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**Research Article**

# MATING STRATEGIES OF SOLIFUGAE *GALEODES OLIVIER* 1791, (ARACHNIDA: GALEODIDAE) IN LABORATORY CONDITIONS

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## ABSTRACT

In all cases of mature *Galeodes fatalis*, mating was forcefully and painful. Sexually cannibalism is more common in Solifugae. The mating rituals can be said to be unique in Solifugae. The benefit of mating and cannibalism requirement of nutritional value for the forming eggs was high in virgin female of Solifugae other than mated female. Virgin female doesn't attack to male first as mated female attack first; it means mated female does not have multiple mating. Virgin female of Solifugae choose male for both as sperm transfer and nutritive values. Therefore females have high reproductive rate. Their courtship and copulation orientation was successful. Mature females showed positive responses with mature male. Their chances of participation in mating rituals were decided by female.

**Keywords:** *Galeodes Fatalis*, Mating, Arachnida, Alirajpur.

## INTRODUCTION

The mating of Solifugae was first observed in *Galeodes caspius* Birula by Heymons (1902). After it has been described in *Galeodes granti* Pocock by Clousley-Thompson (1961), in *Galeodes sulfuripes* Roewer by Amitai *et al*. (1962), and mating behavior in two sexually cannibalistic species *Galeodes Capsicus subfuscus* (Galeodidae) and *Gluvia dorsalis* (Desiidae) were studied by Hruskova-Martisova *et al.* (2010). Mating are some unique aspect of Solifugae, mating have courtship and direct and indirect sperm transfer process. In the Solifugae its own family has different mating strategies. Solifugae are cannibalistic by behavior. *G. fatalis* has coercive copulation. Mating strategies of male and female of *fatalis* were observed. Its main steps are A. pre copulation that includes courtship; B. copulation that includes attack phase and contact phase; C. post copulation it has cannibalized or release phase. Courtships in males are increasing risk of cannibalism. Mature female mated with mature male. Females have mating selection, their responses were observed respect to male, coercive copulation was common in *G. fatalis* although multiple mating doesn't observed during mating experiment of *G. fatalis* in laboratory. Mature male responses and attempt to female first, sexual encounter were observed and minor differences occur. *Galeodes* male touches female with his pedipalp and stroking her until female become lethargic then he insert spermatophore into genital with his chelicerae described by Heymons (1902). The pedipalp organ was being a receptor for airborne odours stated by Bernard (1896) and Lichtenstein (1797). The present study was aimed to investigate mating strategies of *G. olivier* in laboratory conditions.

## MATERIALS AND METHODS

### Study Area

Alirajpur district in Madhya Pradesh has rich diversity of Galeodidae family has studied by Pandram and Sharma (2015). Solifugae were collected from Bhabhra town coordinates $22^0$31'48"N $74^0$19'28"E from Alirajpur district, Madhya Pradesh.

### Sampling Methods

Solifugae were collected during day time by turning stones, bottle traps were used for collection. Five females (three mature and two immature females) and five males were used for experiments. Males and females kept separately in the terrarium. Mating experiments was done in the day time.

**ANOVA methods:** Mating data analyze the differences among group means.

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## RESULTS AND DISCUSSION

Male approaches first to female (Figure 3A). There were Five females (three mature and two immature) were observed, three females were mated with males successfully. During mating experiments, female does not attacked on male before mate, male has opportunity to come closer with female and touched with his long pedipalp. Mature female doesn't attacked and male get responses as continue stroking her with his pedipalp (Figure 3B) at that time female lift her abdomen for copulation. Male releases spermatophore and inserted into genitals of female with the help of chelicerae (figure: 4G). There are no distint spermathecae in the Galeodidae (Birula, 1893; Dufour, 1861; Vachon, 1945). Male freeze her body and female doesn't move at this position. After inserted spermatophore male try to escape.

**Table 1.** Interaction between male and female *Galeodes olivier* in the terrarium.

| *Galeodes olivier* | Male approaches to female | Courtship response with mature male | Mating response with mature male | Multiple mating with male | Cannibalism |
|---|---|---|---|---|---|
| Mature female 1 (case 1) | Yes | Yes, lift her abdomen and allow him to grasp her with jaws | Yes, Coercive copulation occurred | No | Yes cannibalizes by female, male doesn't escape |
| Mature female 2 (case 2) | Yes | Yes, lift her abdomen and allow him to grasp her with jaws | Yes, Coercive copulation occurred | No | Yes cannibalizes by female, male doesn't escape |
| Mature female 3 (case 3) | Yes | Yes, lift her abdomen and allow him to grasp her with jaws | Yes, Coercive copulation occurred | No | No cannibalism, male escaped successfully |
| Immature female 4 (case 4) | Yes | No responses by female | No response by female | No | No, both escaped |
| Immature female 5 (case 5) | Yes | No response by female | No response by female | No | No, both escaped |

**Table 2.** Mating steps between male and female of *Galeodes olivier*.

| Groups | Male approaches to female | Courtship response with mature male | Mating response with mature male | Multiple mating with male | Cannibalism |
|---|---|---|---|---|---|
| Case 1 | Yes | Yes | Yes | No | Yes |
| Case 2 | Yes | Yes | Yes | No | Yes |
| Case 3 | Yes | Yes | Yes | No | No |
| Total | 3 | 3 | 3 | 0 | 2 |

**Table 3.** ANOVA single factor calculation.

| Source of variation | Sum of square | Degree of freedom | Mean square |
|---|---|---|---|
| Between sample | 20.3535 | 3 | 10.17675 |
| Within sample | 0.6668 | 6 | 0.111133333 |
| Total | 21.02039 | 9 | 91.5751 |

Table 3 showed the ANOVA single factor calculation stated by Ramakrishnan (2007).

ANOVA F value that is, F value = variance between sample/ variance with in sample.

F value: which has obtained an F ratio of 91.57 with (3, 6) degree of freedom.

The critical value of F is 4.76, our obtain ratio are larger than this, and it concluded that obtained F ratio is likely to occur by chance with a $p<0.05$. That is significant.

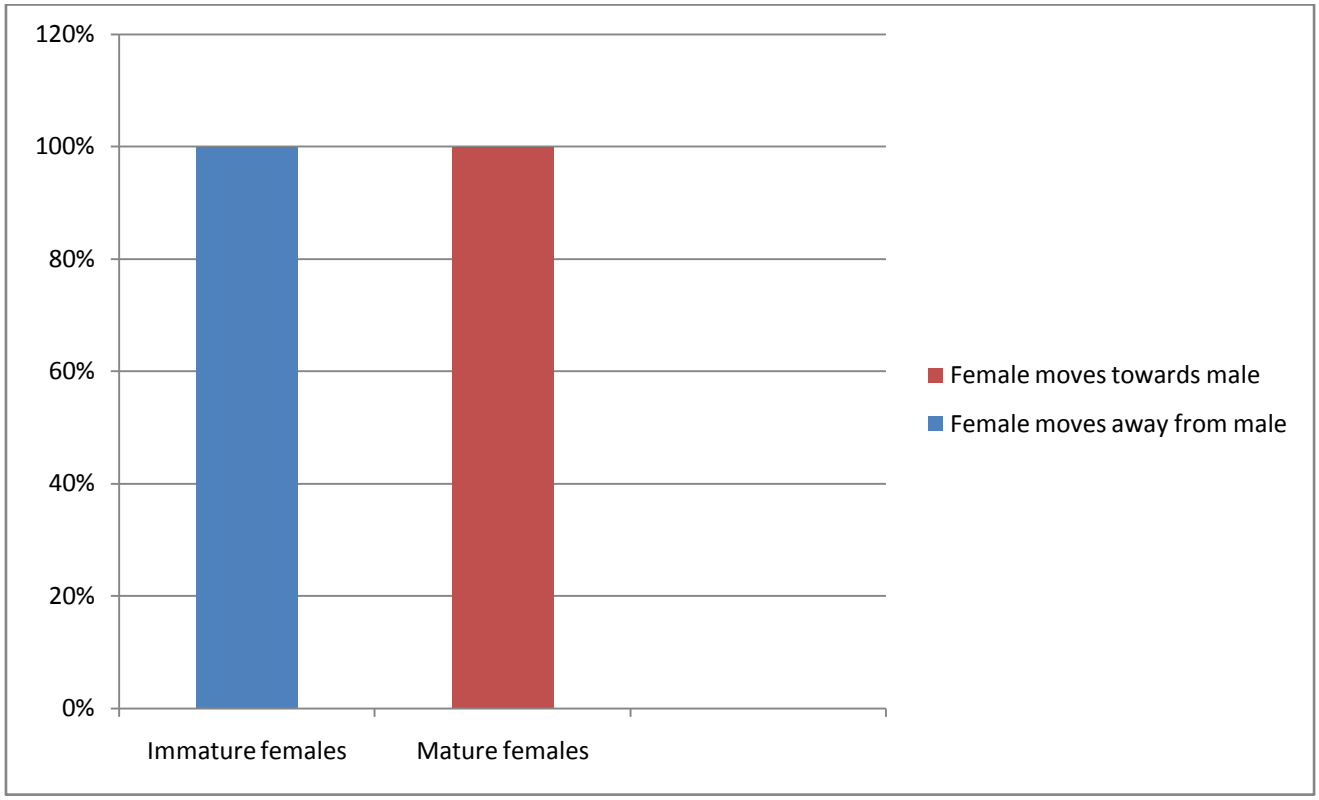


**Figure 1.** Behavioural interaction between male and female *Galeodes olivier*.

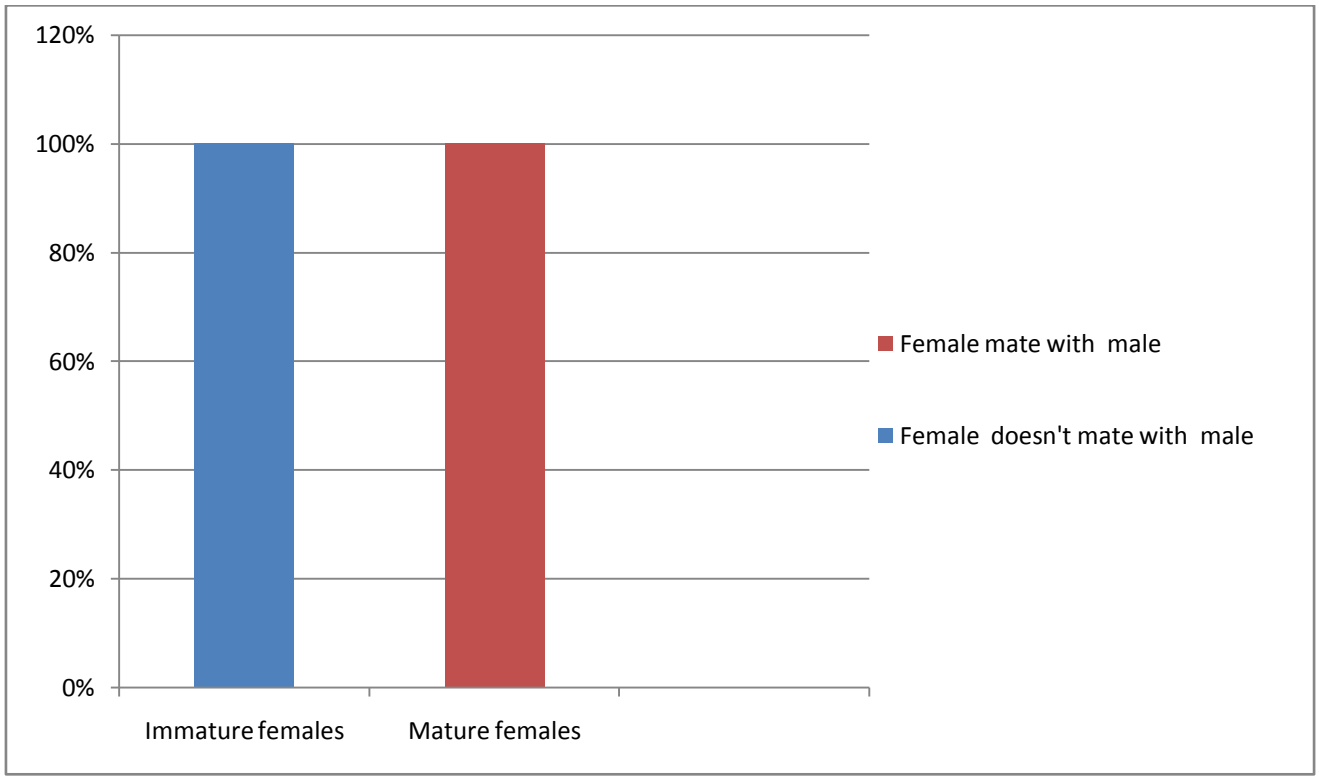


**Figure 2**. Mating interaction between male and Female *Galeodes olivier*.

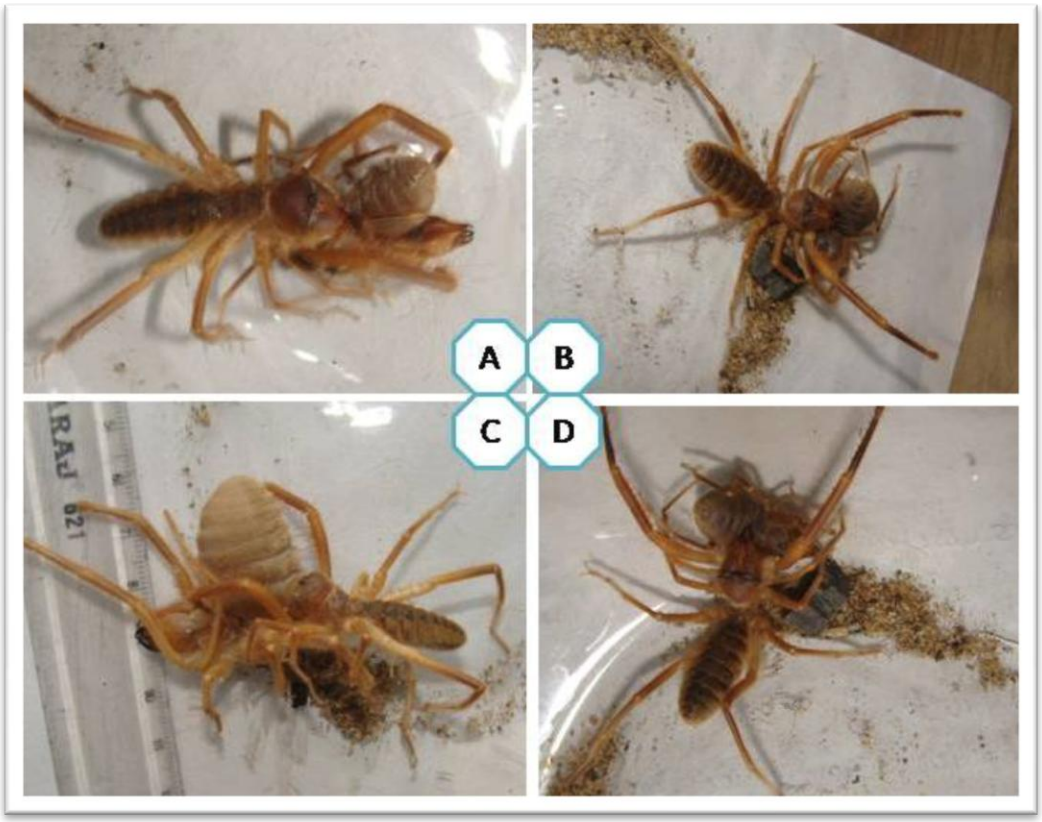


**Figure 3.** Courtship and mating rituals of *Galeodes olivier*. A. showed mature male tapped female. B. showed male bites on abdomen of female. C. male inserted chelicerae into genitals of female. D. after inserted chelicerae male bites on abdomen of female.

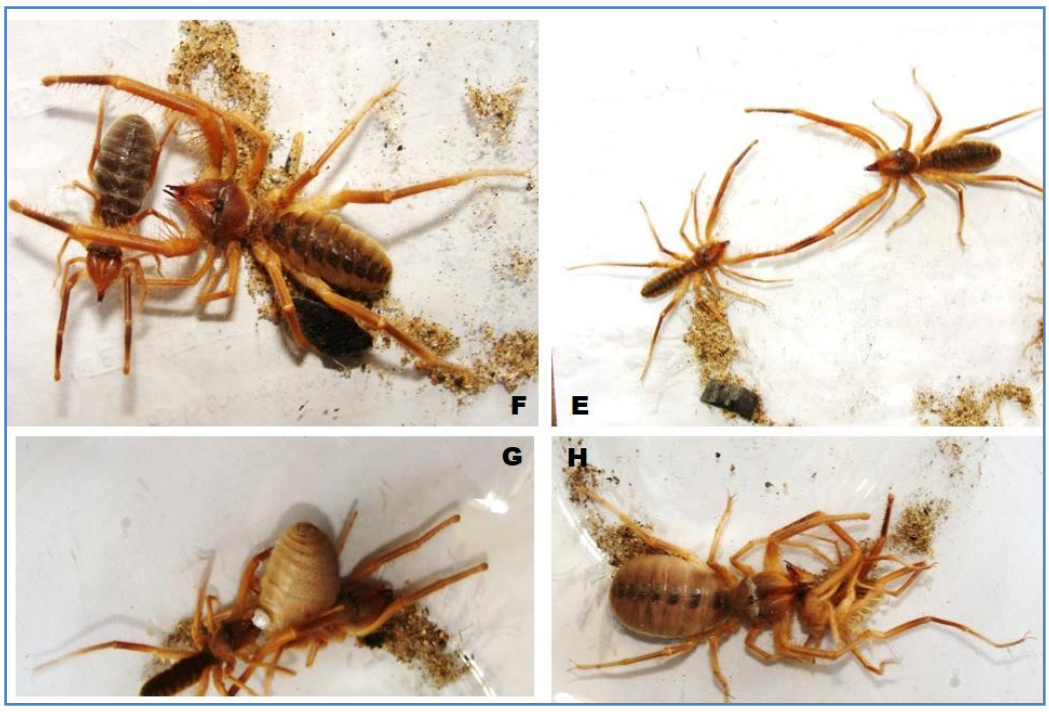

**Figure 4.** Interaction between male with female of of *Galeodes Olivier*. E. male approaches immature female. F. immature female didn't show any responses towards male. G. male inserted spermatophore into mature female. H. female cannibalized male after mating.

**Case 1 and 2:** Interaction between mature female 40 mm size with mature male 46 mm size. Male approaches female with his pedipalp through touch and get successful responses from female. Male bite her abdomen and hold her pedipalp. Female doesn't attacked and cannibalize first. It means female have mate choices and male have opportunistic here. Courtship tactics may be as long as few minutes. Coercive copulation was occurred. Female cannibalize male after mating. Male doesn't get chance to escaped. Another male introduced to female at that movement female attack on male both escaped, Female doesn't benefited with multiple mating.

**Case 3:** Interaction between mature female with mature male. Male escaped after inserting spermatophore into *G. Olivier* genitals of female. Coercive mating successfully occurred. Multiple mating doesn't occur.

**Case 4 and 5:** Female doesn't responses to male and both escaped. Mating doesn't occur.

Table 2 showed Anova that is Analysis of variance as variation among and between groups. We observed and analyzed the differences among groups. Data calculated on the basis of successful mating in *G. olivier*. The first one gives critical values of F at the p = 0.05 level of significance.

Figure 1 showed the interaction between male and female *G. Olivier*, which interpreted that all mature females get 100 % responses towards males instead immature.

Figure 2 showed the interaction between male and female *G. Olivier*, which interpreted that all mature females mated with males, 100 % responses obtained.

## CONCLUSION

This study demonstrated the steps involved for mating in Galeodes. Although virgin mature female always have mate choices instead of cannibalize first.

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