Sexual Activity Patterns in Rams

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ABSTRACT

Behaviour was measured in reproductively experienced rams from three crossbred strains and two pure breeds (Suffolk and Finnish Landrace) in an attempt to develop a method for rapid screening of sexually aggressive rams and to measure breed differences in sexual activity. A set sequential pattern of activity need not occur in sexually experienced rams, and components of their sexual behaviour may be influenced by the estrual status of the ewe. The data indicate that the number of attempted mounts is an acceptable selection tool, with a mount following a short period of investigation most likely to be followed by coitus. Two sequential ten minute periods are sufficient for rapid screening of rams for short-term sexual activity levels.

Key words: Sexual behaviour, rams.

RÉSUMÉ

Cette étude visait à déterminer le comportement sexuel de béliers adultes qui possédaient déjà de l'expérience dans ce domaine et appartenaient à trois souches croisées, ainsi qu'aux deux races suivantes: Suffolk et Finnois Landrace. Les auteurs tentaient ainsi de trouver une façon de sélectionner rapidement les béliers sexuellement agressifs; ils voulaient aussi mesurer les différences relatives à l'activité sexuelle, propres à chacun des groupes précités.

Les béliers déjà utilisés pour la reproduction n'affichent pas toujours une approche sexuelle stéréotypée; leur comportement peut subir l'influence du stade oestral de la brebis. Les résultats de cette expérience révèlent que le nombre de tentatives de monte constitue un critère de sélection acceptable, s'il s'accompagne d'une monte ultérieure à une brève approche sexuelle et particulièrement susceptible de se terminer par un coït. Deux périodes successives de dix minutes suffisent pour déceler rapidement les béliers qui manifestent l'approche sexuelle la plus brève.

Mots clés: comportement sexuel, béliers.

INTRODUCTION

Sexual behaviour is manifested by a group of traits. In ram lambs, sexual behaviour initially occurs from nine to 20 weeks of age and is expressed in the following sequence: nose, nudge, paw, flehmen, lick, mount and ejaculate. This pattern changes with age and experience with the vomeronasal system assuming considerable importance (1). In mature rame sexual behaviour includes the courtship activities seeking and nosing (Fig. 1) (2,3) which

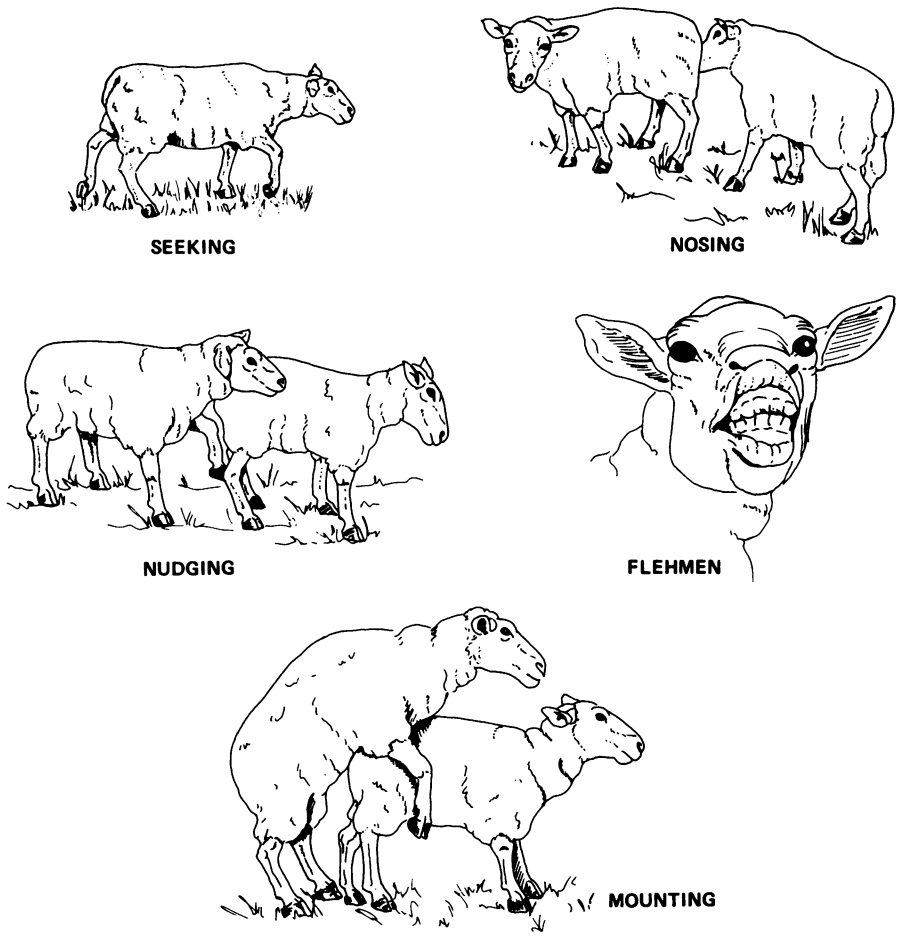

Fig. 1. Ethogram of sexual behaviour in sheep (Fabre, 1977).

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involve olfactory, gustatory and possible temperature reception by the ram, nudging, flehmen and mounts (4,5). These activities do not necessarily occur sequentially or every time.

In rams the ability to perform many completed mounts in a unit time may be innate and within wide limits may not be directly influenced by hormones (6). Thus, mating behaviour in sheep may be genetically influenced (7,8) as in other domestic animals such as the chicken (9) and bull (10). If libido is positively associated genetically with fertility/fecundity traits, genetic gains in these traits may be expected as a correlated response to selection for sexual activity. Although differences among breeds in the percentage of ewes mated during the first 14 days after exposure to teaser rams and in median lambing dates suggest that there may be genetic differences which could be exploited to select ewes, no differences in the time of onset of mating behaviour in ewes and rams were noted (11).

Considering the number of behavioural components described and the possibility of genetic influences, an experiment was undertaken to study sexual behaviour in sexually experienced rams in an attempt to develop a method for rapid screening of short reaction time breeders and to determine if breed differences in sexual activity exist.

MATERIALS AND METHODS

Rams used previously for breeding from three synthetic strains (Sire, Dam 1 and Dam 2) and two pure breeds (Suffolk and Finnish Landrace) were tested for sexual behaviour frequencies during a set time period at the Animal Research Centre. The sire strain was developed mainly from Ile de France and Suffolk breeds, the Dam 1 and Dam 2 strains contained principally Finnish Landrace, Suffolk, Shropshire, Dorset Horn and East Friesian breed contributions. Rams were from six age groups (110, 112, 114, 116, 118 and 120 weeks of age) and had been kept in sexually singular flocks with exposure to two light regimes in windowless barns during physical measurement studies (12).

Mating activity of rams (Table I) was measured in closed pens which excluded viewing other pens. Each test pen contained two different ewes which were injected intramuscularly daily with 1 mg ECP (estradiol cypionate; Tuco Products Ltd., Orangeville, Ontario) to induce estrus. Only ewes in standing estrus were used. Ewes of similar age and body size were used for the test.

TABLE I. Behaviour Component Descriptions

Behaviour	Description
Flehmen	Lip curled and head erected
Nosing	Nasal investigation of anal-genital region
Nudging	Flank, hip region of ewe physically bumped by head and/or shoulder of ram
Pawing	Front leg movements by ram, usually associated with nudging
Mount	Attempts to mount or mounts without pelvic oscillations
Completed Mount	Mounts accompanied by pelvic oscillations. Usually accompanied by penile insertion

Ewes were tested each day prior to the activity test by rams that were not to be tested. Previous studies have recommended time periods of five (13), ten (14), 20 (15,16), 60 (17,18) and 90 minutes (19) for measuring sexual behaviour in rams. For practical purposes, considering the various results obtained for different time periods, a ten minute observation period was accepted. Rams were placed singly in a pen for a ten minute observation period during which flehmen, nosing, nudges, pawing, mount attempts, completed mounts and time to first mount were recorded (Trial 1). The ram was then immediately transferred to a second pen where similar activities were recorded (Trial 2).

Data based on cumulative totals within the ten minute test period for behaviour traits were analyzed by least squares procedures (20) using a model that included breed or strain, light treatment, day of measurement, age group, observer and trial-within-observer (first or second measurement). Statistical analyses indicated that interactions were not important. Partial correlations conditional on strain, light treatment, day of measurement, age group, observer and trial/observer (Table II) were calculated to measure relationships between behaviour traits. Tests of significant differences among individual means were made using Duncan's new multiple range test (21) as extended by Kramer (22).

RESULTS

Significant differences among strains for nosings were observed, with the sire strain having the largest number of nosings and the Suffolk the fewest (Tables III and IV). The Finnish Landrace (Finnsheep) rams had 40.3% (4.70 ÷ 3.35) more nosings than the Suffolk and 25.9% (4.70 ÷ 6.34) fewer than the Sire strain. Although strain differences were nonsignificant for other behaviour traits, a pattern whereby the Finnsheep rams had 35.1%, 38.3% and 30.2% more flehmen, mounts and completed mounts respectively than the Suffolk rams, 43.2%, 62.4% and 58.7% more than the Sire strain, 54.0%, 51.1% and 39.7% more than the Dam 1 strain and 27.0%, 21.8% and 22.2% more than the Dam 2 strain was observed. For nudges the Dam 1 strain had the fewest number with the Sire strain the largest number, and the Suffolk intermediate. Finnsheep rams had 32.6% fewer nudges than the Suffolk rams, 50.6% fewer nudges than the Sire strain rams, 43.0% fewer nudges than the Dam 2 strain rams, and 16.5% more nudges than Dam 1 strain rams. The high correlations between attempted

TABLE II. Partial Correlations Between Traits[a]

	Nosing	Nudge	Mount	Complete Mount	Pawing	Time
Flehmen	0.47	0.37	0.23	0.16	0.17	0.12
Nosing		0.63	0.28	0.17	0.40	0.31
Nudge			0.34	0.21	0.75	0.46
Mount				0.92	0.31	0.44
Complete Mount					0.18	0.33
Pawing						0.40

[a]Conditional on strain, light, day, birthdate, observer and trial-within-observer
$r \geq 0.12$, $P \leq 0.05$ and $r \geq 0.16$, $P \leq 0.01$

TABLE III. Means ± S.E. for Incidence of Behaviour Traits by Strain

Strain	Number Tested	Flehmen	Nosing	Nudge	Mount	Completed Mount	Time to First Mount+* (min)	Pawing
Sire	29	0.21 ± 0.05	6.34 ± 0.56[b]	1.72 ± 0.29	0.50 ± 0.15	0.26 ± 0.10	10.11 ± 1.41	0.28 ± 0.09
Dam 1	54	0.27 ± 0.06	4.18 ± 0.33[a]	0.71 ± 0.31	0.65 ± 0.19	0.38 ± 0.13	8.06 ± 0.95	0.15 ± 0.05
Dam 2	52	0.17 ± 0.05	5.55 ± 0.42[b]	1.49 ± 0.30	1.04 ± 0.27	0.49 ± 0.15	10.78 ± 1.04	0.49 ± 0.13
Suffolk	17	0.24 ± 0.10	3.35 ± 0.87[a]	1.26 ± 0.47	0.82 ± 0.37	0.44 ± 0.27	6.80 ± 1.69	0.29 ± 0.14
Finnish Landrace	23	0.37 ± 0.10	4.70 ± 0.61[a]	0.85 ± 0.26	1.33 ± 0.52	0.63 ± 0.31	3.28 ± 1.68	0.13 ± 0.08

+Times include only those animals that did mount

*Means are calculated as $\frac{\text{Time}_1 + (\text{Time}_2 + 10)}{2}$

[a,b]Means in the nosing column with the same superscript did not differ significantly ($P<0.05$)

mounts and completed mounts, when considered with the low correlations between mounts and/or completed mounts and other activity levels (Table II), indicate that if genetic factors influence the reproductive behaviour traits in sheep there has been no direct artificial selection for specific male sexual behaviour differences among breeds. Individual differences did exist however, which indicate the potential possibility of selection within breeds.

DISCUSSION

The high number of completed mounts, and the lowest time to first mount, when considered with the lower number of other behaviour traits indicate that the Finnsheep rams are sexually agressive breeders. For screening agressive rams for potential artificial insemination (AI) semen collection, the sexual activity of a ram is influenced by the estrual state and receptivity of the ewes. Some of the low activity observed in our experiment may be due to unfamiliarity of the ram to the test situation, because some rams while not mounting ewes in estrus in the test pens mounted rams when returned to their home pens and flocks. Further support of the unfamiliarity aspect is supported by previous reports (23,24) and the observation that although not all rams showed mounting activity, all had previous breeding experience, indicating that improvements can be made in testing procedures to estimate activity for a flock situation. For a flock test situation rather than a rapid screening method improvements may include larger test areas and more test ewes, as well as a longer test time. The significant day differences for flehmen, nosing and nudge support the importance of the condition of the ewe. Partial explanation for observer differences in nosing, nudge and pawing activities may include the possible confounding of other factors (e.g. condition of the ewe, sample size) with observer differences.

In the current study mounts ranged from zero to 17 and completed matings ranged from zero to 12. For rams that mounted, time ranged from less than one minute to nine minutes for the first mount within a test period, or from less than one to 19 minutes across both trials. If a time factor cost is considered with other labour costs a short reaction time ram is desirable for breeder service.

Initial mount latency has been reported as a poor indicator of the total number of ejaculations during a 20 minute test period (25), although others (15,18) have found it to be significantly negatively correlated with fertility parameters. In the current study low correlations between time to first mount and the number of mounts and completed mounts indicate that with rams that continued the activity to the mount stage a ten minute test period is sufficient.

Observations of sexual activity patterns of individual rams showed that some rams may require the second period to become active, with other rams not responding in either trial. No differences between trials were found. Our results indicate that two consecutive ten minute test periods are adequate for identifying potential AI contributors. The difference in behaviour observed in the current two ten minute trials ($P>0.05$) except for pawing and previous experiments (15,16,17,18,19) with trials of longer duration may be due to different genetic and physical factors affecting short term and long term activities.

Mounting may lead to penile erection, pelvic oscillation, intromission and ejaculation. Although no set pattern to precopulatory-copulatory activities always occurs (1), rams may show preferences for individual ewes with individual variation in the number of mounts and matings (26). Within groups subordinate rams may form harems, although the dominance status of the ram does not appear to be related to the creation of the harems or the number of ewes contained (27). The use of two consecutive test pens each containing two ewes as described in the current study may be expected to minimize individual preferences. Although the dominant ram has the

TABLE IV. Significant differences for traits analyzed (F values)

Factor	Trait:	Flehmen	Nosing	Nudge	Mount	Completed Mount	Time to Mount	Pawing
Strain		0.81	3.19[b]	1.22	1.14	0.49	0.05	1.81
Light Trt.		3.79[a]	3.05	0.41	1.23	0.82	0.09	0.99
Day Measure		2.32[a]	2.35[a]	1.96[a]	0.59	0.57	0.80	1.20
Birth Date		1.72	0.61	0.78	2.76[a]	2.64[a]	1.06	0.99
Observer		1.74	12.95[b]	23.26[b]	0.12	0.14	0.94	35.61[b]
Trial/Observer		1.17	0.77	0.77	0.24	0.37	0.57	3.04[a]

[a]$P<0.05$

[b]$P<0.01$

greatest influence in terms of ewes served in a flock (28) the solid walls restricting vision for the sheep would reduce inhibition of activity of subordinate rams. Also ewes were not restrained, thereby allowing evasive movement on their part, which served to identify aggressive rams. Selection for less aggressive breeders may be acceptable at an AI collection depot using restrained teaser ewes or dummies.

As time may be an important factor to rapid AI semen collection, traits measured were recorded on a time basis to determine if any premounting behaviour activities could be used to identify short reaction time males. Flehmen activity ranged from zero displays to four displays by a ram during any test period. Support for the vomeronasal aspects of flehmen activity (29) is presented in the observation that such activity almost always occurred after the ram had investigated urine from the ewe. Pawing behaviour may not be totally sexual however, as it led to aggressive activity by the ram on several occasions. In the current study, when flehmen, pawing, nosing or nudging activity occurred frequently or over an extended time within a ram's test period, there was a long reaction time or complete lack of mounting.

Correlations between traits indicate that nosing may be partially an investigation for identification and does not always lead to mounts. However, nosing may lead to nudges, which occasionally lead to a mount and completed mating. If a successful mount occurs there will often be coitus. The pawing behaviour is not entirely aggressive, as it leads to a nudge more often that nosing activity, often occurring after nosing investigation has occurred and nudging has started.

There does not appear to be a reasonable biological explanation for the difference among age groups in mounts and completed mount activity, since it would be expected that a two month difference in age would be negated over a two and one-half to three year period. As the primary sexual trait of interest for potential breeder selection is completed mounts, with relatively low correlations between completed mounts and nosing, nudging or pawing observed in the current study, one may possibly conclude that for practical purposes differences in nosing, nudging and pawing behaviours may not be of major importance to the breeder.

Similarly, no acceptable explanation for the significant difference in pawing activity due to previous light treatment is, at present, biologically possible.

The current study has described a new approach for rapidly screening rams which allows one to select aggressive breeders with a short reaction time. The test is simple and may be used by the producer to select a ram out of a flock of rams. For increasing genetic gain the use of AI methods has great potential, but further studies are required to determine if genetic relationships between short reaction time and economically important traits exist. Thus the two consecutive ten minute trials should serve to select short reaction time breeders.

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REFERENCES

1. **THWAITES CJ.** Development of mating behaviour in the prepuberal ram. Anim Behav 1982; 30: 1053-1059.
2. **FABRE C.** Étude du comportement sexuel mâle induit par traitement aux hormones stéroides chez la Brebis adulte ovariectomisée. Thèse de Doctorat 3° cycle, Université de Paris VI. 1977.
3. **PELLETIER J, SIGNORET JP, CAHILL L, COGNIE Y, THIMONIER J, ORTAVANT R.** Physiological processes in oestrus, ovulation and fertility of sheep. Management of Reprod Sheep and Goats Symp. Madison, Wisconsin: Univ. Wisconsin, July 24-25, 1977.
4. **BANKS EM.** Some aspects of sexual behavior in domestic sheep, *Ovis aries*. Behav 1964; 23: 249-279.
5. **PRETORIUS PS.** Mating behaviour of rams. J S Afr Vet Med Assoc 1972; 43: 155-161.
6. **LINDSAY DR.** Mating behaviour in sheep. Tomes GJ, Robertson DE, Lightfoot RJ, Haresign W, eds. Sheep breeding. London: Buttersworth, 1979: 473-479.
7. **KILGOUR RJ, BLOCKEY MAdeB.** Selection for fertility in rams and bulls. Proc Aust Soc Anim Prod 1980; 13: 56-57.
8. **MATTNER PE, BRADEN AWH, GEORGE JM.** Ram libido. CSIRO Anim Phys Ann Rep 1973-1974: 3.
9. **BERNON DE, SIEGEL PB.** Mating frequency in male chickens: Crosses among selected and unselected lines. Genet Selec Evol 1983; 15(3): in press.
10. **BLOCKEY MAdeB, STRAW WM, JONES LP.** Heritability of serving capacity and scrotal circumference in beef bulls. J Anim Sci 1978; 47 (Suppl): 253-254.
11. **KNIGHT TW, DALTON DC, HIGHT GK.** Changes in the median lambing dates and lambing pattern with variation in time of joining and breed of teasers. NZ J Agric Res 1980; 23: 281-285.
12. **SHRESTHA JNB, FISER P, LANGFORD GA, HEANEY DP.** Environmental factors affecting testicular measurements of growing rams housed in total confinement. Can J Anim Sci 1983; 63: 835-847.
13. **MICKELSEN WD, PAISLEY LG, DAHMEN JJ.** Seasonal variations in scrotal circumference, sperm quality, and sexual ability in rams. J Am Vet Med Assoc 1982; 181: 376-380.
14. **LAND RB, SALES DI.** Mating behaviour and testis growth of Finnish Landrace, Tasmanian Merino and crossbred rams. Anim Prod 1977; 24: 83-90.
15. **MATTNER PE, BRADEN AWH, GEORGE JM.** Studies in flock mating of sheep. 4. The relation of libido tests to subsequent service activity of young rams. Aust J Exp Agric Anim Husb 1971; 11: 473-477.
16. **PEPELKO WE, CLEGG MT.** Studies of mating behaviour and some factors influencing the sexual response in the male sheep *Ovis aries*. Anim Behav 1965; 13: 249-258.
17. **BERMANT G, CLEGG MT, BEAMER W.** Copulatory behaviour of the ram, *Ovis aries*. I: A normative study. Anim Behav 1969; 17: 700-705.
18. **WINFIELD CG, CAHILL LP.** Mating competency of rams and flock fertility. Appl Anim Ethol 1978; 4: 193-195.
19. **LINDSAY DR, DUNSMORE DG, WILLIAMS JD, SYME GJ.** Audience effects on the mating behaviour of rams. Anim Behav 1976; 24: 818-821.
20. **HARVEY WR.** Least squares analysis of data with unequal subclass numbers. US Dept Agric ARS-20-8. 1960.
21. **DUNCAN DB.** Multiple range and multiple F tests. Biomet. 1955; 11: 1-42.
22. **KRAMER CY.** Extension of multiple range tests for group correlated adjusted means. Biomet 1957; 13: 13-18.
23. **KILGOUR RJ, WHALE RG.** The relation between mating activity of rams in pens and subsequent flock mating performance. Aust J Exp Agric Anim Husb 1980; 20: 5-8.
24. **KILGOUR RJ, WILKINS JF.** The effect of serving capacity of the ram syndicate on flock fertility. Aust J exp Agric Anim Husb 1980; 20: 662-666.

25. **WINFIELD GG, KILGOUR RJ.** The mating behaviour of rams in a pedigree penmating system in relation to breed and fertility. Anim Prod 1977; 24: 197-201.
26. **JENNINGS JJ.** Mating behaviour of rams in late anoestrus. Ir J Agric Res 1976; 15: 301-307.
27. **CROKER KP, LINDSAY DR.** A study of the mating behaviour of rams when joined at different proportions. Aust J exp Agric Anim Husb 1972; 12: 13-18.
28. **FOWLER DG, JENKINS LD.** The effects of dominance and infertility of rams on reproductive performance. Appl Anim Ethol 1976; 2: 327-337.
29. **O'BRIAN PH.** Flehman: its occurrence and possible functions in feral goats. Anim Behav 1982; 30: 1015-1019.