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# Animal welfare in the musk deer

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## Abstract

The Himalayan musk deer (*Moschus chrysogaster*) is a primitive ruminant living in the remote high Himalayas. The male deer possesses a musk gland specialized for the production of musk which is one of the most valuable scented animal products—it is more expensive than gold. The deer have been commercially exploited for centuries for their precious musk pod. The musk is used for perfumes all over the world and also for traditional medicine in oriental countries. The deer originally ranged throughout the Himalayas from Afghanistan to Pakistan, India, Nepal, Bhutan and Burma. At present they are found only in isolated areas due to heavy poaching and massive habitat destruction. This species is endangered and threatened with extinction. A procedure for musk extraction from live deer (without killing them) has been developed to help in the conservation of this species. In this regard, the extraction of musk was successfully conducted many times in the Kathmandu Zoo over a period of several years. Musk deer farms have been established in China, India and Nepal. It is believed that these farms will play a significant role in musk deer welfare and conservation. In addition, there is an urgent need to give this species total protection in national parks and wildlife reserves in order to preserve genetic diversity and maintain essential ecological processes and life support systems. In addition, there should be international control of the musk trade to aid in the survival of this species. © 1998 Elsevier Science B.V. All rights reserved.

*Keywords:* Musk deer; Scented musk; Poaching; Endangered; Farming; Conservation

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## 1. Introduction

The history of the Himalayan musk deer (*Moschus chrysogaster*), a primitive animal, follows a trail from the birch forests of the high Himalayas overseas through Hong Kong into the world market of luxurious perfumes. The musk, confined in a small bottle, is

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sold to humans at great cost in animal lives each year. The musk trade has jeopardized the survival of the species which has become endangered and threatened with extinction.

The musk deer once ranged throughout the Himalayas starting from Afghanistan, Pakistan, India, Nepal, Bhutan, Burma to southwest China. Currently, they are found only in isolation because of heavy poaching and massive habitat destruction. The International Union for the Conservation of Nature and Natural Resources includes this species of deer as threatened for extinction (IUCN, 1974). In Nepal, the deer is found in the birch and rhododendron coniferous forests above the pine zone of the Himalayan region at an altitude of 2400 to 4300 m. Only the males possess the musk gland. The musk deer has been commercially exploited for centuries for its valuable musk pod, which is usually excised after killing the deer.

In the past, musk was renowned as a vital ingredient of medicine and perfumes dating back to 3500 BC. In 8th century China, the musk extracted from the hunted deer had become so fashionable that one minister used musk to scent the plastered walls of a pavilion. In Iran, Arabs mixed musk with mortar to provide enduring scent in the construction of their mosques. In the 19th century, courtesans of Paris carried bags of musk between their breasts, ostensibly to conceal the body's natural odor but in all probability to enhance it (Bista et al., 1979).

## **2. Body structure and habitat**

Phylogenetically, the musk deer hold a position between deer and antelopes. It stands no more than 50 cm high at the shoulders, slightly higher at the croup. It is regarded as an undeveloped form of deer that has not evolved with the rest of its family. It is hornless and without facial glands and unlike other deer, it possesses a gall bladder, a caudal gland and a musk gland. It has a peculiar tail which is naked except for a large tuft of hair at the tip and at the base. The tail lies completely buried in its thick, bristly, pithy hair coat (Prater, 1993). The absence of antlers and the possession of long upper canine teeth also help differentiate the musk deer from other species.

## **3. Behaviour**

Musk deer are solitary animals; they tend to remain in dense cover during the day and use open habitat at night, when they are more active. They are primarily browsers and very selective feeders. They eat mainly shrub foliages, forbs, woody plant leaves and flowers. They avoid grass, moss and lichen except in winter. Sometimes they are seen in trees which they climb for browsing and predator avoidance. In view of its solitary behavior and need for cover, the musk deer relies chiefly on olfaction for communication. Both sexes scent mark by defecating at latrines, usually on one spot. Males also use musk, (which appears to be secreted in the urine), and secretions from the caudal gland to mark their territories. They scent mark using the caudal gland with its greasy secretions, by rubbing their tail region against the stems of dried forbs or bushes. In another form of marking males use their front feet, which possess an interdigital gland,

to paste secretions on the ground or snow (Green, 1985). Because the caudal and musk glands are so well developed, it is inferred that females seek out males in the breeding season. The breeding season is in January and the young are born in June. Young musk deer are hidiers and probably become independent by the age of two months. They reach sexual maturity at eighteen months of age and some females may reproduce in their first year.

The anti-predator behaviour of musk deer involves camouflage to avoid detection by predators and provide a shorter flight distance. However, their tendency to stop and look back during flight make them more vulnerable to predators such as leopards, yellow throated martens, and foxes.

#### **4. Musk gland**

The musk gland is situated beneath the skin of the abdomen between the reproductive organ and umbilicus of males. It opens to the exterior through an orifice that lies anterior to the urethra. The synthesis of musk is probably regulated by androgens from the testes, as castrated males produce a negligible amount (Macartney, 1983).

From the age of 12 to 18 months, musk is secreted from a single layer of columnar epithelial cells that lines the vesicle of the gland. The inner wall of the musk sac is lined with 30 or more keratinized layers of epithelium that slough and become mixed with the musk. Musk takes 30 days or more to mature in the sac where it changes from being creamy white and pasty (with no remarkable scent) into a powerfully scented, granular, dark red-brown substance (Shrestha, 1983). Musk is synthesized seasonally, prior to the rut, and may influence oestrus cycling (as has been suggested for the analogous preputial gland secretion in other mammals).

#### **5. Uses of musk**

Musk is currently used for expensive perfume all over the world and for traditional medicine in oriental countries. Musk is one of the oldest raw materials used in perfumery and is highly esteemed for both its fixative and scent properties. Between 0.5–2.0% of musk is muscone, the odorous component (Parry, 1925). Most natural musk is currently used within indigenous systems of medicine, particularly in China, India, Nepal and Japan. As a traditional medicine musk has many qualities. It is believed to make all sense organs more sensitive, to improve the condition of the body's main and collateral channels, to stimulate the blood circulation, to reduce inflammation and to relieve internal heat or fever. China leads the world's musk production both in quantity and quality (Macartney, 1983). In India and Nepal, musk is used in Ayurvedic medicine as a stimulant to cure bronchitis, pneumonia, impotence, typhoid, typhus and as a sedative to treat asthma, epilepsy, hysteria and other nervous disorders. As an anti-inflammatory agent, musk is a more effective antidote for snake venom than hydrocortisone (Arora et al., 1962). Little attempt has been made to isolate the pharmacologically active components of musk, but its therapeutic effects may be due to the combined

action of all of its constituents (Seth et al., 1975). In Japan, both 'stamina' drinks and children's tonics are made from plant and animal derivatives, of which the most important is musk (Green and Taylor, 1986).

In Hong Kong, the international center for musk (despite a ban on imports), musk is valued at US\$50 000 per kg, while its value in India is four times its weight in gold (Zhang, 1983). The current international trade in musk from three different species (Siberian, Dwarf and Himalayan musk deer) together, is estimated to be approximately 325 kg per year; about 85% of the total is imported to Japan and the rest to France. The international trade in musk from Himalayan musk deer alone is estimated to be at least 100 kg per year. This represents an annual toll of 4000 males, based on an average pod weight of 25 g and could mean that from 18% to 53% of the Himalayan population is harvested annually (Green, 1986).

## **6. Musk extraction and farming**

Musk can be removed from the gland of live male deer without killing the animal and without harming their growth, breeding and health. The extraction of musk from live deer has been successfully conducted many times and the characteristics of musk have been studied at the Kathmandu Zoo in Nepal. The extraction technique involves physically restraining the deer, using three persons, in lateral recumbency with the umbilical region exposed. A sterilized silver scoop, lubricated with antibiotic cream, is gently inserted (with a rotating movement) holding the musk sac with another hand. The scoop should be designed with a small groove at one end and larger groove at another. It is preferable to introduce the scoop with the smaller grooved end first. The edges of the scoop must be smooth and rounded to facilitate easy insertion and to prevent injury to the musk gland. The musk is collected by rotating and then removing the scoop. At completion, antibiotic cream is applied in the gland to prevent possible infection. The whole operation of musk extraction, including the restraint, is completed in 15 min. This technique is most suitable and can be repeated every year in adult male deer (Shrestha, 1989). The musk can also be obtained by a simple incision at the gland to open and collect the musk with the help of a scoop. This method involves chemical immobilization with more risk to the life of the musk deer. It was found that the harvesting of the musk is optimal between the third week of December and third week of January (Shrestha, 1989).

Since 1958, China has set up many musk deer farms in the areas of Maerkang, Miyalo and Manchuan of the Sichuan Province, in the Zhenping county of Shaanxi Province and the Fuzling area of Anhui Province. Over the past 20 years, much has been learned about most aspects of the musk deer's habitat, feeding, management, domestication, the extraction of musk from living animals, and the mechanism and regular pattern of musk secretion (Green, 1985; Shrestha, 1983). In India, musk deer are at present kept at Dachigaun Sanctuary, Kashmir, Darjeeling Zoo and Kufri near Simla, and a new musk deer breeding farm is planned at Shokh, India (Zhang, 1983). One breeding farm recently opened at Godavari near National Botanical Garden in Kathmandu valley in Nepal.

## 7. Conservation

Conservation efforts concerning the musk deer should be directed toward the maintenance of essential ecological processes and life support systems, to preserve genetic diversity, and to ensure the sustainable utilization of the species and its ecosystem. First and foremost is the urgent need to give proper protection to the species within existing national parks and sanctuaries, second is the need to control the musk trade, both at national and international levels, and third is the need to utilize the species at a sustainable level for the benefit of rural communities (Green, 1986). The maximum area of habitat potentially available to musk deer on the south side of the Himalayas is estimated to be roughly 50 000 km<sup>2</sup>. This amount of habitat may be capable of supporting about 200 000 musk deer but more likely it harbors only about 30 000 animals (Green, 1985). The musk can be extracted annually during the rut season from adult males in the wild, after capturing them with the help of nets and releasing them after harvesting the musk. The musk extracted from live deer can produce significant annual income for a person earning his living in the high altitude region of the Himalayas where alternate sources of livelihood are meager. Arrangements should be made at the village level for a program which could generate a self-supporting economy and support wildlife conservation at the grass-roots level. Under these conditions, villagers themselves become watch dogs against rampant poaching, they would be motivated to protect both the valuable resource and its habitat, ensuring survival of this endangered species in Nepal. Musk deer poaching and smuggling could be eliminated or minimized if successful farming techniques could be developed either by governmental agencies or private individuals (Bista et al., 1979). The establishment of musk deer farms will also help to supplement the income of mountain people and help conserve the species, since musk production in captivity can be profitable (Shrestha, 1993).

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