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MATING AND OVIPOSITION IN *CASSIDA INDICOLA* DUVIVIER (COLEOPTERA : CHRYSOMELIDAE)

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The mating and oviposition of *Cassida indicola* Duv. was studied in the laboratory at 28°± 2° *C* temperature and 70-80% relative humidity. Mating begins a week after the emergence of adult females. Each mating process takes 35-45 minutes. Oviposition occurs three days after copulation. In total 50-55 eggs are laid by a single female during its ovipositional period of 20-22 days. The eggs are laid singly or in pairs.

INTRODUCTION

Cassida indicola was reported on *Convolvulus arvensis* L. in Pakistan (Baloch, 1977). but in India *C. indicola* has been attacking both *C. arvensis* and *C. microphyllus* Sieb. An attempt has been made herein to provide the requisite information regarding the mating and ovipositional behaviour of *C. indicola*. The results obtained by providing the leaves of the two host plants were same although the leaves of both the hosts were provided separately in separate jars.

MATERIAL AND METHODS

The adults of *C. indicola* were collected from the host plants *C. arvensis* and *C. microphyllus* and were kept in pairs (a male and a female) in jars (1000 ml each) and each jar was covered with a piece of fine muslin cloth. The jars were covered with a piece of fine muslin cloth. The jars were kept in a BOD incubator and the temperature was maintained at 28 ± 2° C and the relative humidity was maintained at 70-80%. Fresh leaves of the host plants were provided daily. The mating behaviour of the adults was studied in detail. The number of eggs laid were recorded separately for each pair and the number of eggs hatched were also recorded daily

RESULTS AND DISCUSSION

Mating : Mating is initiated a week after the emergence of adult females. Mating and oviposition overlap each other and multiple mating throughout the active period of the adult life span is the normal behaviour pattern of *Cassida indicola* Duv. At the beginning of the mating the male mounts the back of the female and positions himself at an angle of 45° (approximately) with the first pair of legs just touching the female's elytra The second pair clasps the female midway on the lateral margins of the elytra and the third pair holds the terminal segments of the female's abdomen (segment fifth and beyond).

The male bends the tip of its abdomen down and extends and inserts the adeagus into the female's vagina. The pair shows slow lateral oscillatory movements in the mating posture with the male above the back of the female during copulation. The female continues feeding even during copulation. During this act, the female expands the elytra slightly from time to time. Mating continues for 35-45 minutes (Table I). Sometimes, it is repeated with the same individual but it occurs successively with different individuals also, as observed by keeping

more than one pair of individuals in a single jar. Mating stops on the slightest disturbance. During mating the pair does not move from one place to another.

Barrows (1979) records an interesting phenomenon in *Metriona bicolor* (F.). According to him in this Cassid, the older adults during copulation, change their colour from brownish orange with black spots, to brilliant metallic gold and the mating takes 15-583 minutes. According to Hinton (1976) *M. bicolor* (F.), *Aspidomorpha tecta* and other Cassidinae are evidently the only beetles that change colour rapidly. The gold coloration in *M. bicolor* (F.) might be a signal that they are sexually receptive because in the laboratory, beetles which had not attained full gold coloration did not mate. No such change has been observed in *Cassida indicola* Duv. and the mating pair retains its original contour and colour. Singh *et al.* (1985) in *Cassida enervis* Boh. do not mention any such change during copulation.

Table I. Showing the time taken for mating by different pairs of individuals of *Cassida indicola* Duv. during the months of February–June.

Date	Beginning of mating	Separation time	Duration for coputation/l (in min)
18. 2. 1990	10.0 a.m.	10.38 a.m.	38
18. 2. 1990	11.11 a.m.	11.52 a.m.	41
4. 3. 1990	4.36 p.m.	5. 20 p.m.	44
16. 3. 1990	6.56 a.m.	7.33 a.m.	37
12. 4. 1990	2.10 p.m.	2.50 p.m.	40
20. 4. 1990	9.21 a.m.	10.3 a.m.	42
4. 5. 1990	10.40 a.m.	11.15 a.m.	35
18. 5. 1990	4.21 p.m.	5.00 p.m.	39
6. 6. 1990	1.16 p.m.	2.1 p.m.	45
25.6. 1990	12.00 a.m.	12.41 p.m.	41

Oviposition and fecundity : Oviposition occurs three days after copulation and after ten days of the emergence of the adult females. Thus the mating begins only a week after the emergence of the adult females. These findings coincide with those of Visalakshi et al. (1980) in *Aspidomorpha furcata* Thunb., Singh *et al.* (1985) in *Cassida enervis* Boh. and Sangita *et al.* (1988) in Oocassida pudibunda Boh. According to them the oviposition occurs 3-4 days after copulation and 10-12 days after the emergence of adult females Manjunath *et al.* (1987) showed that the females of *Aspidomorpha miliaris* F. have a pre-ovipositional period of only 1.25 days.

In the beginning of the ovipositional period the female lays 3-4 eggs per day for the first 10-11 days. Later the rate of oviposition declines to just 1-2 eggs per day. Thus a total of 50-55 eggs are laid in about 20-22 days (Table II). The ovipositional period is quite variable in Cassidinae and may differ widely in the individuals of the same species depending upon environmental conditions. Rawat & Modi (1973) in *Oocassida pudibunda* Boh. report the ovipositional period of 14-69 days. Buzzi (1975) in *Anacassis cribrum* (Klug) records the ovipositional period of 38 days at the maximum.

Singh *et al.* (1985) have observed that the mated females of *Cassida enervis* Boh. lay 35-50 eggs during the ovipositional period. However, this number is quite low as compared to the other genera of Cassidinae. Buzzi (1975) records that 1618 eggs are laid by females

of *Anacassis cribrum* (Klug) during the ovipositional period. Majunatha *et al* (1987) report that the females of *Aspidomorpha miliaris* F. have an average fecundity of 171.50 eggs. Sangita *et al.* (1988) obsered that the totoise beetle, *Oocassida pudibunda* Boh. lays about 115 oothecae each containing 1-4 eggs.

Table II. Showing decline in the rate of oviposition with the age of the female in different individuals.

S.No.	No. of eggs laid in Ist five days of oviposition	No. of eggs laid in 5th to 10th day of eviposition	No. of eggs laid durign 10th 15th day of oviposition	No. of during 15th to last day of oviposition	Total number of eggs laid
1.	19	18	6	8	51
2.	18	19	8	10	55
3.	20	12	8	10	50
4.	15	18	10	12	55
5.	18	16	10	9	53
6.	16	16	9	9	50
7.	18	18	7	8	51
8.	19	19	8	5	51
9.	18	18	8	8	52
10.	16	17	9	8	50

The eggs are laid singly or in pairs covered over by the oothecae which are in the form of semi-transparent membranous coverings. They are laid on the lower side of the leaves in the field but in the laboratory, they are laid on both the surfaces. Takizawa (1980) reports that the eggs are generally laid in semi- transparent egg cases in Cassidinae, however in *Cassida versicolora* the eggs are laid singly without an egg case and are streaked with faeces. According to Buzzi (1988) the eggs of Neotropical Cassidinae are covered with faeces or protective scale but it never happens likewise in *Cassida indicola* Duv. The covering of egg by faeces, has also not been reported by Singh *et al.* (1985) in *Cassida enervis* Boh. and by Sangita (1989) in *Cassida syrtica* Boh. The number of eggs per egg-case is specific to each species of Cassidinae and ranges from 1-15 (Takizwawa, 1980). Muir and Sharp (1904) suggest that the ootheca in Cassidinae is essentially similar in nature to epichorion of other Chrysomelidae. They also report the presence of 14-20 eggs in each ootheca in *Aspidomorpha tecta* Boh.

Egg structure and hatching : The eggs of *Cassida indicola* Duv. are creamish brown with a smooth chorion. They are elliptical in shape (Fig.1) and each measures about 1.0303 ± 0.023 mm in length and 0.51 ± 0.028 mm in breadth (Table III).The eggs lie longitudinally parallel to the leaf surface and are firmly glued to it. When laid in pairs, the eggs are also laid upright or obliquely, or sometimes, fixed with strings, or hung down by strings from the leaf like a bunch of grapes (Takizawa, 1980). Winder (1987) records an interesting phenomenon in *Acromis sparsa* Boheman, wherein th females use their broad elytra to shield their eggs from invertebrate enemies. Nothing likewise is recorded in *Cassida indicola* Duv..

Table III. Showing measurements of the eggs of *Cassida indicola* Duv.

S. No.	Length (in mm)	Breadth (in mm)
1	1.02	0.51
2	1.02	0.476
3	1.054	0.51
4	1.02	0.51
5	1.054	0.544
6	1.054	0.544
7	0.986	0.51
8	1.02	0.476
9	1.054	0.544
10	1.02	0.476
Mean ($\bar{X}$)	1.0302	0.51
Standard deviation (σ)	0.023	0.028

After oviposition there is no significant change in the texture or the size of the egg, but just prior to hatching, the eggs become darker in colour. Singh et al., (1985) and sangita (1989) in *Cassida enevis* Boh. and *Cassida syrtica* Boh. respectively state that the colour of the egg changes from creamish to pinkish just before hatching.

The egg hatches in 6-7 days (Table IV). The larva makes a hole in the egg shell with its sharp toothed mandibles and it is the head which comes out first. The thoracic region takes more time for its protusion than the abdominal part. The total time taken by the larva to come out of the egg is about 20-25 minutes.

Table IV. Showing the incubation period of the eggs of *Cassida indicola* Duv. under controlled laboratory conditions ($28 \pm 2^{\circ}$ C temperature and 70-80% relative humidity).

S. No.	Data of egg laying	Date of hatching	Incubation period (in days)
1	21. 2. 1990	27. 2. 1990	6
2	21. 2. 1990	27. 2. 1990	6
3	8. 3. 1990	15. 3. 1990	7
4	19. 3. 1990	26. 3. 1990	7
5	15. 2. 1990	21. 4. 1990	6
6	15. 4. 1990	22. 4. 1990	7
7	15. 4. 1990	22. 4. 1990	7
8	23. 4. 1990	29. 4. 1990	6
9	8. 5. 1990	14. 5. 1990	6
10	6. 6. 1990	12. 6. 1990	6
Mean period of incubation ($\bar{X}$)			6.4
Standard deviation (σ)			0.516

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