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Reproduction behaviour in *Abgrallaspis nahari* (OJHA) (Homoptera: Coccoidea: Diaspididae)

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Abstract
Abgrallaspis nahari falling among armoured scale insects are the most serious, cosmopolitan pest of leaves, fruits and berry cultured, subtropical fruits, commercial and decorative plants as well as forest species. It includes many injurious pest of economical plants and thus reproductive studies of *Abgrallaspis nahari* will disclose the accurate identification and infestation of this species and will be utilized by future workers for control purpose.

Keywords: *Abgrallaspis nahari*, mating behaviour, egg laying

Introduction
Abgrallaspis nahari belongs to famly Diaspididae, super family Coccoidea, order Homopetera and class Insecta. *Abgrallaspis nahari* is a common armoured scale insect pest which infest on leaves, fruits, decorative plants and commercial trees. It mainly infests leaves and twigs of *Cassia semia. Abgrallaspis nahari* causes underneath the chlorotic effect on leaves and twigs.

Lellakova-Duskova (1963) [4] studied the morphology, metamorphosis and life cycle of the scale insect *Quadraspidiotus gigas*. Tashiro and Moffitt (1968) [10] observed reproduction in California red scale, *Aonidiella aurantii* mating behaviour and pest insemination female changes. Williams (1970) [11] described studies on the biology, ecology and economic importance of the sugarcane scale insect (Zhnt.) in Mauritius. Williams and Kosztarab (1970) [12] discussed the morphology and systematics study on the first instar nymphy of the genus *Lecanodiaspis* (Homoptera: Coccoidea: Lecanodiaspididae). Stimmel (1980) [8] studied seasonal history and occurrence of *Fiorinia externa* Ferris in Pennsylvania (Homoptera: Diaspididae). In 1982 he described seasonal history of the white peach scale *Pseudaulacaspis pentagona* (Targ Fazz) (Homoptera: Diaspididae) in the northeastern Pennsylvania. McClure (1981) [5] reported the effect of voltinism, interspecific competition and parasitism on the population dynamics of the hemlock scales *Fiorinia externa* and *Tsugaspidiotus tsugae* (Homoptera: Diaspididae). McClure (1983a) [6] observed reproduction and adaptation of exotic hemlock scale (Homoptera: Coccoidea Diaspididae) on their new and native host and in 1983b he worked on role of predators of endemic population of *Matsucoccus matsumurae* (Homoptera: Margarodidae) in Japan. Dutta (1990) [2] described contribution towards the study of scale insects (Homoptera: Coccoidea: Diaspididae) of North India. Dutta and Singh (2001) [3] observed the studies on the reproduction behaviour in *Aonidiella orientalis* (Newstead) (Homoptera:Coccoidea Diaspididae).

Belguendouz Benkhelfa *et al*. (2013) [1] studied bio-ecology of a citrus pest (*Aonidiella aurantii* Maskell) (Hemiptera: Diaspididae) spatiotemporal relationship with its host plants *Citrus limon* and *C. sinesis* in Algeiers region. Author has paid his attention on the studies of mating behaviour means of reproduction and number of eggs laid down by this species.

Material and Methods
Plants of *Cassia semia* were marked in the Paliwal Park, University Campus, Agra and observed regularly during July 2011 to June 2013. Periodical observations were made on the mating behaviour and egg laying time in the natural conditions on the plants. Counted the total number of eggs laid by per female or found per gravid body by lifting the covering of dead mature females. The specimens were preserved in dry condition and author adopted the procedure used for mounting the slides by Williams and Kosztarab (1970) [12].

Observations
Mating behaviour: In *Abgrallaspis nahari* the male is pterous, however is the female apterous and remains permanently attached on the host plant. Mostly the males emerge before noon at 9-11 a.m. in winter and 7.00 –9.00 a.m. in summer. Male is short lived. During mating adult male *Abgrallaspis nahari* just after emergence, orients itself on the edge of the female scale cover, facing towards its centre and inserts the sharp aedeagus under the edge of mature female scale where the vulva of female lies. At this place the scale of the female is not attached to the leaves and twigs, however, the rest of part of female's scale remains attached to the host plant.

Egg laying: It was observed that the female is oviparous and starts egg laying at any time either day or night. The total numbers of eggs were counted within the body of the gravid females on mounted slides. The same number of eggs laid by per female were counted after the counting of egg shells under the scale of dead gravid female. The average number of the developed eggs found in the body of the female was studied in different months for two years from July 2011 to June 2013. The results are presented in Table-1 and Table-2.

Table 1: Number of eggs in the body of the female *Abgrallaspis nahari* from July, 2011 to June 2012

S. No.	Month	No. of eggs in the body of female			Average
		I	II	III	
1.	July, 2011	25	23	24	24
2.	August, 2011	20	22	15	19
3.	September, 2011	25	28	22	25
4.	October, 2011	29	28	27	28
5.	November, 2011	26	24	28	26
6.	December, 2011	24	23	19	22
7.	January, 2012	20	22	21	21
8.	February, 2012	22	24	23	23
9.	March, 2012	27	28	26	27
10.	April, 2012	16	13	10	13
11.	May, 2012	16	18	14	16
12.	June, 2012	20	18	22	20
	Average				22%

Table 2: Number of eggs in the body of the female *Abgrallaspis nahari* from July, 2012 to June 2013

S. No.	Month	No. of eggs in the body of the female			Average
		I	II	III	
1.	July, 2012	24	22	20	22
2.	August, 2012	18	18	15	17
3.	September, 2012	23	22	24	23
4.	October, 2012	32	31	33	32
5.	November, 2012	29	27	28	28
6.	December, 2012	18	20	22	20
7.	January, 2013	21	19	17	19
8.	February, 2013	24	19	20	21
9.	March, 2013	32	30	28	30
10.	April, 2013	10	12	08	10
11.	May, 2013	10	14	12	12
12.	June, 2013	18	16	20	18
	Average				21%

Tables 1 & 2 show that the maximum and minimum number of the eggs found in the body of a gravid female are 33 and 8 respectively. The minimum numbers of eggs are found in a gravid female in the month of April of the year. However, the maximum number of eggs per gravid female were found in the month of October. The average number of eggs 21.5 were found in per female per year.

Results and Discussion

The mating mechanism of *Abgrallaspis nahari* is like that of *Aonidiella orientalis* Newstead (Dutta and Singh, 2001) [1], *Aonidiella aurantii* (Tashiro and Moffitt, 1968) [10] and *Aulacaspis tegalensis* (Williams, 1970) [11] the reproduction method is always sexual type. Female *Abgrallaspis nahari* is oviparous like that of female *Aulacaspis tegalensis* (Williams, 1970) [11]. *Fiorinia externa* (Stimmel, 1980 and McClure, 1981, 1983a) [8, 5, 6], *Pseudaulacaspis pentagona* (Stimmel, 1982) [8, 9], *Matsucoccus matsumurae* (McClure, 1983b) [7] and *Aonidiella orientalis* (Dutta and Singh, 2001) [3]. However, *Aonidiella aurantii* (Tashiro and Moffitt, 1968) [10] and *Quadraspidiotus gigas* (Lellakova-Duskova, 1963) [4] are ovoviviparous. The eggs laid in *Fiorinia externa* (McClure, 1981) [5], *Pseudaulacaspis pentagona* (Stimmel, 1982) [9] average 27.2 per female, and *Aonidiella orientalis* (Dutta and Singh, 2001) [3] average 52 eggs per female. However the female *Abgrallaspis nahari* has laid average number of eggs 21.5 per female in her life.

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