

&lt;Case Report&gt;

## Comparison of Female Reproductive Systems in Himalayan Tahr (*Hemitragus jemlahicus*) and Corriedale Sheep (*Ovis aries*)

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### ABSTRACT

A necropsy of a primiparous, 4-year-old, Himalayan tahr (*Hemitragus jemlahicus*) was performed in September 8, 2009. Typical appearances of ovaries, oviducts, uterine horns, cervix and caruncles were well shown. Five cervical folds were present in the cervix. Cervical opening can be reached in the length of less than 15 cm from the entrance of vagina. Development of two follicles was found in the left ovary even though breeding season of this species naturally starts in late November.

The reproductive organs of a primiparous, 3-year-old, Corriedale sheep showed that differences in the length and morphological appearance of cervix exist between two species. Comparative understanding of reproductive systems in Himalayan tahr and Corriedale sheep could help advancing assisted reproductive technologies in feral goats.

(Key words : Himalayan tahr, Corriedale, ovary, reproductive, uterus)

### INTRODUCTION

There are three species of tahr in the world. The Himalayan tahr (*Hemitragus jemlahicus*) is the most well-known species (Fig. 1A~1C), and the other two tahr, Arabian tahr (*Hemitragus jayakuri*) and Nilgiri tahr (*Hemitragus hylocrius*) are distributed in Oman and southern India, respectively (Nowak, 1999). These species belong to order Artiodactyla, family Bovidae, subfamily Caprinae and genus *Hemitragus*. International Union for Conservation of Nature (IUCN) designated Himalayan tahr as conservation status of "Near Threatened (NT)". The adult male Himalayan tahr has an outstanding, beautiful mane (Fig. 1B). The gestation period is seven months and usually only one kid is born at a time or rarely two kids are born (Nowak, 1999; Pare *et al.*, 1996). The nursing period is about six months, and the young tahr may live with its mother for up to two years (Pare *et al.*, 1996). They reach to sexual maturity at 2 to 3 years old (Fig. 1C). In the wild, tahr can live up to 15 years while up to 21 years in captivity (Jones, 1993). The breeding season occurs from October to January in natural habitat while from November to January in Korea. Himalayan tahr was one of feral ungulates successfully introduced to New Zealand in 1960s (Forsyth, 1998; Forsyth and Hickling, 1998). This species also had been introduced to United States, Canada and South Africa where they have been well

settled down and used for recreational sports and commercial activities. The Corriedale sheep was evolved in both Australia and New Zealand by selectively breeding from cross bred progeny of pure Merino and Lincoln sheep (Fig. 1D). Like most sheep, Corriedale sheep are seasonal breeders that have estrus cycles of about 17 days and the gestation period of about five

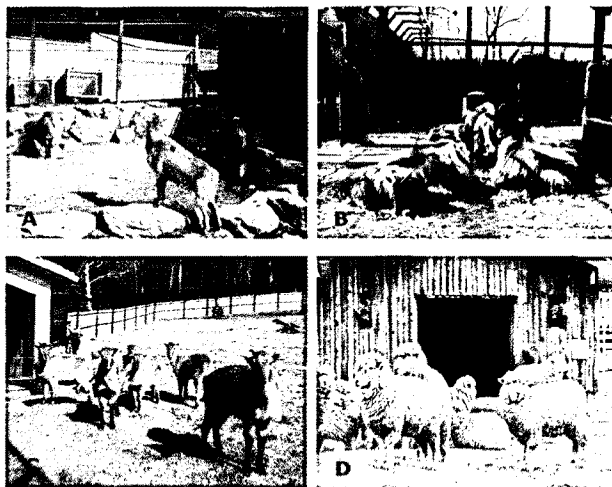


Fig. 1. Himalayan tahr (A, B, C) and Corriedale sheep (D). (A) Adult female Himalayan tahr. (B) Adult male Himalayan tahr. (C) Juvenile male and female Himalayan tahr born in 2008 and 2009. (D) Corriedale sheep that are used for sheep dog performance.

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months (King, 1981).

The purpose of this retrospective study is to understand the reproductive system of Himalayan tahr comparing to Corriedale sheep, which could be used for applying assisted reproductive technologies established in farm animals to Himalayan tahrs.

## CASE REPORT

A necropsy of a primiparous, 4-year-old, Himalayan tahr (*Hemitragus jemlahicus*) was performed in September 8, 2009. Two developing follicles sized more than 3 mm were found in the left ovary (Fig. 2A) while follicles more than 2 mm diameter were not identified in the right ovary. Oviducts were located between Y-shaped uterine horns and ovaries (Fig. 2A). Many caruncles occupy both sides of endometria (Fig. 2B) which are divided by a septum (Fig. 2C). Cervical opening could be reached in the length of less than 15 cm from the entrance of vagina. Cervix was composed of five, parallel folds (Fig. 2B). Like the other ruminants, Himalayan tahrs can feed on any chewable things like debris of carpet and ropes (Fig. 2D).



Fig. 2. Appearances of reproductive organs and rumen in a female Himalayan tahr. (A) Two arrows indicate oviducts and two ovaries are shown in small rectangular boxes. In the magnified rectangular box, two follicles on the left ovary are indicated by arrows. The entrance of cervix is shown in the square box. (B) A lot of caruncles and five cervical folds are shown in the thin and thick rectangular boxes, respectively. (C) Both uterine horns are divided by a septum (rectangular box) and the bladder is in the square box. (D) Like the other ruminants, Himalayan tahrs have rumen, reticulum, omasum and abomasum. Foreign bodies such as ropes and parts of carpet were found in the rumen (box).

The primiparous, 3-year-old, Corriedale sheep showed different appearances of reproductive organs (Fig. 3). The length of cervix, the shapes of cervical folds and cervical opening in the Corriedale sheep are different from Himalayan tahr (Fig. 1B, 1D). The cervical folds ran posteriorly (Fig. 3D). But, Ovaries, oviducts, uterine horns and a septum look similar to Himalayan tahr (Fig. 3A, 3C).

## DISCUSSION

Like a cow, the types of uterus and placentation in Himalayan tahrs and Corriedale sheep are uterus bipartus and cotyledonary, respectively (Fig. 2, 3C). Endometrium is composed of caruncles (Fig. 2B, Fig. 3C). The differences between two

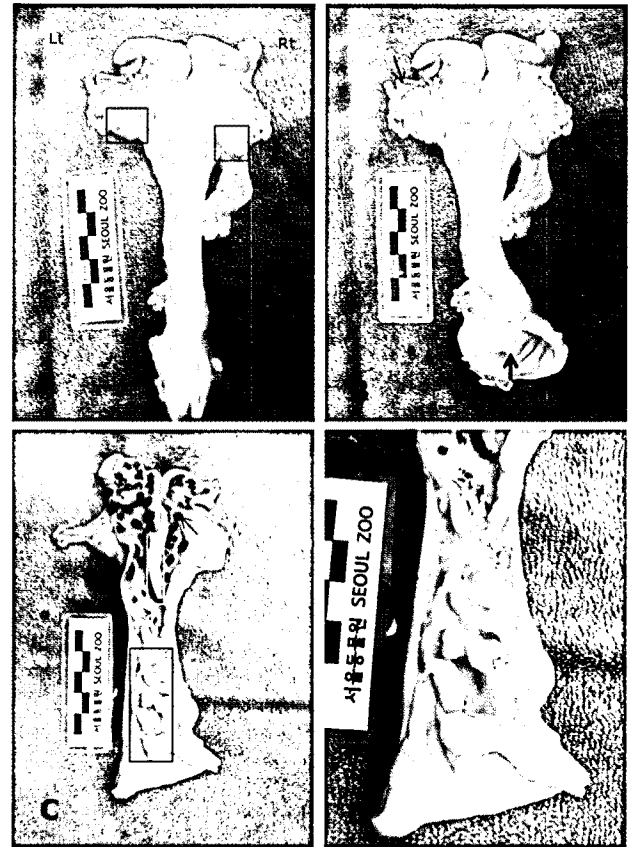


Fig. 3. Appearances of reproductive organs in a female Corriedale sheep. (A) Two ovaries are shown in small rectangular boxes. (B) Two thin arrows indicate oviducts. The thick arrow shows the entrance of cervix. (C) Both uterine horns are divided by a septum (white-lined box) and five to six cervical folds are shown in the black-lined box. A caruncle is indicated by an arrow. (D) The magnified appearance of cervical folds is well shown.

species were the appearance of vaginal fornix and cervical folds (Fig. 2A, 2B, 3B, 3D). The vaginal fornix of Corriedale sheep looks like a cervical fold extends and overlaps the opening of cervix (Fig. 3B) while Himalayan tahrs have a protruding cervical fornix (Fig. 2A). Unlike goats and cattle, Corriedale sheep have a curved cervix of which the folds run posteriorly (Fig. 3D). Penetrating the cervical folds is so difficult that transcervical insemination is not readily performed in domestic sheep and European mouflons (*Ovis gmelini musimon*), one of wild sheep (Yong *et al.*, 2009). In addition, the shape of vaginal fornix and the longer length of cervix could make laparoscopic insemination preferable in sheep breeding (Windsor, 1995; Wulster-Radcliffe, 2004). Two developing follicles which developed to the size of more than 3 mm were found in the left ovary of the Himalayan tahr that died in September, 2009 (Fig. 2A). As a seasonal breeder, Himalayan tahrs at Seoul Zoo start estrus from November to January but it seems that the ovary commences infertile estrus in September.

In the captive breeding of Himalayan tahr, applying artificial breeding techniques to this species must be considered indispensable because males fight to determine which individual mate females and even physically harm each other to death during the rut.

The Himalayan tahr has 48 chromosomes while the Nilgiri and Arabian tahr has 58 chromosomes (Nelson-Rees *et al.*, 1967; Benirschke and Kumamoto, 1980; Bunch and Nadler, 1980). Its native habitat is located in the rugged, wooded hills and mountain slopes of the Himalaya from northern India to Tibet. Himalayan tahrs are very shy, wary, difficult to approach and would not disturb the genetic pool of Korean goral (*Nemorhaedus caudatus*) that has 56 chromosomes. As an alternative animal species, Himalayan tahrs could be a future nominee of foreign wild ungulates that might be introduced into wild habitats in Korea.

This anatomical study of Himalayan tahr and Corriedale sheep can help apply artificial breeding techniques established in farm animals to wild goats and sheep.

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