

THE MATING BEHAVIOUR OF RED DEER

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INTRODUCTION

Although the behaviour of wild red deer has been comprehensively described (Clutton Brock *et al* 1982), there is little information available to veterinarians and farmers about the mating behaviour of captive deer during the rut (Bray 1979 a and b.) In the study reported here, a small herd of red deer was closely observed in order to discover the social and sexual interactions between individuals and to produce a reliable description of mating behaviour.

This paper summarises hind social behaviour and the pattern of stag-hind courtship in single-sire mating regimes, and should serve as background to the instructional video now available.

METHODS

Groups comprising 16 hinds in 1983, 21 hinds in 1984 and 24 hinds in 1985 were monitored during the rut at the Massey University Deer Unit, Palmerston North, from the day a single stag was introduced until five days had elapsed from the last observed mating. All hinds were individually identified by ear tags, or symbols spray-painted onto the flanks. Watches were maintained from 0500 to 2200 hrs in 1983 and 1984, but reduced to 0600 (dawn) to 1830 (dusk) in 1985. Observers were seated in a caravan immediately outside the paddock, and all parts of the paddock were visible. The deer were habituated to cars, and were not disturbed by the changeover of observers.

In 1983 the activity of each hind and the stag was scored every ten minutes. Subsequently, only the stag time-budget was recorded in this way. Whenever the participating hinds could be identified, aggressive encounters were noted and the winner recorded. All occurrences of sexual behaviour were scored as they happened.

In 1983 and 1985 many of the sexual encounters were filmed.

RESULTS

In all, 1158 hours of observation were logged over three seasons; 465 in 1983, 237 in 1984, and 456 in 1985.

(1) The social behaviour of hinds

Interactions between females were predominantly aggressive, involving non-contact head threats, kicking, biting, and bipedal boxing. The loser was identified as the animal running or walking rapidly away from an aggressor, as the animal displaced from sitting, or as the animal adopting appeasement postures such as a long, stretched neck.

These aggressive encounters were unidirectional, leading to a social hierarchy in which hinds dominated others below them in the rank order but were subordinate to higher ranking females.

In all years, the rank order of hinds was positively and significantly correlated with their bodyweight measured at the onset of the rut. The heaviest hinds were dominant over lighter hinds.

(2) Courtship and mating behaviour

A total of 53 copulations were observed, involving four stags. A consistent courtship pattern emerged, comprising six rather stereotyped actions grouped into four temporal phases.

During the first or inspection phase, the stag approached sitting and standing hinds and sniffed their faces, flanks or perineums. If a hind urinated in response to a stag's olfactory investigation, flehmen frequently followed. Individual hinds were singled out from the group during short chases by the stag..

Chasing activity escalated during the second phase of courtship. The focal hind was chased up to 30 metres from her initial position by the stag running behind with his head low and tongue extended. Repeated bouts of chasing were often punctuated with roaring by the stag. (Figure 1)

The onset of the third courtship phase was marked by the performance of low-mounting behaviour by the stag, in which he mounted the hind but did not copulate with her. This activity was repeated several times, often interspersed with riding by the hind. Hinds were observed to repeatedly chin and mount the stag during this phase, descending to stand behind him, resting or pushing the head against his hindquarters. (Figures 2 and 3)

Copulation took place in the fourth and final phase of courtship. During copulation a hind adopted a hunched posture, and the stag completed service in a vertical position with the hind feet momentarily off the ground. Immediately afterwards, hinds squatted and urinated. This squatting posture was not normally adopted during urination, and was not performed following low-mounts. (Figure 4)

(3) Timing of courtship sequence and copulation

The mean time before copulation at which each activity first appeared is shown on Table One.

TABLE ONE

ACTION	HOURS BEFORE MATING
sniff-approach by stag	22
short chase by stag	17
long chase by stag	6
low mount by stag	45 mins.
mount by hind	20 mins.
copulation	-

In 11 (28%) cases over all years, hinds were mated two or three times in one oestrus interval.

Of the 29 matings observed in 1983 and 1984, 26 (90%) took place between 0600 and 1800 hrs. This provided the rationale for the reduced observation periods in 1985. In 1985, 18 (75%) of the hinds were seen to be mated during the dawn-to-dusk watches.

Figure 1



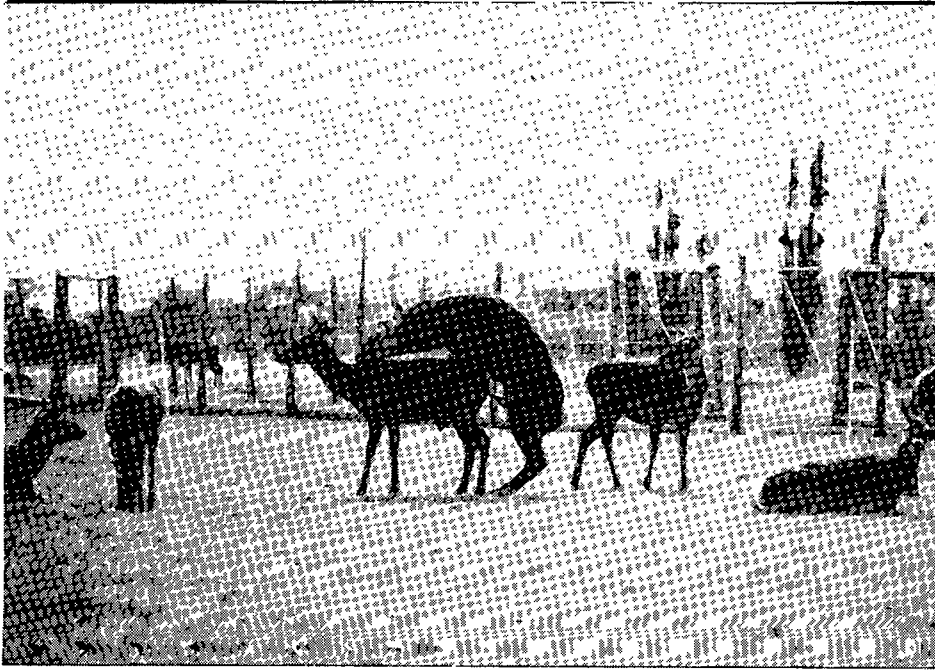
A short chase by the stag during the inspection phase of courtship. Longer chases occurred as the first phase of courtship progressed.

Figure 2



The hind mounts the stag during the third courtship phase.

Figure 3



"Low mounting" by the stag during the third phase of courtship. This is a non-ejaculatory mount posture. Note the head extended forward and the centre of gravity of the stag. Little weight is borne by the hind.

Figure 4



Copulation. (The stag has been outlined to improve clarity). The stag thrusts forward with feet off the ground and nose pointed skyward.

(4) *Non-copulatory mounting by stags*

Low-mounting behaviour preceded 46 (87%) of the observed copulations, and accounted for a high proportion of all stag mounting activity observed during the study. As shown in Table Two below, the ratio of mounts to services ranged between 4.0 and 7.8. Since the conception-to-first-service ratio for hinds observed to be mated in 1983 was over 80%, there was no evidence that non-copulatory mounts were pathological.

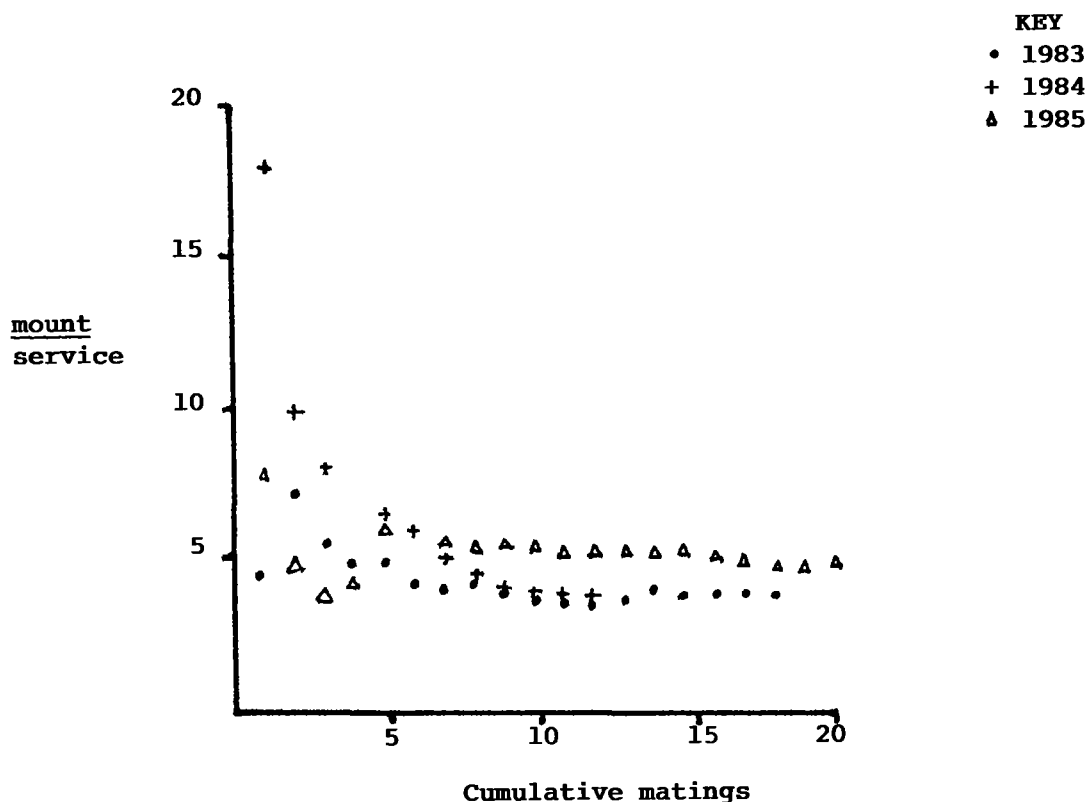
The low rate of conception measured in 1984 when a similar degree of low-mounting activity took place illustrates the need to be wary of using behavioural indicators of infertility.

TABLE TWO

SEASON	1983	1984	1985
HINDS	16	21	24
NON-COPULATORY MOUNTS	71	34	163
COPULATORY MOUNTS	18	11	24
TOTAL	89	45	187
% NONCOPULATORY	$\frac{71}{89} = 79.7\%$	$\frac{34}{45} = 75.5\%$	$\frac{163}{187} = 87.2\%$
MOUNT/SERVICE	$\frac{89}{18} = 4.9$	$\frac{45}{11} = 4.0$	$\frac{187}{24} = 7.8$
CONCEPTION/SERVICE	$\frac{10}{12} = 83\%$	$\frac{3}{9} = 33\%$?

If the mount-to-service ratio is calculated for each observed copulation accumulated by a stag, an initial tendency to perform repeated low-mounts is shown. See Figure Five. After a settling-in period of up to 5 services, the mount/service ratio steadies between 4.0 and 6.0. This indicated that 4 to 6 low-mounts are typically performed before copulation.

FIGURE FIVE



Should the graphed line begin to climb, there is evidence that the stag is not completing courtship with copulation.

The shortest inter-service interval measured during the study was 13 minutes. Inter-service intervals ranged from 13 to 404 minutes, with a mean of 210 mins (n=24).

High ranking hinds were low-mounted as often as hinds of low rank (Mann-Whitney U test), so that stags did not appear to be discriminating in their performance of low-mounting.

(5) Hind riding activity

Hinds rode the stag before 40 (75%) of the matings. In those cases, an average of 4 female mounts was performed.

Hinds also rode other hinds infrequently, with no discernable pattern.

Rank order did not affect the likelihood that hinds would ride the stag (Mann-Whitney U test).

(6) Order of Mating

A significant positive correlation between social rank and order of mating was discovered in 1983 and 1984, but was not exhibited in 1985.

DISCUSSION

Although affiliative behaviour between hinds was observed, the bulk of hind-hind interactions were agonistic and led to a linear social hierarchy. The correlation between rank order and bodyweight must not be interpreted as cause and effect, but does provide deer farmers with a useful diagnostic tool. If the weights of all hinds in a group are ranked from low to high, it is almost certain that the social rank of an individual is the same.

The sequence of courtship behaviour described above may be treated as definitive for red deer. No new patterns of behaviour were detected in the second and third years of the study, in spite of using different stags. This behaviour has been illustrated in a video film available from the author.

Red deer tend to mate in daytime, and about a quarter of hinds are repeatedly mated. This is a hopeful sign for deer farmers planning to exploit artificial insemination with a teaser stag.

It is normal for mating to be preceded by several non-copulatory mounts, called low-mounts. Usually, a steady-state mount/service ratio is reached after 5 services. If low-mounting points to sexual exhaustion (Bray and Kelly 1979, Bray and Moore 1983), then the mount/service ratio should rise with successive matings. This did not happen during the study reported here, and was the reason for asserting that non-copulatory mounts were a normal part of courtship (Veltman and Dudley 1983).

If a hind is observed riding the stag, it is certain that she is in oestrus. However, no useful generalizations may yet be made about female-female riding behaviour.

Unfortunately the early discovery of a social rank effect on mating behaviour was contradicted by the 1985 results. It should be noted that hinds of all ranks do not interact with equal frequencies, and that larger groups of hinds support subgroups of more and less socially involved animals (Dudley 1983). There may be influences other than social rank on female sexual behaviour.

SUMMARY

1. Detailed observation has shown that four phases of courtship lead to copulation in red deer.
2. Non-copulatory mounts are a frequent and normal precursor to courtship.
3. Hinds seen riding the stag are definitely in oestrus, but not all hinds exhibit this behaviour.
4. Red deer tend to mate in daytime.
5. A video film illustrating red deer sexual behaviour is available from the author.

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