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# Identifying behaviours associated with oestrous behavior in female fallow deer *Dama dama* L

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**Abstract:** *The identification of oestrus-specific behaviour and its onset in female fallow deer *Dama dama* is addressed. All behavioural elements were quantified during three periods (1) before (2) around and (3) after mating in 30 randomly-chosen females. For convenience, the 42 elements were divided into 12 groups including; Stance, locomotion, feeding, auto-grooming, tail posture, communication, intrasexual aggression, Doe-doe interaction, fawn directed aggression, Buck directed aggression, buck-doe interaction, mating and other behaviour. A one-zero sampling protocol was used to analyse videotaped observation periods.*

**Key words:** Fallow deer, *dama dama*, oestrous element behaviour.

## I. INTRODUCTION

Determining which partner is primarily responsible for any given effect in a dyadic interaction is extremely difficult. In fallow deer *Dama dama* females select a mate based on male phenotypic traits, such as large antlers or large body mass, or else females show preferences for particular mating territories (Clutton-Brock *et al.* 1989, McElligott and Hayden 1999). In sticklebacks, *Gasterosteus aculeatus*, females show a consistent preference in their choice of males, there is a positive relationship between preference and male ornament (Bakker 1993). In black grouse leks, *Tetrao tetrix*, female-female aggression occurred when more than one female attended a territorial male and males interfere with each other's mating attempts and this may constrain female choice (Karvonen, Rintamaki and Alatalo 2000). During the reproductive season most female ungulates, spend significantly more time grazing and most of their active time foraging while males reduce or cease feeding and spend more time lying down (Apollonio and Di-Vittorio 2004). Sub adult males and yearlings which are not successful in approaching females seem to have more time to spend in feeding than do adults (Apollonio and Di-Vittorio 2004). The adult males of moose cease feeding, and lose the appetite and appear the scent urination, this may be a consequence of a physiological processes associated with chemical communication (Miquelle 1990).

## II. MATERIAL AND METHODS

### *Data collection*

Data were collected by focal animal observation within days before and after mating. Groups of females were selected from the available groups in the study area. Where there was an unobstructed view from the camera position, a female was selected at random from the group and filmed for 25-30 minutes

### *Analysis of Videotapes*

The sampling protocol used the 1-0 sampling method (Martin and Bateson, 1993). The observation period was divided into 5-second intervals and each interval was scored for the presence or absence of any elements of behaviour. All elements behaviour were divided into 12 groups dealing with; Stance, locomotion, feeding, auto-grooming, tail posture, communication, intrasexual aggression, Doe-doe interaction, fawn directed aggression, Buck-directed aggression, Buck-doe interaction, mating and other behaviour. A one-zero sampling protocol was used to analyse videotaped observation periods.

### *Statistical analysis*

Friedman's Test (Non-Parametric Repeated Measures Comparisons) was used in all behaviour elements quantified in the periods before, around and after mating. Table (1) summarise all statistic analysis of behaviour over oestrus.



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III. RESULTS AND DISCUSSION

### *Ethogram description*

#### **1- Stance:**

Does spent significantly more time standing during the period around mating than before or after (Friedman's test,  $\chi^2 = 20.67$ ,  $df = 2$ ,  $p < 0.001$ ). Does were never recorded lying down around the time of mating Fig. (1). (Friedman's test,  $\chi^2 = 22.89$ ,  $df = 2$ ,  $p < 0.001$ ). Fig. (1).

#### **2- Locomotion**

The amount of time spent walking was significantly less in the period after mating than before or around mating, (Friedman's test,  $\chi^2 = 15.53$ ,  $df = 2$ ,  $p < 0.001$ ). Fallow does before and around mating, spend more time walking than after mating, and walk less frequently after mating for both comparisons. Does were recorded running after mating less frequently than at around mating ( $\chi^2 = 25.05$ ,  $df = 2$ ,  $p < 0.001$ ), fig. (2)

#### **3-Feeding**

Female fallow deer before oestrous are more active, spend more time grazing and ruminating, but during oestrus are less likely to feed than before ( $p < 0.01$ ) or after ( $p < 0.01$ ), female were rarely seen to ruminate or lie down around mating, (Friedman's test,  $\chi^2 = 26.49$ ,  $df = 2$ ,  $p < 0.001$ , fig. (3).

Fallow does spend significantly less time feeding around mating than at other times fig. (3). For each variable, similar values are labelled with the same letter or the same number of symbols. The values represent the mean proportion of intervals within the observation period in which the behaviour occurred.

#### **4-Auto-grooming**

Fallow does spend significantly more time auto-grooming around mating than at other times. Does were significantly recorded grooming more around mating than before or after mating ( $p < 0.001$ , fig. 4.4). Does were observed to rubs their flanks in a circular motion with their head at any time but particularly around mating ( $p < 0.001$ ,  $\chi^2 = 58.09$ ,  $df = 2$ ,  $p < 0.001$ ,  $n = 30$ , Fig. (4). Does were observed to lick their perineum significantly more frequently around mating than before and after mating, (Friedman's test,  $\chi^2 = 25.17$   $df = 2$ ,  $p < 0.001$ ).

#### **5-Tail posture**

Fallow does were significantly more likely to raise their tail (tail vertical or horizontal or tail flicking) around mating than at any other time ( $p < 0.001$ ). There was a significant differences in the number of records of tail-flicking by the doe ( $P < 0.001$ ) between before, around or after mating, (Friedman's test  $\chi^2 = 16.28$ ,  $df = 2$ ,  $p < 0.001$ ), see fig. (5).

#### **6-Communication**

Females around the mating event are more likely to demonstrate investigative olfactory behaviour (Fig. 4.6). At this time they are more likely to sniffs bucks and to sniff the ground. They are also more likely to direct visual and auditory attention to the rear than before and after mating (Friedman's test,  $\chi^2 = 14.39$ ,  $df = 2$ ,  $p < 0.001$ ). Fig. (6).

#### **7-Intrasexual aggression**

This includes cases of a doe biting a doe, a doe nudging another doe and a doe threatening another doe. Fallow does became more aggressive towards other females around mating. They were more likely to display aggression towards other females and towards fawns around mating than at other times (Friedman's test,  $\chi^2 = 41.06$ ,  $df = 2$ ,  $p < 0.001$ ) see fig. (7).

#### **8-Doe – Doe interaction**

There were a significant differences in the extent to which the focal doe was;



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(a) either the initiator (focal biting other doe, focal kicking another doe and focal nudging another doe), or (b) The recipient (another doe nudges, sniffs or mounts the focal doe, in before or after mating, but there a significant different in phase around mating (Friedman's test,  $\chi^2 = 26.47$ ,  $df = 2$ ,  $p < 0.001$ , table (1).

**9- Fawn-directed-aggression**

There was a significant difference between periods in the tendency of a doe to direct aggression towards fawns (Focal doe bites fawn, Focal doe kicks fawn, or Focal doe nudges fawn, (Friedman's test,  $\chi^2 = 25.17$   $df = 2$ ,  $p < 0.001$ ,  $n = 30$ , table( 4.1).

**10-Buck-directed aggression**

There was aggression by focal does toward bucks recorded in each period, (doe nudges buck, doe kicks buck and doe mounts buck). Does showed a significant difference in aggression towards males between periods. They were significantly more aggressive towards bucks around mating (Friedman's test,  $\chi^2 = 41.06$ ,  $df = 2$ ,  $p < 0.001$ ,  $n=30$ , table 4.1). Does were never seen to mount a buck during the fieldwork reported here. Table (1).

**11- Buck-doe interaction**

Bucks performed flehmen towards does around mating but not before or after ( $p < 0.001$ ). Bucks were significantly more likely to lick a doe around mating than before or after ( $p < 0.001$ ). Bucks were also significantly more likely to mount a doe around mating than at other times ( $p < 0.001$ . for all comparisons). Bucks also were more likely to contact does by nudging around mating than before or after ( $p < 0.001$ ). They were more likely to sniff a doe around mating ( $p < 0.001$  or all comparisons).

**12-Mating and Other behaviors**

Does adopted the back-flexed posture only around mating but never before or after mating ( $p < 0.001$ ). Similarly marked abdominal contractions were only noted around mating, but not before or after ( $p < 0.001$ , Fig. 4.8). Fallow does were significantly less tolerant of other females around mating. There was no difference in the reaction of a doe to the fawns in relation to mating.

**Table (1) Summary of behaviour over oestrus**

<b>Comparison of the elements of behaviour during the three different periods</b>			
<b>Behaviour</b>	<b>1 (Mean ± SE.)</b>	<b>2 (Mean ± SE.)</b>	<b>3 (Mean ± SE.)</b>
Walking	0.345 ±0.041 <sup>a</sup>	0.409± 0.015 <sup>a</sup>	0.227±0.199 <sup>b</sup>
Standing	0.320±0.044 <sup>a</sup>	0.543±0.016 <sup>b</sup>	0.306±0.043 <sup>a</sup>
Running	0.030±0.007 <sup>a</sup>	0.000±0.000 <sup>b</sup>	0.008±0.002 <sup>ab</sup>
Sniffs ground	0.033±0.005 <sup>a</sup>	0.063±0.006 <sup>b</sup>	0.024±0.004 <sup>a</sup>
Grazing	0.351±0.048 <sup>a</sup>	0.033±0.010 <sup>b</sup>	0.166±0.040 <sup>b</sup>
Ruminating	0.295 ±0.14 <sup>a</sup>	0.00± 0.00 <sup>b</sup>	0.604 ± 0.19 <sup>a</sup>
Ruminating lying	0.323±0.104 <sup>a</sup>	0.000±0.000 <sup>b</sup>	0.604±0.105 <sup>a</sup>
Rubs flank	0.002±0.001 <sup>a</sup>	0.122±0.014 <sup>b</sup>	0.000±0.000 <sup>a</sup>
Flicking horizontal	0.027±0.006 <sup>a</sup>	0.053±0.009 <sup>a</sup>	0.010±0.003 <sup>b</sup>
Raise tail	0.026±0.006 <sup>a</sup>	0.124±0.010 <sup>b</sup>	0.026±0.006 <sup>a</sup>
Stand back flexed	0.004±0.003 <sup>a</sup>	0.029±0.025 <sup>b</sup>	0.000±0.000 <sup>a</sup>
Sniffs buck	0.003±0.009 <sup>a</sup>	0.024±0.0429 <sup>b</sup>	0.00±0.001 <sup>a</sup>



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Licks perineum	0.000±0.001 <sup>a</sup>	0.020±0.006 <sup>b</sup>	0.002±0.000 <sup>a</sup>
Scratching	0.006±0.002 <sup>a</sup>	0.024±0.005 <sup>b</sup>	0.001±0.000 <sup>a</sup>
Aggression by doe	0.002±0.01 <sup>a</sup>	0.057±0.004 <sup>b</sup>	0.00±0.000 <sup>a</sup>
Doe mounts fawn or doe	0.002±0.00 <sup>a</sup>	0.003±0.003 <sup>b</sup>	0.003±0.001
Grooming	0.001±0.003 <sup>a</sup>	0.019±0.003 <sup>b</sup>	0.002±0.000 <sup>a</sup>
Urinating	0.007±0.007 <sup>a</sup>	0.02±0.003 <sup>b</sup>	0.024±0.020 <sup>a</sup>
Buck mount a doe	0.00 ± 0.000 <sup>a</sup>	0.072 ± 0.007 <sup>b</sup>	0.00 ± 0.00 <sup>a</sup>
Abdominal contraction	0.003±0.002 <sup>a</sup>	0.057±0.010 <sup>b</sup>	0.000±0.000 <sup>a</sup>
Listen behind	0.017±0.010 <sup>a</sup>	0.038±0.007 <sup>b</sup>	0.009±0.004 <sup>ab</sup>
Preorbital Gland open	0.03±0.003 <sup>a</sup>	0.133±0.063 <sup>a</sup>	0.000±0.000 <sup>a</sup>
Lying down	0.167±0.055 <sup>a</sup>	0.00±0.000 <sup>b</sup>	0.401±0.069 <sup>a</sup>
Fawn-directed aggression	0.000±0.001 <sup>a</sup>	0.001±0.0004 <sup>b</sup>	0.00±0.069 <sup>a</sup>
Inter-sexual aggression	0.002±0.000 <sup>a</sup>	0.013±0.003 <sup>b</sup>	0.000±0.001 <sup>a</sup>
Buck doe interaction	0.000±0.000 <sup>a</sup>	0.020±0.017 <sup>b</sup>	0.001±0.0001 <sup>a</sup>

Group 1 consisted of observations that were collected between 1 hour 19 minutes and up to 6 days before mating. Group 2 consisted of observations collected around mating. These began when the female first stood to be mounted and ended when the female left the area after mating. Here the observation period lasted from 2.3 minutes to 21.9 minutes. Group 3 consisted of observations that were collected between 1 hour and up to 7 days after mating. Pair-wise comparisons that were not different are indicated by the same superscript. For each significant difference variables are labelled with different letters, the same letter means there was no significant difference.

The length of oestrous cycle in female fallow deer *Dama Dama* is 21 days (Fraser, 1985) whereas the length of oestrous is 48 hours. Harty (2002) indicated that many female fallow deer visit a number of males on the day of mating and a small number continue to do so on the day after mating. The fact that the majority of visits were observed on the day before and on the day of mating further indicates that the duration of oestrus is 48 hours. A characteristic behaviour of does in the oestrous stage is rubbing her flank and walking in front the male by shortening or lengthening her strides.

Female may use scent urinating which in many species play an important role in sexual attraction and recognition of males (Apollonio and Di Vittorio 2004). Bucks on the other hand were observed exhibiting flehmen at any time other than around mating, usually after sniffing the genital area of a doe or testing her urine during micturition or soon after.

The main body of data was derived from a focus on female sexual behaviour particularly close to oestrus. Particular attention was paid to variation between female types in an attempt to detect variation between monogamous and polyandrous females that might be used by males as predictors of female multiple mating.

Female fallow deer actively choose their mate. The decision of a female to stand to be mounted by male can be taken as an expression of mate choice as originally pointed out by Farrell (2001). The probability of a mating going to completion after a doe has stood to be mounted was 0.93 (Naulty 2006). From this it is clear that females do not allow bucks to mount them unless they are ready to mate. The mount sequence is almost invariably concluded by ejaculation. If the mating sequence is disturbed, females in almost half the cases complete this mating. In a study conducted by Naulty (2006) 47% of disturbed matings go to completion.



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Female and young male fallow deer increase grazing activity in response to an improvement in forage quality from summer to autumn (Apollonio and Di-Vittorio 2004). The longer time spend grazing results in a higher food intake in coincidence with increase in reproductive activity. In this study females tended to be more likely to be recorded grazing before mating. The lower grazing recorded around mating may represent an element of the cost of mating. During the rut season adult males completely ceased feeding, while Sub-adult males and yearlings which are not successful in approaching female seem to have more time to spend in feeding than do adults (Apollonio and Di vittorio 2004).

#### ACKNOWLEDGEMENT

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Appendix

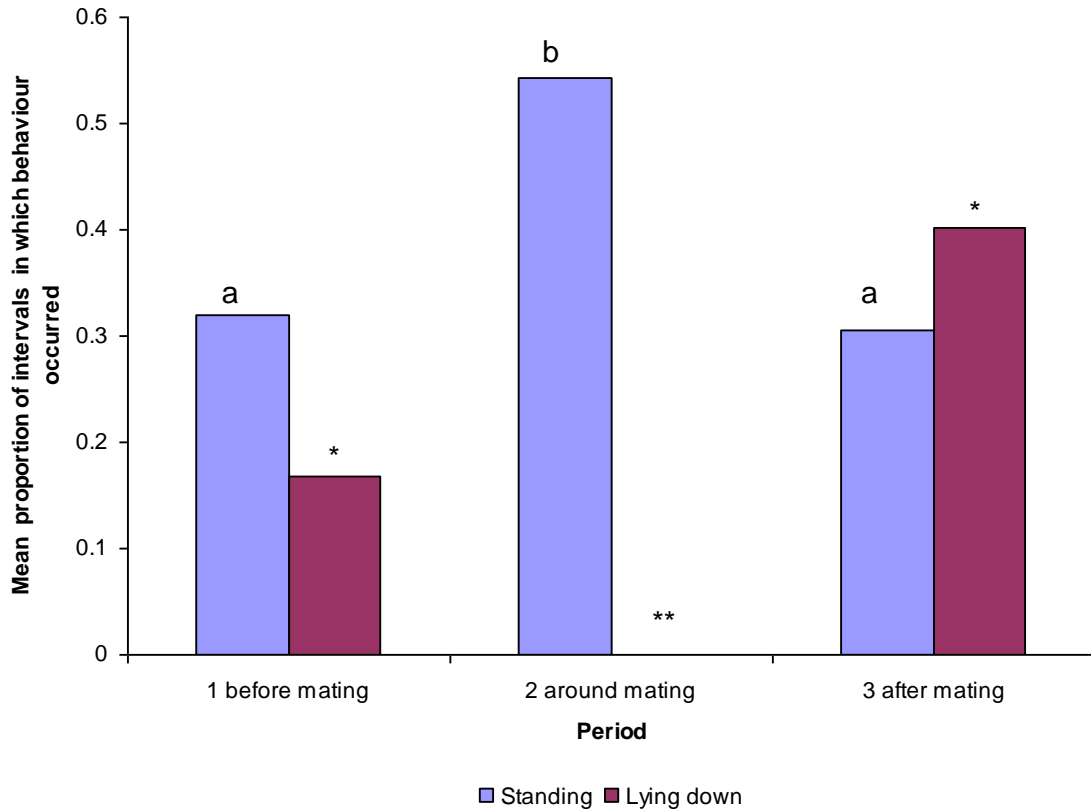


Fig (1) Stance of fallow does before, around and after mating

For each variable, similar values are labelled with the same letter or the same number of symbols. The values represent the mean proportion of intervals within the observation period in which the behaviour occurred.

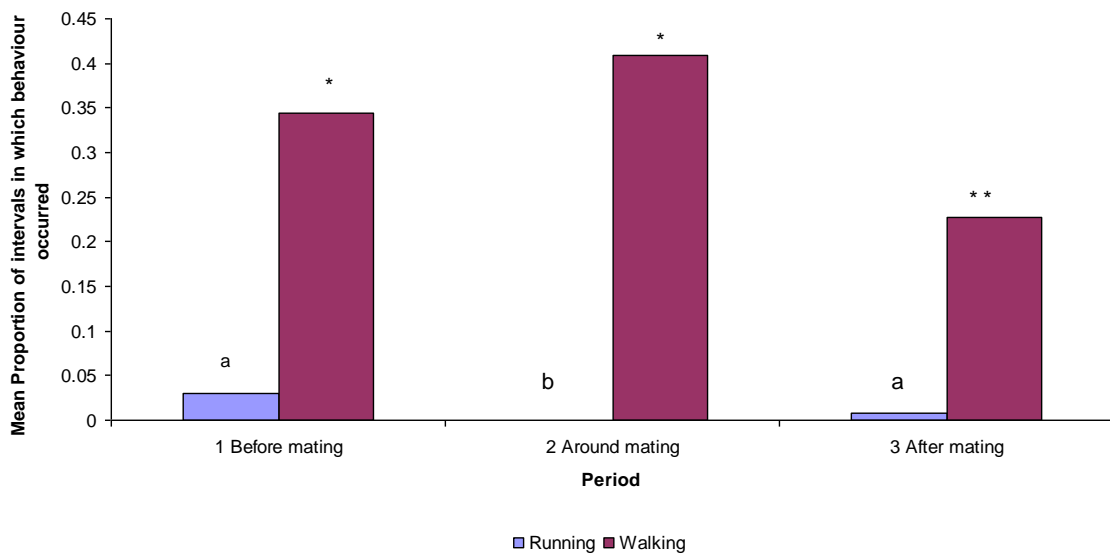


Fig (2) Locomotion of fallow does before, during and after mating

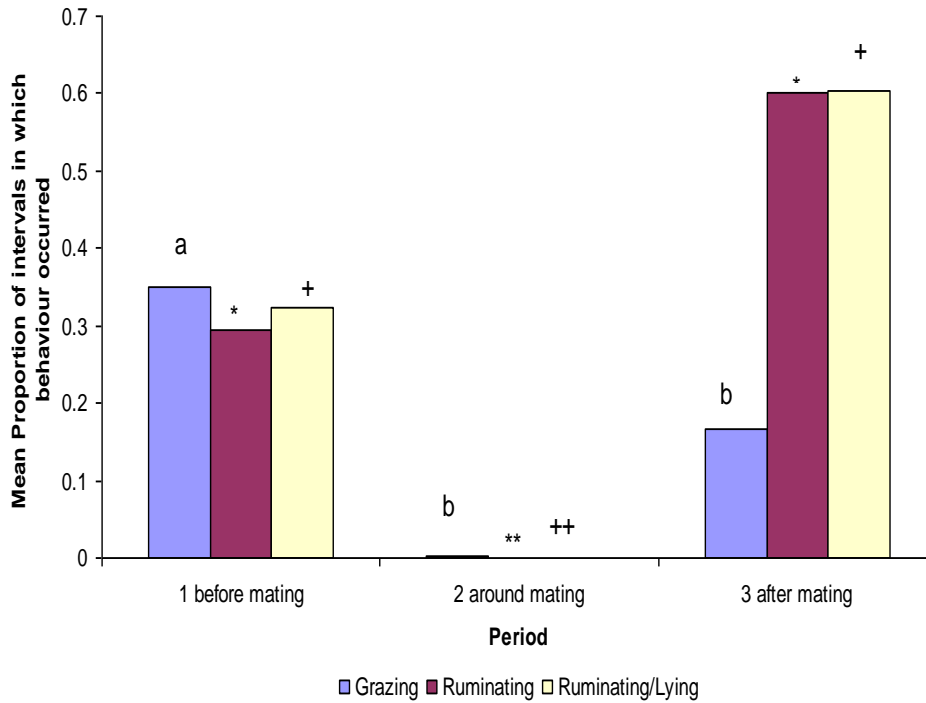


Fig ( 3 ) Feeding by fallow deer before, during and after mating

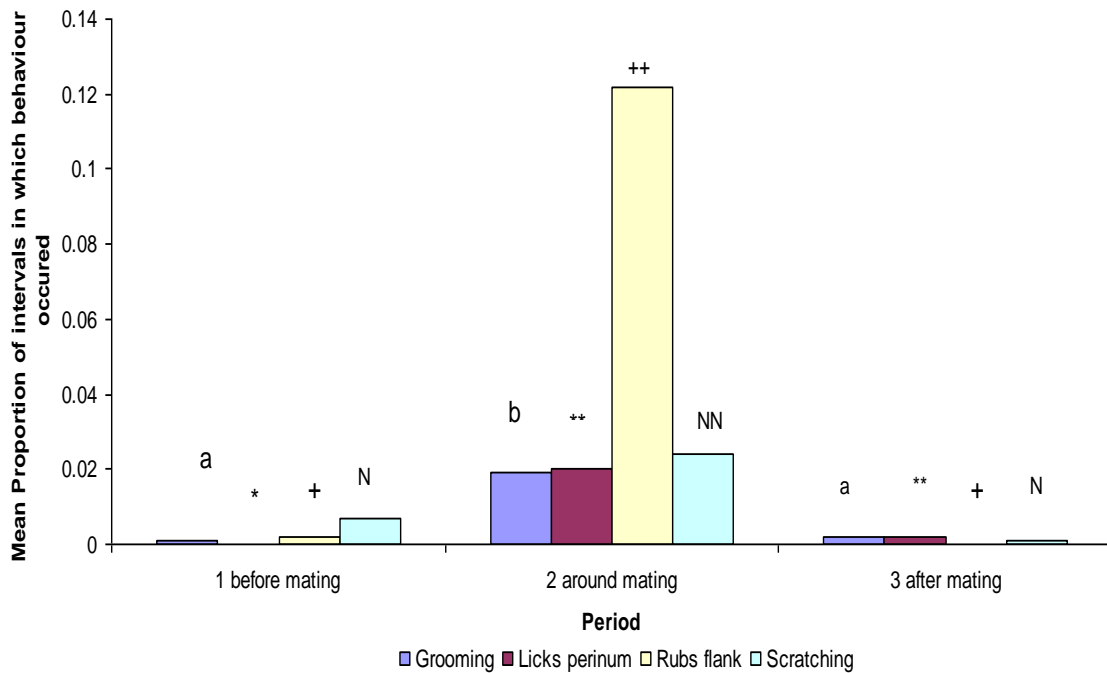


Fig (4) Auto-grooming by fallow does before, during and after mating



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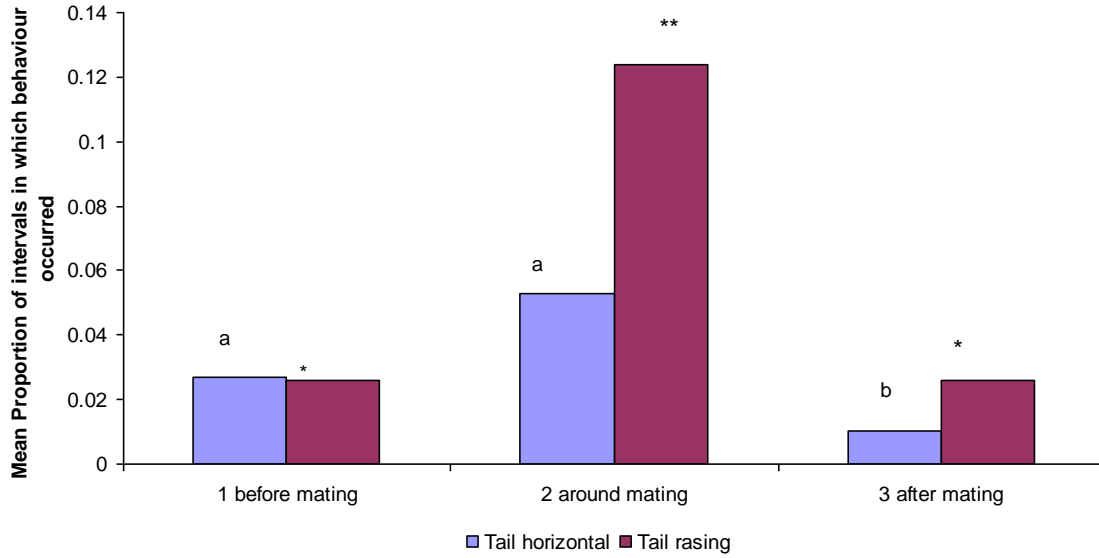


Fig (5) Tail posture of fallow does before, during and after mating

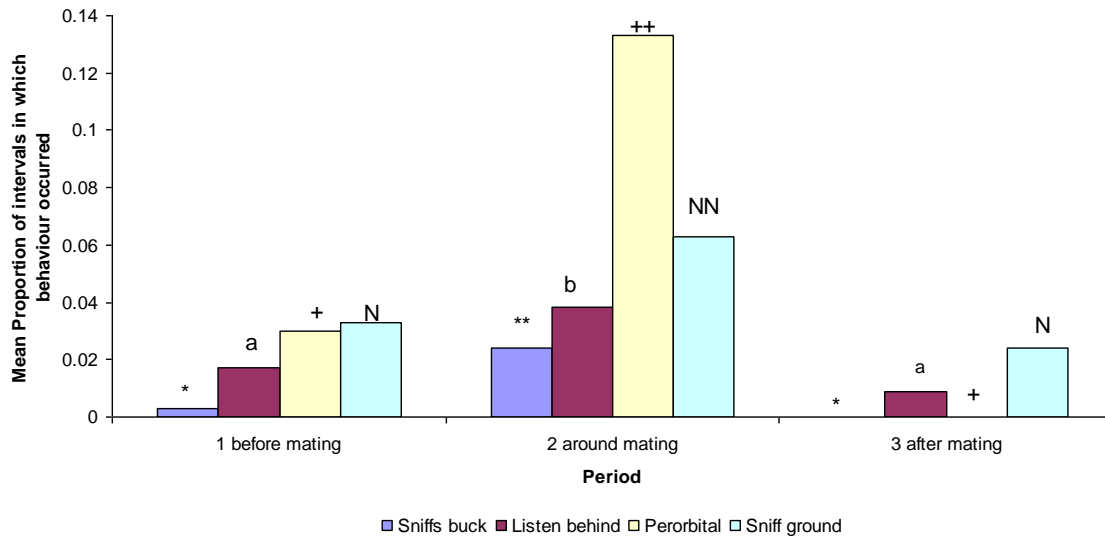


Fig (6) Communication by fallow does before, during and after mating



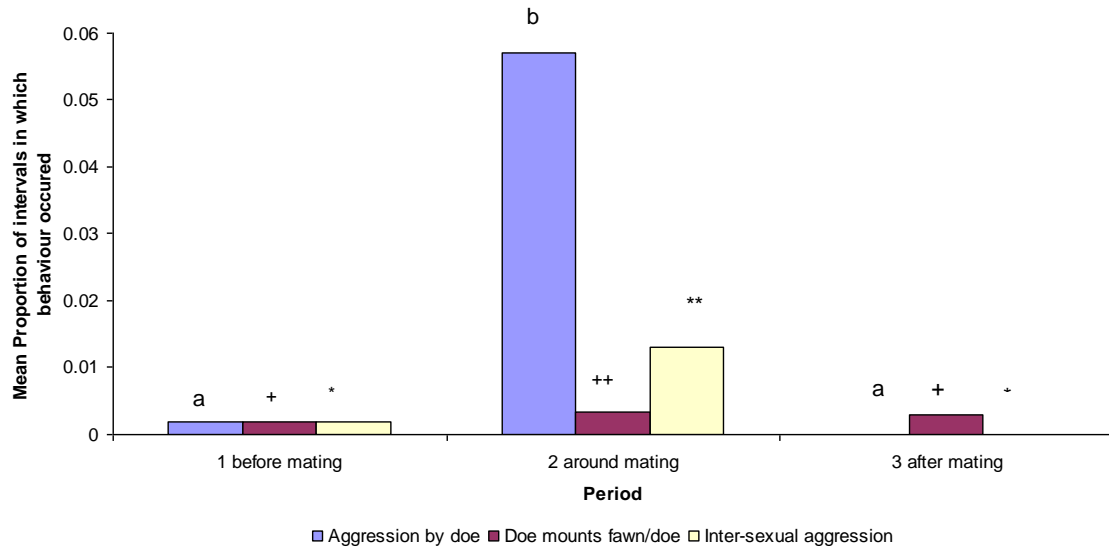


Fig (7) Intrasexual aggression of fallow does before, during and after mating

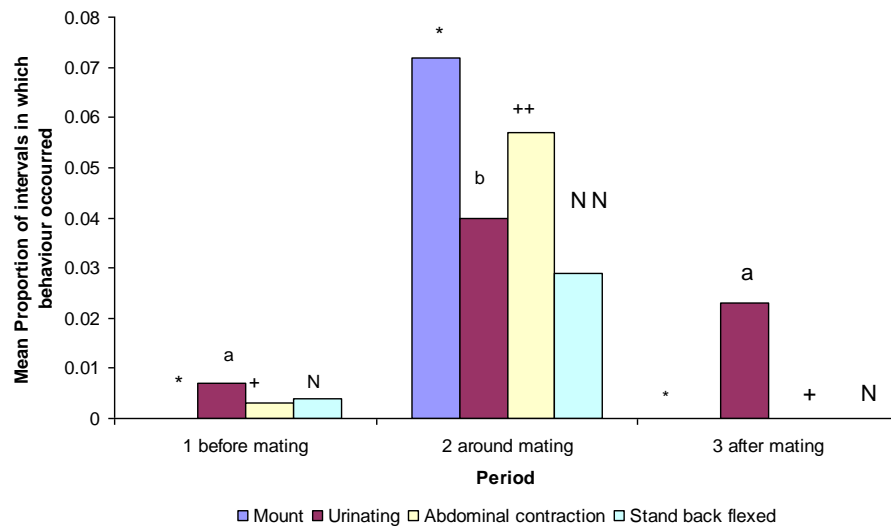


Fig (8) Mating and other behaviour of fallow does before, during and after mating