stinstar nymphs were maintained under clip cages. Observations on survival and molt of the crawlers were daily recorded until they became adults. Adult longevity also was recorded for males and females. The daily number of the 1st instar nymphs within the female's ovisac was counted as female fecundity. As soon as the 1st instar nymphs of each generation were born (<24), they were transferred to new clip cages to begin the next generation. There were from 20 to 135 replicates for each generation (20-135 plexi glass clip cages), and this variety depended on different seasons. The clip cages were randomly placed in all directions of shrubs.

Statistical analysis

The developmental time of male and female, as well as the fecundity of female *P. solenopsis* was compared among generations by Sigma Plot 12.00. We used Tukey-Kramer procedure at α=0.05 to compare treatments. The relationships between temperature, RH% parameters, and generation time were expressed by nonlinear regression equations using SPSS software (SPSS, Software Package of Social Sciences, ver. 22).

Results

Phenacoccus solenopsis had 11 overlapping generations per year in Dezful County, northwest of Khuzestan Province. In 2015, the first generation began in early spring (early March to early April) and the last one (11th), ended in winter (mid-March). The 8th generation was the shortest which lasted 28.71±1.39days, (the late September to mid-October), and the 2ndone was the longest, from early April to early May followed by the11th generation from mid-December to mid-March (Table 1).

Developmental time of *P. solenopsis* on *H. rosa-sinensis* leaf during 2015-2016 are presented in Table 2. Statistical analysis reveals that the seasonal weather fluctuations *i.e.*, temperature and humidity, have important effects on the developmental time of pre-adult stages of both sexes (F= 9.066; df=2; P=0.009, R^2=0.833) (Fig.1).

The program output of Spss showed that the contribution of both factors (Temp.: variance proportions=0.96) (RH%: variance proportions=0.97) on population fluctuation were equal.

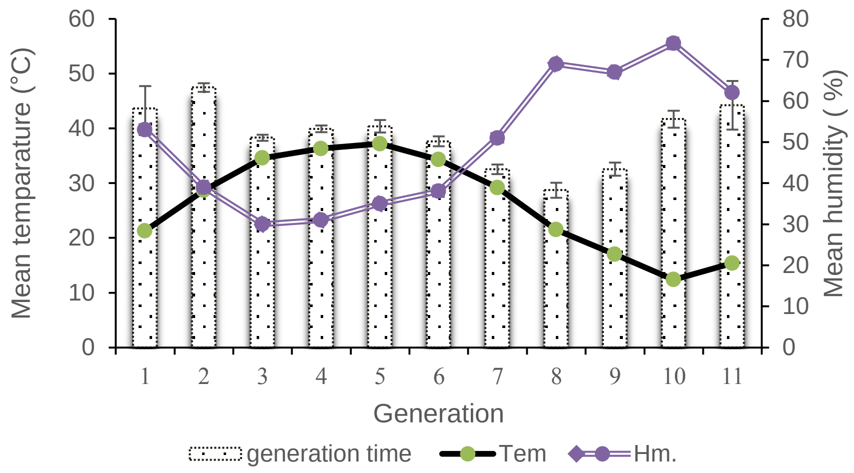

Figure 1. The effect of temperature and humidity on the developmental time of *Phenacoccus solenopsis on Hibiscus rosa-sinenensis* in the urban landscape of Dezful, during 2015-2016

Table 1. Mean generation time (±SE) of *Phenacoccus solenopsis*on *Hibiscus rosa-sinenensis* leaf in cleap cages during the season 2015-2016 at different generations in Dezful county

Generation	Beginning	End	Mean temperature (ºC)	Mean relative humidity (%)	Mean generation time (Day)
1	Early March	Early April	21.3	53	43.61±4.11 ab*
2	Early April	Early May	28.7	39	47.47±0.79 ab
3	Early May	Late May	34.6	30	38.30±0.55 bc
4	Late May	Late June	36.3	31	39.90±0.61 b
5	Late June	Early August	37.2	35	40.38±1.14 b
6	Early August	Early September	34.3	38	37.64±0.90 b
7	Early September	Late September	29.2	51	32.53±0.86 c
8	Late September	Mid October	21.5	69	28.71±1.39 d
9	Mid- October	Mid- November	17	67	32.55±1.18 c
10	Mid- November	Mid- December	12.4	74	41.68±1.57 b
11	Mid- December	Mid-March	15.4	62	44.22±4.42 ab

*Means bearing the same letter in each column were not significantly different (Tukey test, α =0.05).

The shortest mean developmental time of the 1st instar, the 2nd instar, the 3rd instar, and total pre-adult occurred in the 7th generation and the longest one in the 11th (Table 1). Whereas, for the male, it was slightly different. No male progeny has appeared at 1st, 10th and 11th generations. The1stinstar nymph remained for the significantly longer period (8.20±0.66days) in 2nd generation and shorter periods in the 5th, 6th and 7th generations, with an average of 5.5 days. The duration of 2nd instar nymphs in all generations was almost the same and not significant. The pupation period (3rd nymph+ 4th nymph) was relatively shorter in the 5th generation with an average of 5.33 days. However, it was not significantly different in other generations (Table 3).

The weather fluctuations considerably affected on life span. The female longevity was significantly different among generations; as the shortest longevity was 14.94±0.83days in the 8th generation and the longest one was around 20 days in the warm seasons 3rd, 4th, and 5th generations.

Table 2. Mean developmental time (±SE) of the 1st, 2nd, 3rd instar and total pre adult of *Phenacoccus solenopsis* females rearing on *Hibiscus rosa-sinenensis*leaf indifferent generations, during the season 2015-2016 in Dezful county

Generation	Developmental stages (day)			Total pre-adult	N
	1st instar	2nd instar	3rd instar		
1	6.35±0.27 c*	9.94±0.78 b	11.13±0.54 b	25.24±1.72 b	20
2	7.57±0.08 b	5.98±0.15 d	7.79±0.16 de	21.35±0.22 c	135
3	5.38±0.10 e	5.57±0.10 e	6.84±0.12 e	17.74±0.24 f	129
4	5.82±0.08 d	6.58±0.10 c	7.12±0.12 e	19.40±0.22 df	123
5	6.09±0.08 cd	6.61±0.12 c	7.75±0.14 de	19.40±0.40 df	116
6	5.34±0.16 e	6.89±0.20 c	7.80±0.19 d	19.48±0.48 df	98
7	3.73±0.13 h	4.18±0.09 g	5.93±0.12 f	13.48±0.32gh	89
8	4.12±0.07 g	4.25±0.09 g	7.27±0.26 de	15.44±0.40 g	83
9	3.62±0.07 h	5.22±0.25 ef	6.56±0.26 e	14.84±0.48 h	68
10	4.52±0.17 f	4.87±0.19 f	9.63±0.39 c	18.33±0.78 f	58
11	10.59±0.38 a	12.91±0.51a	17.24±0.78 a	31.64±2.5 a	46
F	162.71	101.40	99.03	52.98	-
df	10, 950	10, 936	10, 898	10, 949	-
P	<0.0001	<0.0001	<0.0001	<0.0001	-

*Means bearing the same letter in each column were not significantly different (Tukey test, α =0.05).

Table 3. Mean developmental time (±SE) of the 1st, 2nd, 3rd instar and total pre adult of *Phenacoccus solenopsis* males rearing on *Hibiscus rosa-sinenensis* leaf in different generations, during the season 2015-2016 in Dezful county

Generation	Developmental stage (day)			Total preadult	N
	1st instar	2nd instar	3rd and 4th instar		
1	-	-	-	-	-
2	8.20±0.66 a*	4.20±0.37 a	7.20±0.58 a	19.60±1.44a	5
3	6.67±0.33 b	4.83±0.31 a	7.17±0.48 a	18.67±0.92a	6
4	6.50±0.50 b	4.50±0.50 a	6.50±0.50 a	17.50±0.50a	2
5	5.33±0.33 c	3.67±0.33 a	5.33±0.33 a	14.33±0.88b	3
6	5.50±0.50 c	4.50±0.50 a	5.50±1.50 a	15.50±2.50a	2
7	5.50±0.50 c	4.50±0.50 a	6.00±1.00 a	16.00±1.00ab	2
8	7.00±2.00 b	4.00±0.00 a	6.00±1.00 a	17.00±3.00a	2
9	7.25±0.48 b	4.25±0.25 a	6.75±1.03 a	18.25±1.65a	4
10	-	-	-	-	-
11	-	-	-	-	-
F	2.44	1	1.03	6.91	
df	8, 31	7, 25	7, 27	7, 26	
P	0.450	0.5610	0.5436	0.438	

*Means bearing the same letter in each column were not significantly different (Tukey test, α =0.05).

Adult males were winged, delicate, with no feeding. The longevity of males in different generations was not significantly different. They lived only a short time ranged between 1-2 days (Table 4). The pre-reproduction period of females ranged between 6.60±0.16 days in 3rd generation and 24.67±0.87days in 11th generation. Females parthenogenetically reproduce to be born as crawlers, and eggs are formed in hyaline waxy threadlike structures. The fecundity of females ranges from 6.67±1.01 to 163.11±6.19 offspring per female, in the 11th and 4th generations, respectively. The post-reproduction period ranged from 0.44 days in the 11th generation to 14.30 days in the 2nd generation (Table 4).

Table 4. Mean biological characteristic (±SE) of female and male of *Phenacoccus solenopsis* reared on *Hibiscus rosa-sinenensis* leaf in different generations, during the season 2015-2016 in Dezful county

Generation	Pre-oviposition period (day)	oviposition period (day)	Post- oviposition period (day)	Fecundity (offspring/female)	Time ovipositing (%)	Female longevity (day)	Male longevity (day)
1	9.13±0.40 ^{cd*}	3.53±0.26 ^{bc}	11.07±0.83 ^{b}	65.40±9.36 ^{d}	15.71	19.78±2.21 ^{bc}	0
2	8.58±0.26 ^{d}	4.32±0.11 ^{a}	14.30±0.50 ^{a}	23.84±4.11 ^{c}	15.43	26.12±0.70 ^{a}	1.60±0.25 ^{a}
3	6.60±0.16 ^{e}	4.32±0.11 ^{a}	10.48±0.24 ^{b}	136.04±3.89 ^{b}	20.36	20.56±0.44 ^{bc}	1.17±0.17 ^{a}
4	9.40±0.17 ^{c}	4.41±0.14 ^{a}	7.78±0.18 ^{cd}	163.11±6.19 ^{a}	20.41	20.50±0.46 ^{bc}	1.50±0.50 ^{a}
5	13.81±0.23 ^{b}	2.97±0.06 ^{cd}	7.41±0.17 ^{d}	74.64±3.52 ^{d}	10.28	20.95±0.80 ^{bc}	1.33±0.33 ^{a}
6	9.33±0.20 ^{c}	2.78±0.14 ^{d}	7.81±2.57 ^{cd}	54.88±3.39 ^{de}	13.93	18.17±0.60 ^{c}	1.50±0.50 ^{a}
7	7.99±0.19 ^{d}	3.13±0.14 ^{cd}	9.77±0.24 ^{b}	126.12±5.38 ^{bc}	14.88	19.05±0.66 ^{c}	1.00±0.00 ^{a}
8	8.91±0.21 ^{cd}	3.67±0.16 ^{bc}	5.94±0.27 ^{e}	149.95±9.62 ^{a}	19.65	14.94±0.83 ^{d}	1.00±0.00 ^{a}
9	9.41±0.16 ^{c}	2.31±0.10 ^{e}	8.25±0.25 ^{cd}	30.59±1.719 ^{e}	11.43	19.00±0.64 ^{c}	1.00±0.00 ^{a}
10	13.90±0.59 ^{b}	1.67±0.07 ^{f}	8.48±0.46 ^{c}	10.03±0.81 ^{f}	7.09	22.58±0.99 ^{b}	0
11	24.67±0.87 ^{a}	1.67±0.12 ^{f}	0.44±0.14 ^{e}	6.67±1.01 ^{f}	6.32	13.79±2.03 ^{d}	0
F	10, 862	10, 844	10, 843	10, 844	-	10, 947	0.99
df	179.18	49.25	74.68	66.53	-	18.69	7, 27
P	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001	0.5707

*Means bearing the same letter in each column were not significantly different (Tukey test, α =0.05).

Discussion

The lack of proper quarantine equipment, as well as the warm and dry climate of southwestern Iran, provide the appropriate conditions for mealybugs, especially, *P. solenopsis*. Field studies on life history of this pest on *H. rosa-sinensis*, the dominant ornamental plant species in Dezful landscape, in the season from 2015 to 2016, indicated that *P. solenopsis* passed 11 generations per year in this region. Similarly, Seyfollahi et al. (2017) reported that *P. solenopsis* has 11 generations in Ahvaz. Dezful is located in the northwest of Khuzestan province (32° 38′ 11″ N, 48° 39′ 74″ E, 143 AMSL), with moderate weather condition compared to Ahvaz (31° 18′ 14″ N, 48° 39′ 29″ E, 12 AMSL) at the west of the province. We did not see any difference in generations despite different geographical locations and regional temperatures in the present study. Arif et al. (2012), reported 10 generations for *P. solenopsis* in cotton fields of India; whereas, Shehata (2017), reported only seven generations per year in Egypt.

The longest generation (2nd one) begins in spring (from early April to early May) with the moderate temperature of 28.7°C and 30% relative humidity. Since this environmental condition is suitable to develop *P. solenopsis*, it seems that adult females maximize their reproduction period to produce more progeny. Increasing in temperature and humidity negatively affected the growth of this mealybug in summer. During the warm season from early May up to late September, the survival rate, developmental time, and fecundity decreased. The shortest generation time occurred in mid-October when the average temperature was around 21.5°C, and relative humidity was 69%. This study showed that the mealybug continued to develop and reproduce during the winter months and rainy season, the growth rate sharply declined and mortality considerably increased. In a similar study, Seyfollahi et al. (2017) reported the longest generation time in 3rd (21.63 days), 4th (21.48 days), and 5th generations (23.11 days) during mid-May to mid-August, and the shortest one in 11th generation (90.2) during mid-January to late March. Depaket al. (2014) reported that *P. solenopsis* on *H. rosa sinensis* exhibits a significantly positive correlation with maximum temperature and a significant negative correlation with rainfall and relative humidity at two agro-ecological zones of the west Bengal during 2012.

The reproduction was realized only via parthenogenesis, and females produce their offspring as eggs and crawlers through oviparity and ovoviviparity, respectively. Under our field conditions, the typical occurrence of an ovisac was missing, although crawlers or eggs were entangled in hyaline waxy thread-like structures. Moreover, it seems that oviparity was mainly temperature-dependent. In the field, the cold temperatures induce oviparity, just like the 11th generation in which ovisac appeared behind the females. Similarly, Vennila et al. (2010) reported, the reproduction by *P. solenopsis* was parthenogenesis, and ovoviviparity (96.5%) was dominant over the oviparity (3.5%) mode of reproduction. However, quite different reproductive methods can be used by *P. solenopsis*. Chong et al. (2003), Prasad et al. (2012), Rashid et al. (2012), Huanga et al. (2013), Forouzan et al. (2016), Suroshe et al. (2016), Seyfollahi et al. (2017), Waqas et al. (2019) reported a bisexual reproduction by *P. solenopsis*, in which only mated female were able to produce offspring while unmated.

In this study developmental time of pre-adult stages was lengthened both during winter and summer months in which temperature extremes occurred. The development rate was increased during the autumn months when temperature declined from 37.2°C to 21°C, and relative humidity increased from 35 to 69%. Seyfollahyet al. (2017) obtained that the longest pre-adult development in spring during mid-May to Early-June, and the shortest in winter during mid-January to Late-March which partially supports our study. In a laboratory study, Prasad et al. (2012), reported that pre-adult development shortened from 18°C to 32°C and then increased again beyond 32°Cup to 36°C. Rashid et al. (2012) observed that the developmental times for females and males of *P. solenopsis* on *H. rosasinensis,* at 40°C, are 16.53 and 17.88 days, respectively. Forouzan et al. (2016), reported that the mean pre-adult duration of female *P. solenopsis* feeding on *H. rosasinensis* at 20, 25, and 35 °C, is 19.02, 16.6, and 13.54 days, respectively. Shehata (2017) observed the total nymphal duration of *P. solenopsis* on *Okra* leaves, *Abelmoschus esculentus* L., is 32.76 days at 20ºC, which significantly decreases to 14.89 days with the rise in temperature to 30ºC.

The females were more fecund at late and fall when temperature fluctuated around 28°C and 29°C. A very low fecundity was recorded in 11thgeneration when temperatures dropped to 15.4°C. Seyfollahy et al. (2017) showed similar results, as the highest fecundity occurred at 32°C; and the lowest one at 18.2°C.Fecundity of *P. solenopsis* feeding on *H. rosa sinensis* showed a vast variation among literature, as it was recorded 540.8 by Singh and Kumar (2012), 389.68 by Forouzan et al.(2016), 90.4 by Abbas et al. (2010), 183.2 by Guan et al.(2012), 99.33 by Arif et al. (2013)184.5 by Caliskan et al. (2016), and 212.60 eggs by Mamoon-ur-Rashid et al. (2012), at laboratory condition.

The longest and shortest female longevities were in spring (26.12 days) and winter (13.79), respectively. In contrary to our results, Seyfollahy et al. (2017) reported the maximum longevity of female in 11thgenerations in winter (53 days) and the shortest in 4th generations in summer (19.04 days). The maximum number of adult males appeared in the 2nd and 3rd generations in spring. However, in the 1st, 10th, and 11th generation, no male appeared. The lack of males in 1st generation is because we started the biology study with parthenogenes female; however, the absence of males in 10th and 11th generation, could lead due to unfavorable temperature conditions. Lower numbers, the short life span of males, the presence of males from 2th to 9th generations but lack of role in reproduction, and thelytokous parthenogenesis by females suggest that males have a minor role in reproduction (Vennila et al., 2010). Due to our result, Seyfollahy et al. (2017) reported that the maximum adult male appeared in 1st to 3rd generations in spring; however, the adult male longevity is reported from 1 to 3.83 days. The adult male and female longevities are different in laboratory conditions. For example, adult male 2.55 days and females 41.47 days (Rashid, et al.,2012) male 3.50 days and females 41.94 days at 20 °C, male 3.46 days and females 33.8 days at 25°C, and male 3 days and females 26.1 days at 35°C (Forouzan et al., 2016).

The present study confirms that *P. solenopsis,* with 11 short life generations, has the ability to spread in a short period across the other regions in Iran and it could be a serious threat for farmlands and green houses, in Khuzestan Province. Recently, field, laboratory, and studies indicated that among all its natural predators reported from Khuzestan Province, coccidophagous predators *Nephus arcuatus* Kapur (Mossadegh et al., 2015; Forouzan et al., 2016) and *Hyperaspis polita* Weise (Seyfollahi et al., 2017; Nakhai Madih et al., 2016; Nakhai Madih et al., 2017), and a hymenoptera parasitoid, *Aenasius bambawalei* Hayat (Joodaki et al., 2018; Tamoli et al., 2020) are the most viable indigenous agents to reduce the population of *P. solenopsis* on ornamental plants. However, further studies such as the investigation of the population dynamic of the pest and its natural enemies are needed under field conditions to make a good decision to control this pest.

Acknowledgment

The Authors wish to thank the Agricultural Science and Natural Resources University of Khuzestan, Iran for financial support of this research project.

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بیولوژی شپشک آردآلود پنبه *Phenacoccus solenopsis* Tinsley روی ختمی چینی *Hibiscus rosa-sinenensis* در فضای سبز دزفول، جنوب غرب ایران

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تاریخ دریافت: ۹۹/۰۷/۲۵ تاریخ پذیرش: ۹۹/۱۱/۱۳

چکیده

شپشک آرد آلود پنبه *Phenacoccus solenopsis* Tinsley یکی ازآفات مهم گیاهان زراعی و زینتی در جنوب غرب ایران می‌باشد. در این مطالعه بیولوژی این آفت روی بوته‌های ختمی‌چینی به عنوان مهم‌ترین میزبان آن در فضای سبز شهر دزفول طی سال‌های ۱۳۹٤ تا ۱۳۹۵ مورد بررسی قرار گرفت. نتایج نشان داد این شپشک در شرایط آب و هوای دزفول دارای ۱۱ نسل در سال می‌باشد. اولین نسل در اوایل اسفند شروع و تا اوایل فروردین ادامه داشته و نسل یازدهم در اواسط اردیبهشت خاتمه یافت. فعالیت این آفت در زمستان هم ادامه داشت. کوتاه‌ترین طول نسل آفت در نسل هشتم از اواخر شهریور تا اواسط مهر (۱/۳۹±۲۸/۷۱ روز) و طولانی‌ترین آن نسل دوم (۰/۷۹± ٤۷/٤۷ روز) از اوایل فروردین تا اوایل اردیبهشت بود. تولیدمثل این شپشک به صورت بکرزایی و بیشترین نرخ زاداوری (۳/۱۱±۱٦۳/۱۱نتاج) و دوره‌ی تخم‌ریزی (۰/۱٤±٤/٤۱ روز) در تابستان در نسل چهارم و کمترین دوره‌ی تخم‌ریزی (۰/۱۲±۱/٦۷روز) و نرخ زادآوری در نسل یازدهم (۰/۱۲±٦/٦۷ نتاج) در زمستان مشاهده شد. طول عمر ماده‌ها در نسل‌های مختلف از ۲/۰۳±۱۳/۷۹ روز در نسل هشتم تا حدود ۰/۷۰±۲٦/۱۲ روز در نسل دوم بود. طول عمر نرها بسیار کوتاه و بین یک تا دو روز متغیر بود. بر اساس نتایج بدست آمده شپشک آردآلود پنبه سرعت نمو بالا، زادآوری زیاد، الگوی تولید مثلی بکرزایی با تولید پوره سن یک و توانایی سازگاری با شرایط آب و هوایی گرم و خشک دزفول را دارد. متأسفانه به دلیل فقدان مدیریت صحیح آفت و وجود میزبان‌های گیاهی زیاد، این شپشک می‌تواند تهدید جدی برای پوشش گیاهی در استان خوزستان باشد.

کلیدواژه‌ها: شپشک آردآلود پنبه، ختمی چینی، تعداد نسل، زادآوری