

OBSERVATIONS OF SEXUAL BEHAVIORS IN GOATS (*CAPRA HIRCUS*) RAISED ON NON-PROFESSIONAL FARMS

Corneliu GAȘPAR, Luminița-Iuliana AILINCĂI* and Adina-Ximena DODAN

Iași University of Life Sciences, Faculty of Veterinary Medicine, Public Health Department,
8, Mihail Sadoveanu Alley, 700489, Iasi, Romania; e-mail: cgaspar@uaiasi.ro; adinadodan1@gmail.com

*Correspondence: lailincai@uaiasi.ro

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ABSTRACT. This study focuses on monitoring the sexual behaviours of male and female goats (*Capra hircus*) at each stage of mounting and observing sexual reflexes and related peculiarities. The ethological behaviours of females and males were observed twice per day, between 6:00 and 8:00 a.m. and between 19:00 and 21:00 p.m., and the anatomical parts of females in estrus were inspected and scanned. Each mount was recorded using a video camera. A digital timer was also used to record the stages of sexual act (prelude and copulation). The sexual behaviours of a common breed of goats reared in non-professional holdings was studied in August, September and October 2020 and 2021. Sexual behaviour was observed in a total of 24 goats, 5 males, aged 3–8 years, and 19 females, aged 1–10 years, raised in a rural area (Priponesti) in Galati County. The data gathered provide details of the sexual behavior of this species, supplementing the information currently available. The most numerous mounts were carried out by the 4-year-old buck (M1 male)

with 7 out of 20, representing 35% of the total mounts observed. The mount was characterized by very high duration of courtship (average 98%) compared to the true mounting (average 2%) ($p < 0.05$). The postlude behavioural manifestations observed were bucks continuing to inspect the anogenital area of the female, wagging their tongues while the goats expressed a characteristic bleat.

Keywords: sexual behavior; goats; true mounting; courtship; non-professional farms.

INTRODUCTION

Goats (*Capra hircus*) are thought to have the widest ecological range of all domestic animals, ranging from tropical rainforests to dry deserts where sheep cannot survive. Goat farming is an economically significant activity. Knowledge of the behaviour of these ruminants has contributed to their



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successful domestication, as well as to their management in captivity, both extensively and intensively (Katz, 2007). Mating is triggered by the onset of oestrus in the female and the activation of sexual behaviour in the male. Initial copulations are centered mainly in the first part of estrus, with repeats occurring in the latter part (Broom and Fraser, 2015). In this species, raised in temperate areas, photoperiod is the main factor responsible for seasonal sexual activity (Bedos *et al.*, 2016). As light decreases and the daily dark period lengthens, the breeding period in goats begins. This is seasonal, manifesting both oestrus behaviour and cyclic ovarian activity, so that females ovulate on short days rather than long days (Pellicer-Rubio *et al.*, 2007). During the transition between these two distinct periods, goats may undergo anovulatory oestrus (Fatet *et al.*, 2017). Signs of oestrus are characteristic of each species individually, but there are also variations between individuals (Fabre-Nys, 2000). Contact with a male goat induces an immediate LH surge followed by ovulation in anestrus goats (Houpt, 2018).

The buck is primarily noted for its increased libido and sexual vigour. Prior to mating, the buck engages in several distinct behaviors that together constitute courtship behaviour. It is common for male goats to get an erection and urinate towards their front legs, beard and hair. This behaviour, although not frequently displayed during courtship, may play a role in this process (Longpre *et al.*, 2011). While various functions have been attributed to self-enurination, including the function of increasing the intensity of the buck's

specific odour, the behaviour most commonly occurs when male goats are not allowed to breed in situations of sexual frustration (Fritz, 2017). Homosexual behaviour, in both females and males, is often observed in animals that are kept together for a long time (Broom and Fraser, 2015). There are studies that associate homosexual behaviour with social hierarchy (Ungerfeld *et al.*, 2014), so in males this behaviour is correlated with leadership status (Dagg, 1984). The hypothesis of this study was based on the observation of the characteristic manifestations of sexual behaviour and the quantification of the length of courtship and mounting in goats (*Capra hircus*) and its statistical evaluation ($p < 0.05$), as well as highlighting possible non-characteristic manifestations (autofelatio, etc.), as potentially less-known elements in the evaluation of sexual behaviour in this species. Thus, the objectives of the work were to monitor each stage of mounting in terms of behavioural, physiological and morphological manifestations in both sexes and in regards to the time and frequency spent by males in the mounting process (courtship and true mounting).

MATERIALS AND METHODS

The research was carried out in August, September and October 2020 and 2021, by observing the characteristics of the sexual behaviour of 5 males ($n = 5$), aged 3–8 years, and 19 females ($n = 19$), aged 1–10 years, on a non-professional farm in Priponești, Galati County. The study was carried out during these months since the sexual cycle of goats is seasonal, i.e., it takes place at a certain time of the year. August, September and October are the most

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favourable months for mating, as the onset of heat is influenced by light (heats start in August, when daylight begins to decrease). The bucks were reared and kept with the goats not only during the breeding season but all year round, so a natural free-ranging system was used. The materials needed were a camera, digital timer, farmer's books and diary for self recording. Ethological behaviours of both sexes at each stage of sexual act were observed by time intervals, twice per day, between 6:00 and 8:00 a.m. and between 19:00 and 21:00 p.m. The anatomical parts of females in estrus were inspected and scanned. Each mount was photographed and filmed and timing the stages of sexual act (courtship and true mounting) was recorded. The video camera made it possible to keep precise track of the time the males spent in each stage of the copulatory act, while the photos taken during the study made it possible to highlight the morphological and physiological signs of the females in oestrus and to capture representative elements of sexual behaviour in both sexes with a focus on the peculiarities of the sexual reflexes in the males. Observations were made on the ethological behaviours in bucks during all stages of sexual act (approach, erection, jumping, ejaculation), their time spent in courtship and true mounting and morphological, physiological and behavioural changes before and during mounting in females. Ethological behaviour was observed in both sexes during courtship, true mounting and postcopulation, which is detailed in the results and discussion by subchapters (Sexual behavior of males; Sexual behavior of females; Courtship; True mounting; Postcopulation). The mean values were calculated in Excel and interpreted using Student's t-tests (two-sample t-test with equal variance) ($p < 0.05$); the standard deviation and p-value were also calculated for the means of the parameters analysed (time of courtship and true mounting). (According to the Agreement of the Ethics

committee of the Faculty of Veterinary Medicine in Iași, University of Life Sciences, no. 2022/28.11.2022)

RESULTS AND DISCUSSION

Sexual behavior of males

Males responded to the estrus signals of the goats with representative behaviours; the most common behavioural signs observed in males courting females (*Figure 1*) were primarily nazo-genital contact and licking the anogenital region of the female.

After performing these actions, male goats extended their heads upwards and pulled back their upper lips (which is called the Flehmen response), which is a behavior observed in all males. All bucks also urinated on their own forelimbs, neck, beard and snout, then vigorously shook their bodies to spread the urine over the entire body surface to present attractive olfactory cues to females. It is likely that this behaviour serves a social purpose since it is frequently displayed even in the absence of females, which is also described by Delgadillo *et al.* (2004). Another intriguing behaviour observed only in some males was unfinished autofellatio during foreplay, a behaviour observed in four of the five males. It was also observed independent of courtship, being noticed after males urinated or simply as a sign of frustration when they were unable to mate.

Table 1 describes the characteristics of the sexual reflexes observed in the bucks used in this study.



Figure 1 – Courtship behaviour in bucks - upper lip curl (Flehmen response) and self-satisfaction behaviour (Autofellatio)

Table 1 – The particularities of sexual reflexes in bucks

Stages of sexual act	Stage description
Approaching	All bucks chased the females in heat, then olfactorily inspected their anogenital region, performing the Flehmen response. Except M5, all males licked the genital region of the goats after prior olfactory inspection. All males urinated on their own forelimbs, neck and beard. Autofellatio was observed in 4 of the 5 males (M1, M3, M4 and M5) with F3, F12, F13 and F16 females.
Erection	Ranged from 20 seconds (M2 with F10 and M5 with F16) to 3 minutes (M1 with F1 and F9), with a mean duration of 75 seconds.
The jumping	Males adopted the specific “a tergo” position an average of four times before intromission occurred.
Ejaculation	Occurred after an average of six–seven copulatory movements. The fewest movements were made by M2 with F2 and F5 (two movements), and the most were by M1 male with F7 (13 movements).
Precopulatory time	Ranged from 1 minute (M4 with F6) to 10 minutes (M2 with F17 and M3 with F19), with an average of about 5 minutes.
Copulation time	Ranged from 2 seconds (M2 with F2 and F5) to 9 seconds (M1 with F7), with an average of 4.7 seconds.

Note: Male (M1, M2, M3, M4, M5), Female (F1, F2, F3, F5, F6, F7, F9, F10, F12, F13, F16, F17)

Sexual behavior of females

The main signs of oestrus in goats were frequent bleating, holding the tail up and violently moving it, searching for a male, frequently urinating in small quantities stimulated by the presence of males, taking the mounting position allowing the male to perform intromission, oedema of the vulva and the presence of heat mucus, which was found in 5 of the 19 females and in most

cases had the following characteristics: clear and stringy at the beginning of the heat, after which it became thicker and sticky, opaque and sometimes milky (*Figure 2*). Homosexual activity was often observed (F4, F8, F19 and F20) and consisted of mounting other females. F1, F3, F4 and F15 initially rejected males, displaying more aggressive behavior than the other females. In the case of the last-

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mentioned females, early age or inexperience was not associated with a longer period of mounting acceptance. However, the response of goats to olfactory cues emitted by male pheromones depended on their previous sexual experience since buck pheromones stimulated the occurrence of oestrus signs more in sexually experienced goats than in inexperienced goats (Delgadillo, 2012). The characteristics of sexual behavior observed in goats are shown in *Table 2*.

Courtship

Courtship, defined as any activity that was spent in advance of true mounting, lasted between 2 minutes (M2) and 10 minutes (M4), accounting for the largest percentage of the total duration of the copulatory act, especially when it preceded the first intromission, with a range of 92–99% and an average of 98% (*Figure 3*). The time of courtship and true mounting in the observed mounts was recorded (*Table 3*).

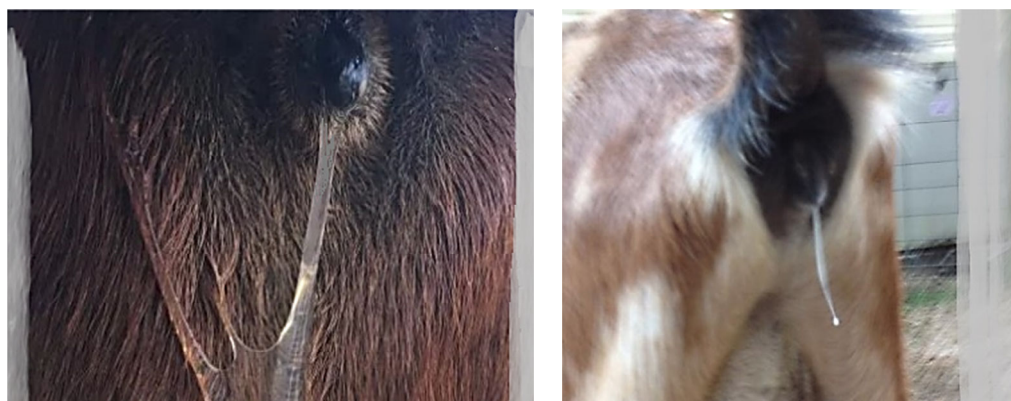


Figure 2 – Vaginal discharge in goats – Clear, stringy and milky

Table 2 – Particularities of sexual behaviour observed in goats

Before mounting	<p>Behavioural signs were well expressed in all females except F2 (yearling first oestrus), F6 and F8. Females generally accepted the mating quickly after a short precopulatory game, but some goats displayed a more aggressive attitude toward the buck while accepting the mating with difficulty (F1, F3, F4 and F15). In the latter goats, early age or lack of experience was not correlated with a longer time to accept mounting. Some females, F4, F8, F19 and F20, performed jumps on males and other females. These also accepted the jump of other goats without showing an aggressive attitude towards them.</p>
During mounting	<p>Morphological signs were mostly represented by a swollen vulva and characteristic vaginal discharge, which were found in 5 of the 19 females (F3, F4, F11, F15 and F18).</p> <p>Females remained in the characteristic mounting posture and the sexual act was repeated after a short time (about 6 minutes) in 9 of the 19 females. Single mounting occurred in 7 females.</p>

Female (F2, F3, F4, F6, F8, F11, F15, F18, F19, F20)

The average courtship/true mounting ratio is represented as a percentage.

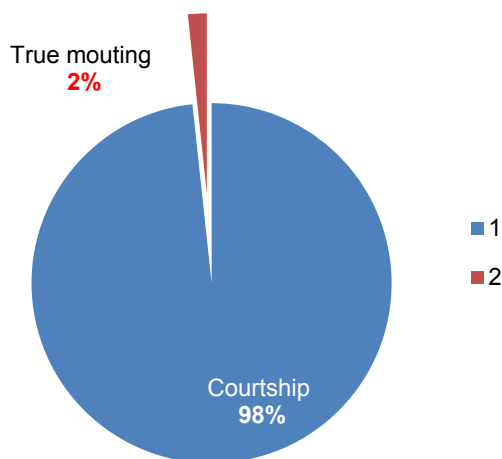


Figure 3 – Percentages of the average courtship and true mounting

Table 3 – Duration of courtship (C) and true mounting (T.M) in goats

Nr. crt.	Male	Female	C (minutes) (seconds)	T.M (s) (seconds)
1	M1	F1	5 min = 300 s	3 s
2	M2	F2	2 min = 120 s	2 s
3	M1	F3	3 min = 180 s	6 s
4	M1	F4	6 min = 360 s	3 s
5	M3	F5	4 min = 240 s	5 s
6	M2	F5	8 min = 480 s	2 s
7	M4	F6	10 min = 600 s	8 s
8	M1	F7	3 min = 180 s	9 s
9	M2	F8	4 min = 240 s	7 s
10	M1	F9	6 min = 360 s	3 s
11	M2	F10	6 min = 360 s	3 s
12	M3	F11	3 min = 180 s	5 s
13	M3	F12	3 min = 180 s	7 s
14	M4	F13	5 min = 300 s	4 s
15	M1	F14	7 min = 420 s	3 s
16	M5	F15	9 min = 540 s	4 s
17	M5	F16	3 min = 180 s	8 s
18	M2	F17	1 min = 60 s	5 s
19	M1	F18	2 min = 120 s	3 s
20	M3	F19	1 min = 60 s	4 s

Min, s = minutes, seconds

True mounting

True mounting accounted for the smallest percentage of the total duration of the copulatory act, ranging from 1% to 8%, with an average of 2% (Figure 4). In the 20 cases observed and monitored in detail, (F5 had two true mountings), it was observed that after courtship play, the male performed the jump by firmly embracing the flanks of the goat on which he pressed with his forelimbs, in the “a tergo” position (hugging reflex). This was followed by the intromission reflex (mating reflex) (Figure 5) and the characteristic “pistoning movements”, repetitive pushing movements across the goat's back, with an average of six movements. Ejaculation occurred after a more forceful movement of the male's posterior train.

True mounting was performed an average of two–three times per day and lasted 4.7 seconds. The M1 buck performed the most mounts (7 out of 20) of the 5 breeders studied, accounting for 35% of the total mounts observed. The leader status was observed in this four-year-old male, who was also the most physically developed, demonstrating the establishment of social hierarchy in a group of males kept together, as specified in another study (Ungerfeld *et al.*, 2014). Relationships were unclear among the other males, with M4 and M5 performing the fewest mounts (two mounts each), despite being the youngest of the breeders included in the study (three years old). These two bucks' mounts accounted for 20% of the total mounts. No leader status was observed in the oldest males, M2 (7 years) and M3 (8 years), so we can speculate that there is not necessarily a directly proportional

relationship between age and group leader status. The M2 male achieved five mounts, representing 25% of the total mounts, and the M2 male had four mounts, representing 20% of the total mounts observed.

The time spent by each male in courtship and true mount was analyzed by two-sample t-tests of equal variance in Microsoft Excel. The statistical analysis aimed to determine variance, standard deviations and p-values, comparing the means of the times taken by males to perform specific behaviours in courtship (variance = 23,674.74; standard deviation = 153.87) and true mounting (variance = 4.54; standard deviation = 2.13). The statistical evaluation resulted in a p-value lower than 0.05 (0.000149), which means that there are differences, and they are significant for the behaviours analysed. Also, in Excel the variances and standard deviations of the mean values of the behaviours performed by the bucks during mounting were calculated: mean number of jumps performed by males (variance = 7.04; standard deviation = 2.65); mean number of copulatory movements (variance = 9.67; standard deviation = 3.11). The variance and standard deviation of the mean number of mounts per day were 1.12 and 1.06, respectively.

Postcopulation

After copulation, males dismounted but remained close to the female for several minutes, placing themselves lateral to the goat or behind her, gently striking her lateral neck, flank and perivulvar region with the head and hooves (Figure 6).

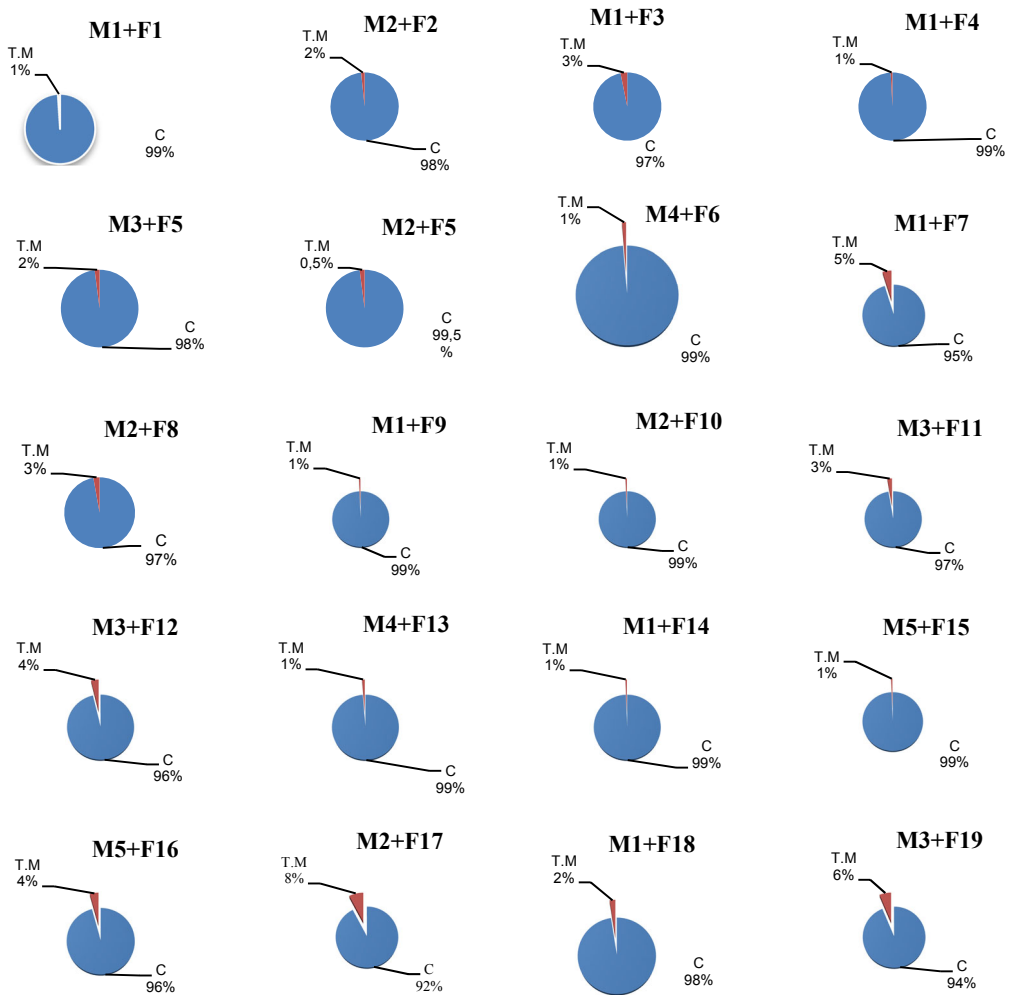


Figure 4 – Percentage of courtship (C)/ true mounting (T.M) in goats



Figure 5 – True mounting

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In most cases observed, males continued to inspect the anogenital area of the female, wagging their tongues and slapping. Occasionally, the goats expressed a characteristic low, short bleat. Autofellatio, which occurred before, after or shortly after sexual intercourse before initiating further mounting, was also observed. Females, on the other hand, urinated in small amounts while walking in front of the male, accepted his presence, and often displayed a tender attitude toward him. Following that, they raised their tails and moved them vigorously to the side, and a whitish fluid was observed oozing from the vulva in most goats. If a second sexual act occurred soon after, the time the buck spent around the female was reduced, and the female was not interested in the male immediately after the second mounting (female F16).

CONCLUSIONS

Sexual behaviour was observed and quantified during courtship as well as during true mounting, observing morphological, physiological and behavioural signs in both bucks and does. The length of courtship was significantly longer compared to true mounting, confirming the study hypothesis ($p < 0.05$) by statistical analysis of the data obtained, which means that there are significant differences regarding the time required by the bucks to perform the mounting (courtship and true mounting). Individual variations between males' sexual behaviours were auto-enurination, especially on the forelimbs, but mostly autofellatio. Behavioural

signs specific to goats especially during the courting period were those mentioned in the literature.

In the literature, we did not find any data on monitoring and recording the time required to perform the mounting stages, which in our view is a novel element needed by veterinarians and farmers to evaluate sexual behaviour in goats. Finally, from a practical point of view, these results represent valuable information for breeding management in goats since sexual behaviour in bucks is one of the most important cues for inducing sexual activity in seasonal oestrous through the "male effect".

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