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Ram Mating Behaviour under Different Social Conditions

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ABSTRACT : The present study was conducted to investigate the attributes of ram sexual behaviour under different social conditions. Six intact rams and eight ovariectomized ewes were used in this experiment. Ewes were artificially brought into oestrus. All mating traits were recorded every 10 sec during a 1 h mating session under five social conditions *viz*., ram exposed to single oestrus ewe, ram exposed to single oestrus ewe and audience ram, ram exposed to multiple oestrus ewes, ram exposed to single oestrus ewe with competitor ram and ram exposed to multiple oestrus ewes with competitor ram. Mean intensity of the mating activities during the 1 h mating session under five social conditions was compared. Either vocalization or leg kicking was found to be the predominant teasing activity under all five conditions. Sniffing differed significantly ($p<0.05$) between different social conditions. Vocalization, leg kicking, and leg kicking with vocalization did not differ significantly ($p<0.05$) between different social conditions. Mounts/h in the multiple oestrus ewe condition was higher and differed significantly ($p<0.05$) from other social conditions. Ejaculations/h for the experimental ram was higher when exposed to multiple oestrus ewes in comparison to other social conditions. Mounts/ejaculation was low in the audience ram condition in comparison to the other four social conditions. (**Key Words :** Mating, Ram, Social Condition, Ejaculation, Mount)

INTRODUCTION

Mating, one of the eight social behaviours reported in sheep (Scott, 1945), is a result of the interaction of physiological, neural, genetic, nutritional, climatic and age factors. Several workers have studied normative mating behaviour under pen and field condition. Due to many types of social interactions, mating performance of rams may decrease or increase. Young rams usually show low libido on introduction to a new group (Holmes, 1980). Price et al. (1994) reported that rams having lack of exposure to ewes during their early life exhibited poor sexual behaviour. It is possible that mere presence of a dominant sheep can inhibit mating behaviour of subordinates even without physical contact (Lindsay et al., 1976; Patel et al., 2005). Social position in groups of sheep is well correlated with success in a competitor mating situation (Hulet et al., 1962b). Conversely, there are some other social conditions, which will enhance the mating performance of the ram such as a new stimulus female and recently mated ram. Change of copulatory behaviour occurs when a ram is presented with a new stimulus female (Lezama et al., 2003). Daniela and Katz (1997) have reported that rams sexual performance increased when they were exposed to a recently mated ram. Kridli and Said (1999) reported that exposing sexually naïve rams to oestrus ewes before the breeding season may be necessary to improve their sexual performance. However, Price et al. (1998) reported that exposing a ram to an oestrus ewe did not affect the mating performance of the ram.

Tillbrook (1987) reported that when a ram was introduced to a number of oestrus ewe at a time, the ram displayed mating preference for a particular ewe, to the exclusion of the others. Work in New Zealand by Muir et al. (1989) concluded that social facilitation by the introduction of 10% oestrus ewes could improve the ram effect. The ram effect means the bio stimulation of the ram on reproductive physiology of the ewe. This is particularly when rams were introduced prior to the commencement of the breeding season.

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Table 1. Summary of experimental design

Social condition	Mating pen	Audience pen	Number of observations	Remarks
Social condition 1 (SC1)	One ram and one ewe	-	Four times for each ram	-
Social condition 2 (SC2)	One ram and one ewe	Audience ram: had unrestricted visual auditory and olfactory contact but with out physical interference with mating ram.	Three times for each ram	Subordinate rams were used as audience rams for dominant ram and vice versa.
Social condition 3 (SC3)	One ram and one ewe along with competitor ram	-	Three times for each ram	Subordinate rams were used as competitor rams for dominant ram and vice versa.
Social condition 4 (SC4)	One ram and four ewes	-	Three times for each ram	-
Social condition 5 (SC5)	One ram and two ewes along with competitor ram	-	Three times for each ram	-

Thus, selection of rams to be used for mating should depend not only upon the genetic superiority of the ram but also on its mating ability. Selected males should have good libido; any variation in libido can have quite considerable consequences in farm economics (Nawaz et al., 1998). In light of the above facts, this work has been undertaken to study the mating behaviour and capability of rams under different social conditions. This study would be useful in optimizing the conception rate in pasture breeding.

MATERIALS AND METHODS

This study was conducted in the sheep and goat farm of the Indian Veterinary Research Institute (IVRI) with the aim to analyze the factors which affect mating behaviour of rams in a pen mating system. Six intact, healthy and sexually experienced Muzaffarnagari rams of age 2 and 3 years were selected for the study. Rams and ewes used in this study were maintained under standard feeding and management conditions. Eight healthy, sexually mature ewes of similar age and body weight were overiectomized and artificially brought in to oestrus every 6th day by using the protocol of Kilgour and Whale (1980).

The following experiments were conducted in the mating pen having an area of 4 m×3 m. Recording of mating behaviour of the ram commenced immediately after the introduction of ewe(s) in to the pen or vice versa. The observations were made every ten seconds for ongoing mating activities like sniffing, vocalization, leg kicking, vocalization with leg kicking, nudging with head, flehmen reaction, urination by ram, false mounting, mounting and ejaculation. Further, times taken for mount and ejaculation for experimental rams were also noted. The mating activities were recorded for a 60 min mating session.

Design of experiment: Details of the experimental design have been summarized in the Table 1

For SC2, SC3 and SC5 six experimental rams were randomly divided in to three dominant-subordinate pairs (R1:R2, R3:R4, R5:R6). These three pairs were assessed for the compatibility by both food competition and ewe competition tests.

Food competition test

Each pair of rams was fasted for 15-17 h prior to the start of food competition session. This time interval was chosen as being long enough to result in sufficient motivation to compete for food while not causing unnecessary stress to the animal involved (Erhard et al., 1998).

A bucket of feed was fixed in the corner of the pen, the mouth of the bucket tapered towards bottom, so that the two animals could enter their head but only one could have access to food. Before the testing, animals were allowed to familiarize to eat from the bucket. On the test day both the rams were put together into the food pen. The time spent on eating by each ram was noted using a stop clock. The clock started when the animal put its head into the food bucket and started eating, and the clock stopped when the animal left the bucket (stepped away), either voluntarily or when forced away by the opposing ram. Occasionally a ram lifted its head to chew the food and the time spent in the act was counted as eating time. The ram that first completed 5 min eating (either in single or multiple bouts) was declared dominant over the other. The same test was repeated 5 times on alternate day.

Ewe competition test

Each pair of rams was allowed to interact with a single oestrus ewe. The rams which mated first was considered as

Table 2. Mean (±SD) values of mating activities in ram exposed to ewe(s) under certain social conditions during 1 h mating session

Mating activities	Single oestrus ewe (SC1)	Single oestrus ewe with audience ram (SC2)	Competitor ram and single oestrus ewe (SC3)	Multiple oestrus ewes (Four number) (SC4)	Competitor ram and multiple oestrus ewe (Two number) (SC5)
Sniffing	12.90±7.10^{ab}	4.62±2.00^{bd}	2.03±0.73^{ac}	9.00±3.70^{cd}	0.00
	(6)	(6)	(3)	(6)	
Vocalization	65.70±28.30	20.25±12.20	4.10±1.50	53.70±31.00	2.33±0.94
	(6)	(6)	(3)	(6)	(3)
Leg kicking	19.40±19.0	10.87±8.60	6.50±0.50	22.65±21.80	0.00
	(6)	(6)	(2)	(4)	
Leg kicking with vocalization	61.40±32.20	17.70±14.00	10.15±4.70	56.12±32.55	1.83±0.23
	(6)	(6)	(4)	(6)	(3)
False mounting (Fm)	1.88±0.78	1.00±0.00	0.00	1.54±0.43	0.00
	(6)	(2)		(5)	
Mounting (m)	9.45±7.90^{a}	3.37±2.46^{bd}	9.00±3.60^{cd}	20.99±5.48^{abc}	2.90±1.25^{a}
	(6)	(6)	(4)	(6)	(4)
Ejaculation (E)	5.58±2.01	5.99±2.64	3.16±1.65^{a}	6.77±2.16^{a}	3.66±2.16
	(6)	(6)	(4)	(6)	(3)
M/E = Fm+m/E	1.99±1.08	0.79±0.47^{ab}	3.41±2.12^{b}	3.58±1.04^{a}	1.94±1.20
	(6)	(6)	(4)	(6)	(3)

Figures in parentheses indicate number of rams that showed activity.
Means with same superscript with in a row vary significantly ($p<0.05$).

dominant to the other. The test was repeated 5 times on separate days to find out the consistency of the relationship. The ewe was restrained to minimize the ewe activity during testing.

The five social conditions viz., SC1, SC2, SC3, SC4 and SC5 were then compared for mating activities like sniffing, vocalization, leg kicking, leg kicking with vocalization, false mounting, mounts, ejaculation, mounts per ejaculation during 1 h.

Statistical analysis

Square root transformation (x+1/2))was done for raw data before analysis (Steel and Torrie, 1960), but any activities having zero were treated as zero after transformation. The recorded parameter in different replications for individual ram was averaged and mean values of particular parameter for each ram were utilized for analysis. ANOVA and DMRT were applied to test for significant differences in mating activities between the social conditions.

RESULTS

Mating activities of rams during five social conditions

Values (Mean±SD) of mating activities in rams exposed to ewe(s) under five social conditions during 1 h mating session are presented in Table 2. The mean value of sniffing varied significantly ($p<0.05$) between social conditions. The mean values of teasing activities like vocalization, leg kicking and leg kicking with vocalization did not differ significantly ($p>0.05$) between social conditions. Based on the above results, it can be concluded that courtship activities like sniffing, vocalization, leg kicking were higher when a single ram was exposed to ewe(s) i.e. either single or multiple ewes (SC1 and SC4) in comparison to the condition where a competitor ram was present inside or outside the mating pen (SC2, SC3 and SC5). Further, in comparison to single ewe, multiple ewes reduced the courtship activities of a mating ram in conditions where a competitor ram was either absent (SC1 vs. SC4) or present (SC2, SC3 vs. SC5). False mounting ranged from 0 to 1.9 when a single ram was used (SC1, SC2, SC4) and it was absent when more than one ram was used.

Mean number of mountings under SC1, SC2, SC3 and SC5 differed significantly ($p<0.05$) from that in SC4. However, the mountings numbers did not differed significantly between SC1 and SC2. Mounts/h decreased in the single ram with audience treatment in comparison to the single ram without audience treatment. For the single ram, mounts per hour became double when ewes in the mating pen increased from one ewe (9.45/h) to four ewes (20.99/h).

When dominant rams (R1, R3 and R5) viewed the subordinate ram from outside the mating pen (SC3), the number of ejaculations per hour by subordinate increased marginally and vice-verse for dominant ram in comparison to SC1. The number of ejaculations per hour were 6.58±1.90, 7.55±2.90, 4.58±1.00 and 4.32±0.42, for dominant ram under audience effect, dominant without audience effect, subordinate ram under audience effect and subordinate ram without audience effect respectively. Overall mean ejaculation/h in competitor ram conditions (SC3 and SC5) was less in comparison to SC1 but did not differ significantly ($p>0.05$). Two of the three subordinates (R2 and R4) were totally suppressed by their dominant rams.

Table 3. Mean (±SD) Introductory Ejaculation latency and Mean Post Ejaculatory Interval (min) in rams exposed to ewe(s) under certain social conditions

	Single oestrus ewe (SC1)	Single oestrus ewe with audience ram (SC2)	Competitor ram and single oestrus ewe (SC3)	Multiple oestrus ewes (Four number) (SC4)	Competitor ram and multiple oestrus ewe (Two number) (SC5)
Introductory	0.72±0.43	0.49±0.15	7.72±9.78	1.47±0.90	5.06±9.65
ejaculation latency	(6)	(6)	(4)	(6)	(3)
1st PEI	4.40±2.08	2.58±1.97	13.73±5.18	4.63±2.19	19.79±15.38
(I to II ejaculation)	(6)	(6)	(1)	(6)	(3)
2st PEI	9.21±4.08	8.22±4.5	19.16±11.34	8.47±4.47	23.06±16.35
(II to III ejaculation)	(6)	(6)	(4)	(6)	(2)
3st PEI	13.74±5.16	13.96±7.83	13.83±0.00	10.45±5.59	12.16±0.00
(III to IV ejaculation)	(6)	(6)	(1)	(6)	(1)
4st PEI	16.29±5.92	13.88±8.47	13.33±0.00	12.29±4.84	12.77±0.00
(IV to V ejaculation)	(6)	(4)	(1)	(6)	(1)

Figures in parentheses indicate number of ejaculated rams.

Table 4. Mean (±SD) Initial mount latency and Refractory period (min) for successive ejaculation when rams exposed to ewe(s) under three social conditions

Social conditions	Initial mount latency	1st Refractory period	2nd Refractory period	3rd Refractory period	4th Refractory period
Single oestrus ewe (SC1)	0.42±0.15	3.33±2.0	8.04±5.22	13.25±5.22	15.86±6.5
	(6)	(6)	(6)	(6)	(6)
Single oestrus ewe	0.37±0.08	2.48±1.89	8.05±4.48	12.79±7.5	13.76±8.32
and audience ram (SC2)	(6)	(6)	(6)	(6)	(4)
Multiple oestrus ewes (SC4)	0.50±0.22	3.60±2.28	7.31±3.85	9.22±5.08	10.34±3.86
	(6)	(6)	(6)	(6)	(6)

Figures in parenthesis indicate the number of ejaculated rams.

Overall mean ejaculation under SC4 was relatively more when compared to SC1, but did not differ significantly. Preferential mating by a ram was found among available oestrus ewes (SC4), which led to uneven distribution of mating. Mounts/ejaculation (M/E) was lowest in rams under audience effect SC2 (0.79), followed by SC5 (1.94), SC1 (1.99), SC3 (3.41) and SC4 (3.58). This shows that in SC3 and SC4 M/E value was relatively high.

Introductory ejaculation latency (IEL)

Introductory ejaculation latency (min) under five social conditions is presented in Table 3. In the absence of a competitor ram, the IEL of rams was about 1 min with single ewe (SC1, SC2) and about 1.5 min with multiple ewes (SC4). But when two rams were used simultaneously (SC3 and SC5), the IEL was greater than 5 min. Due to guarding by dominant rams, two of the three subordinates, were unable to mate in SC3 and SC5 conditions.

Post ejaculatory interval (PEI)

Mean post ejaculatory interval (PEI) in rams exposed to ewe(s) under five social conditions are presented in Table 3. PEI increased with successive ejaculations in SC1, SC2 and SC4 where a single ram was used with either a single ewe or multiple ewes. Due to the audience effect, all the PEI values in the SC2 condition were less in comparison to SC1. In conditions where two rams (SC3 and SC5) were used, Ist PEI was 3 to 5 times more than condition where single ram (SC1, SC2 and SC4) was used.

Initial mount latency and refractory period

Mean initial mount latency (min) and refractory period (min) for successive ejaculations under three social conditions (SC1, SC2 and SC4) are presented in Table 4. Mean refractory period had increased with successive ejaculation in all the three social conditions.

DISCUSSION

Mating is one of the eight social behaviours, reported in sheep (Scott, 1945). The result shows that courtship activities were higher when a single ram was exposed to ewe(s) i.e. either single or multiple ewes (SC1 and SC4) in comparison to the condition where a competitor ram was present inside or outside the mating pen (SC2, SC3 and SC5). For a single ram, mounts per hour became double when ewes in the mating pen increased from one ewe (9.45/h) to four ewes (20.99/h). The reason could be that while a ram was trying to mount a particular ewe, other ewes might disturb the ram by butting either the ram or that

particular ewe. Sometimes all the ewes formed a close and compact group and ram found it difficult to mate. Similar observations were made by Hulet et al. (1962a and b), Lindsay (1966) and Tomkins and Bryant (1972).

Overall mean ejaculation under SC4 was relatively more when compared to SC1. A greater number of stimulus oestrus ewes might cause the decrease in the refractory period with successive ejaculations leading to more ejaculations during 1 h. The present observation shows that the total number of services by a ram increased with the increase in the number of stimuli ewe, which confirms the report of Lightfoot and Smith (1968), Hulet et al. (1962a and b), Tomkins and Bryant (1972).

Mean ejaculation/h in competitor ram conditions (SC3 and SC5) was less in comparison to SC1. Low ejaculation in SC3 and SC5 could be due to fact that rams spent much time in guarding instead of mating. Three studies (Hulet et al., 1962; Lindsay, 1966; Maricowitz et al., 1966) have found a positive relationship between social dominance and mating behaviour under confined conditions. Lindsay (1966) also found an uneven relationship between dominance and mating success in that the social advantage was observed only for the performance of highest ranking animals. In contrast, Shreffler and Hohenboken (1974) quoted a study which claimed sexual inhibition of dominant rams in pens (Zenchak et al., 1973). Our result also confirms Zenchak et al. (1973) statement.

Conversely, many others have found that, despite dominance-subordinate relationship between rams, individual rams did not have significantly more or less ejaculation per observation period when they were joined as single or in groups of two or three under flock mating condition (e.g. Mattner et al., 1967, 1971, 1973; Tomkins and Bryant, 1972; Allison, 1975a, b; Allison and Davis, 1976; Tillbrook et al., 1987). This can be explained on the basis that there was sufficient space (Mattner et al., 1967, 1973; Allison, 1978; Synnot and Fulkerson, 1984) and an adequate number of oestrus ewes (Lambourne, 1956; Hulet et al., 1962; Lindsay, 1966; Synnott and Fulkerson, 1984) available for subordinate rams to avoid conflict with dominant rams. In addition, 'harems' of oestrus ewes formed around rams (Lindsay, 1966; Mattner et al., 1967; Tomkin and Bryant, 1972; Tillbrook et al., 1987) and this might have reduced the contact between rams (Mattner et al., 1967; Croker and Lindsay, 1972; Jennings, 1976).

Full suppression of subordinate performance (based on ejaculation) was observed in all the dominant-subordinate pair having adjacent social ranking with dominant ram, except one pair where subordinate succeed in ejaculation under SC5. Full suppression effect of the dominant ram on subordinates could be due to less number of oestrus ewes and limited space.

The reason for high M/E value in SC3 and SC4 condition was that the presence of a competitor ram (SC3) or additional ewe (SC4) might have disturbed the mating ram. Although there were four animals in the SC5 condition, M/E value was low (1.94). As equal number of rams and ewes were used in SC5, there might be an occasion when both rams got the opportunity to mount and ejaculate at the same time without being disturbed by other.

IEL was 0.72 min when a ram was exposed to single oestrus ewe. This value is comparable with the report of Dhillon et al. (1979), but more than the value reported by Singh et al. (1975). Singh et al. (1975) reported that time for 1st ejaculation was 0.28 min during April-June and 0.36 min during Sept.-Nov. However, when two rams used simultaneously (SC3 and SC5), the IEL was greater than 5 min, the reason for higher IEL might be due to the fact that defender ram (dominant ram) had to guard and also had to wait for the opportunity to mate.

PEI has increased with successive ejaculation in SC1, SC2 and SC4 where a single ram was used with either a single ewe or multiple ewes. This increase in mean PEI value with successive ejaculation in SC1, SC2 and SC4 confirms the results of William and Clegg (1965), Papelko and Clegg (1965a) and Bermant et al. (1969). PEI value decreased in the multiple ewes condition (SC4) compared to SC1. The reason might be that with each mating in SC1 condition, the stimulus value of the single ewe for the ram decreased (habituation effect) whereas in the multiple ewes condition (SC4) habituation was delayed.

In SC3 and SC5, the 2nd PEI was more than the 1st PEI, but subsequently the value decreased and remained constant in the 3rd and 4th PEI. The reason might be that, in the beginning of observations both dominant and subordinate rams guarded each other for ewe(s) intensely and vigorously and this continued till the third ejaculation; thereafter the subordinate ram started retreating, which might cause the reduction in 3rd and 4th PEI values.

Initial mount latency in SC2 is less compared to SC1. The reason was that the mating ram in SC2 became excited after viewing the competitor ram standing outside and directly went for mating with very little pre-courtship activities. Mean refractory period increased with successive ejaculation in all the three social conditions. It was also observed that refractory periods in SC4 were relatively less in comparison to SC1. This probably could be due to the presence of more stimulus ewes, which reduced refractory period for successive ejaculations. This agrees with the statement of William and Clegg (1965) and Bermant et al. (1969). In SC2, reduction in refractory periods were found when compared to SC1 which might be due to the fact that, after viewing the competitor ram standing outside, the mating ram reduced the time for courtship activities before subsequent ejaculation.

CONCLUSION

From the present study, it can be conclude that either vocalization or leg kicking with vocalization was found to be the predominant teasing activity. Other courtship activities were also found, but they are not conspicuous in all the mating sessions. When a competitor ram was present, both the rams spent much time in guarding instead of mating. Number of mounts/h and ejaculation/h increased when ewe number in the mating pen increased. The audience effect caused a reduction in the intensity of courtship activities. Additionally, there was a marginal increase in ejaculation/session in dominant rams and slightly decrease in subordinate rams.

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