

Original Research Article

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Population Dynamics of Solenopsis Mealybug Parasitoid, *Aenasius arizonensis* (Girault) on Cotton and Other Alternate Host Plants

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ABSTRACT

Solenopsis mealy bug *Phenacoccus solenopsis* Tinsley has emerged as a major threat to cotton cultivation in India since past few years. *Aenasius arizonensis* Girault has been found to parasitize solenopsis mealy bug. The present study results showed during the months of April to June 2009, parasitization of *P. solenopsis* was found to be ranging from 16.4 per cent to 66.66 per cent on the alternate host plants i.e. Hibiscus rosa sinensis, Parthenium hysterophorus, Acyranthes aspera, Abutilon indicum, Xanthium strumarium, Datura metel and on cotton sprouts etc. From July onwards, the mealybug colonies started appearing on the main cotton crop, the parasitization also increased gradually from 47.43 to 55.66 per cent during July to August. It was concluded from the above studies that *Aenasius arizonensis* can be a potential agent for the biological control of solenopsis mealybug, *Phenacoccus solenopsis*. *A. arizonensis* can effectively check *P. solenopsis* population surviving a wide range of temperature conditions causing upto 76.62 per cent parasitization in the crop season and 74.82 per cent during the off-season.

Keywords

Solenopsis
Mealybug
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(Girault), Cotton

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Introduction

Solenopsis mealybug, *Phenacoccus solenopsis*, Tinsley has emerged as a serious threat to cotton cultivation in India. The mealybugs suck the cell sap from leaves, twigs, stems, roots and fruiting bodies. Cotton plants infested during vegetative phase exhibit symptoms of distorted and bushy shoots, crinkled and/or twisted and bunched leaves,

and stunted plants that dry completely in severe conditions. In the Indian subcontinent, the pest has caused widespread and serious damage to cotton crop (Abbas *et al.*, 2005; Dhawan *et al.*, 2007; Jhala *et al.*, 2008; Saini *et al.*, 2009).

Aenasius arizonensis (Girault) is an important parasitoid of *P. solenopsis* (Ram *et al.*, 2009). Surveys in cotton growing areas of Haryana

showed 23.7 to 76.6 per cent parasitisation of *P. solenopsis* by *A. arizonensis* on cotton (Ram and Saini, 2010). The present study was conducted to know the parasitization extent of the parasitoid on cotton and other alternate host plants during the course of study time.

Materials and Methods

Mealybug infested twigs of cotton and other plants were collected at 15 days interval during April 2009 to July 2010 from areas around Hisar and other parts of Haryana. The plants included were *Abutilon indicum* (Linn.), *Parthenium hysterophorus* L., *Datura metel* L., *Cenchrus ciliaris* L., *Xanthium strumarium* L., *Hibiscus rosa-sinensis* Cooperis, *Helianthus annuus* L. etc. along with the main host plant i.e. *Gossypium* spp. Plant parts (twigs) infested with mealybugs were brought to the laboratory and number of mealybugs on the twigs was counted and the twigs were kept in glass jars (20 x 15 cm) tightly covered with muslin cloth with the help of rubber bands at room temperature (23.2-33⁰C) for further rearing.

The mealybugs parasitized by *A. arizonensis* transformed into reddish brown mummies. Such mummies were counted, removed from the twigs and transferred to glass vials (7.5 x 1 cm) for obtaining adult parasitoids. When no more mummies were formed, the sample was discarded. Number of adult parasitoids emerging from the mummies was recorded daily. The sample was discarded when the adults ceased to emerge from the mummies. The adult parasitoids were sorted under the stereozoom binocular microscope and were preserved in 70 per cent alcohol for further identification.

Per cent parasitisation by primary parasitoid per sample was calculated as: (Total number of mummies / Total number of mummies and surviving mealybugs) × 100

Results and Discussion

Population dynamics of *Aenasius arizonensis*

Parasitization of *P. solenopsis* by *A. arizonensis* under field conditions

The data presented in Table 1 revealed that the parasitoid, *A. arizonensis* of *P. solenopsis* throughout the year except in the winter months of January-February when no colonies of the pest were seen. During the months of April to June 2009, parasitization of *P. solenopsis* was found to be ranging from 16.4 per cent to 66.66 per cent on the alternate host plants i.e. *Hibiscus rosa sinensis*, *Parthenium hysterophorus*, *Acyranthes aspera*, *Abutilon indicum*, *Xanthium strumarium*, *Datura metel* and on cotton sprouts etc.

From July onwards, the mealybug colonies started appearing on the main cotton crop, the parasitization also increased gradually from 47.43 to 55.66 per cent during July to August (Plate VII).

However during end August (24.31 %) and first fortnight of September (13.47 %) a decline in parasitization was recorded.

During October-November 2009 per cent parasitization ranged from 34.42 to 53.06 per cent. During December, parasitization decreased to 10 per cent probably due to very low temperature prevailing during that period. During January-February, probably due to severe cold conditions no mealybug colonies were observed and hence no parasitization was recorded.

During winter season, the pest probably survived in the stacks of cotton sticks or under the dried leaves of its other host plants or in soil and the parasitoid might have survived in the mummified mealybugs until the favourable temperature prevailed.

Table.1 Parasitization of *Phenacoccus solenopsis* by the parasitoid *Aenasius arizonensis* on cotton and/or other alternate host plants during 2009-10

Date of collection	Host plants	Parasitisation (%)	Max. Temp. (°C)	Min. Temp. (°C)	Avg. Temp. (°C)	Morn. R.H. (%)	Eve. R.H. (%)	Avg. R.H. (%)	Total Rainfall (mm)
1-4-2009	<i>A. indicum</i>	66.66	30	13.9	21.9	91	43	67	4.1
15-4-2009	Cotton sprouts	45.52	34.2	16.3	25.3	78	46	62	24.9
30-4-2009	<i>A. indicum</i>	25.23	37.3	18.3	27.8	47	13	30	0
15-5-2009	<i>A. indicum</i>	61.53	39.8	22.5	31.1	52	21	37	0
31-5-2009	<i>P. hysterothorus</i>	34.4	41.8	24.8	33.1	57	30	44	38.2
15-6-2009	<i>A. indicum</i>	16.4	41.4	24.4	34.8	57	27	4	24.9
30-6-2009	Cotton sprouts	33.93	41.9	26.1	33.9	53	24	38	5
15-7-2009	Cotton	47.43	37.1	25.8	31.4	77	57	67	28.5
31-7-2009	Cotton	51.89	36.3	26.9	31.5	79	59	68.5	63.9
15-8-2009	Cotton	55.86	39.7	28.2	33.9	69	45	57	0
31-8-2009	<i>A. indicum</i>	24.31	36.4	25.5	32.9	83	54	68.3	14
15-9-2009	Cotton	13.4	32.6	22.8	27.7	73	65	79	239.9
30-9-2009	Cotton	76.62	36.2	22.2	29.1	84	37	61	0
15-10-2009	Cotton	39.61	34.6	19.3	27	84	34	57	0
31-10-2009	Cotton	53.06	32.3	12	22.1	85	24	54.8	0
15-11-2009	Cotton	34.42	28.6	13.3	20.9	89	47	68	0
30-11-2009	Cotton	39.94	25.7	6.4	17	93	35	64.7	0
15-12-2009	Cotton	19.63	24.5	7.4	15.9	88	37	63	0
31-12-2009	<i>A. indicum</i>	10	21.8	2.7	12.2	91	36	63.2	0
15-3-2010	<i>A. indicum</i>	12.5	31.5	14.2	22.9	82	35	61	2.5
30-3-2010	<i>A. indicum</i>	10.38	38.1	19.2	28.6	74	26	51.1	0
15-4-2010	<i>A. indicum</i>	30.55	39.8	17.8	30.8	61	19	40	0
30-4-2010	<i>A. indicum</i>	29.01	42.4	23	32.7	41	16	29.1	0
15-5-2010	<i>A. indicum</i>	37.66	41.5	23.3	32.4	53	20	37	1.9
30-5-2010	<i>H. rosa-sinensis</i>	5.29	44.2	25.4	34.7	41	16	28.6	0
15-6-2010	<i>H. rosa-sinensis</i>	28.57	38.7	23.8	31.2	62	34	49	47.8
30-6-2010	<i>H. rosa-sinensis</i>	14.36	42.2	27.8	34.9	58	32	45.2	2.5
15-7-2010	<i>A. indicum</i>	16.37	36.3	26.2	31.2	86	63	75	71.9
31-7-2010	<i>P. hysterothorus</i>	74.87	34.3	26.6	32.1	89	68	77	228.1
15-8-2010	<i>A. indicum</i>	56.64	34.1	26.2	31.1	90	67	79	66.6
31-8-2010	<i>A. indicum</i>	10.52	33.5	25.2	31.5	93	72	82.6	143.3

*No collections were made from January-February as during this time period no mealybug colony was observed on the alternate host plants perhaps due to the prevailing severe cold conditions

Table.2 Correlation coefficient between weather parameters and per cent parasitization by *Aenasius arizonensis* on cotton and alternate host plants (weeds) during 2009 and 2010

Weather parameter	Correlation Coefficient
Maximum Temperature (°C)	-0.02
Minimum Temperature (°C)	0.11
Average Temperature (°C)	0.04
Morning Relative Humidity (%)	0.23
Evening Relative Humidity (%)	0.17
Average Relative Humidity (%)	0.21
Rainfall (mm)	0.04

In March, 2010, mealybug colonies started appearing on weeds like *Abutilon indicum*. Mealybug parasitization was very low in March (10.38-12.50 %) and it started increasing gradually and the parasitization reached to 37.66 per cent in first fortnight of May, 2010. The parasitization declined in second fortnight of May, 2010 (5.29 %) and remained low upto second fortnight of July, 2010 probably due to high temperature. High parasitization (74.87 %) was recorded in second fortnight of July, 2010. During August, 2010 parasitization declined considerably to 10.52 per cent in the second fortnight.

Correlation coefficient between per cent parasitization and weather parameters

As evident from the data in Table 2, there was no significant effect of the weather parameters on the parasitization of *Phenacoccus solenopsis* by the parasitoid, *Aenasius arizonensis* on cotton and other alternate host plants. However, stage of the host plant, stage of the pest and hyperparasitization might play an important role in the fluctuation of the parasitization.

The parasitoid, *A. arizonensis* parasitized *P. solenopsis* on cotton and other alternate host plants throughout the year except in the winter months of January-February when no colonies of the pest were seen causing 13.4-76.6 per cent parasitization during crop season and 5.2-74.8 per cent during off-season on alternate host plants like *Hibiscus rosa sinensis*, *Parthenium hysterophorus*, *Acyranthes aspera*, *Abutilon indicum*, *Xanthium strumarium*, *Datura metel* and on cotton sprouts etc. Ram and Saini (2010) also reported that during 2009, parasitization of solenopsis mealybug by *A. arizonensis* was observed on cotton throughout the crop growing season causing upto 76.6 per cent parasitization. Similarly, different workers

like Mahmood (2008) reported more than 50 per cent parasitization, Tanwar *et al.*, (2008) reported 20-70 per cent parasitization and Ram *et al.*, (2009) reported 37.6-72.3 per cent parasitization of *P. solenopsis* by *Aenasius* sp. on cotton and other host plants.

Correlation between per cent parasitization and weather parameters

It was seen that there was no significant effect of the weather parameters like temperature, relative humidity and rainfall on the parasitization of *P. solenopsis* by the parasitoid, *A. arizonensis* on cotton and other alternate host plants. However, stage of the host plant, stage of the pest and hyperparasitization might play an important role in the fluctuation of the parasitization.

It was concluded from the above studies that *Aenasius arizonensis* can be a potential agent for the biological control of solenopsis mealybug, *Phenacoccus solenopsis*. *A. arizonensis* can effectively check *P. solenopsis* population surviving a wide range of temperature conditions causing upto 76.62 per cent parasitization in the crop season and 74.82 per cent during the off-season.

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