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A REVIEW ON BEHAVIOR OF MUSCOVY DUCK (*CAIRINA MOSCHATA*)

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ABSTRACT

As semi-aquatic birds, ducks may have different behavioral requirements than other species of poultry that are usually raised for food, such as chickens. It originated in countries in Central and South America. Due to their adaptability, muscovy ducks can also be found close to water sources in suburban and urban settings. They can frequently be found roosting in trees, on ponds, and even in rivers. Given their innate love of water, ducks depend on it for behaviors like swimming, foraging, and cleaning. Ducks must have access to suitable water sources, and their living environments must meet these requirements as well. Behaviors exhibited by Muscovies include aggression, shyness, foraging, sexuality, and brooding tendencies. Muscovies' behavior, which is regulated by several hormones, including growth hormone, is crucial to their development and sexual maturity. The gonads are stimulated by LH to create testosterone and estradiol, the sex hormones necessary for reproduction. A muscovy duck takes 32 to 35 days to hatch from its 60-120 large white eggs.

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Keywords: Muscovy duck, Behavior, Hormone, Sexual dimorphism.

INTRODUCTION

The Muscovy duck is a species of waterfowl native to Central and South America (Stahl, 2003), and was introduced to other continents of Africa, Europe, and Asia (Arias-Sosa and Rojas, 2021). Due to purposeful or accidental introduction, groups of Muscovy ducks that have escaped or spread widely have established themselves. They belong to class Aves, which show bipedal locomotion and arial mode of life (Verma and Prakash, 2020). Muscovy ducks are globally acceptable due to their distinct flavor, excellent meat yield, and low-calorie content. The male Muscovy ducks are larger than the females and reveal sexual dimorphism, adapting to various habitats. Muscovy ducks are described as enormous domestic ducks with red caruncles on their faces and bills.Through foraging, Muscovy ducks may contribute to the reduction of hazardous insect populations. These are also domesticated animals and can be used to produce food and other goods. Domestic poultry's ability to hatch is a crucial economic characteristic and an essential element of reproductive fitness (Hassan *et al.,* 1971). Muscovy ducks may occasionally be seen as pests, particularly if they damage crops while foraging in farmers' fields. Because of this, some localities use hunting and trapping techniques to reduce their numbers and lessen their influence on agricultural areas. Muscovy ducks belong to the Least Concern category indicates that as of the last update, the species is not considered to be at immediate risk of extinction (IUCN, 2023). However, local populations can still face threats, particularly in areas where habitat loss and hunting are significant (Anonymous, 2022). Genetic and non-genetic factors both affect

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fertility and hatchability, with non-genetic factors having a stronger impact on both traits in production (King'ori, 2011). Native and naturalized Muscovy ducks have not received much research despite their abundance and vast geographic distribution. In their natural habitat, where they are occasionally threatened, free-ranging Muscovy ducks have been studied the most. Several authors (Alves and Gomes, 2006; Alava *et al*., 2007; Ayala-Perez *et al*., 2013) conducted demographic studies of Muscovy ducks as a part of wider exploration of bird abundance in Mexico and South America. The most thorough research on the nesting, feeding, development, and health of wild Muscovy ducks is found in Mexico (Woodyard and Bolen 1984). Muscovy ducks inhabited wetlands and agricultural areas and consumed maize, insects, and the seeds of aquatic plants. They constitute an important part of biodiversity. The biodiversity and ecological balance with balanced anthropogenic activities are essential for survival of all the biota including humans (Ashok, 2017; Kumar, 2018; Prakash and Verma, 2022). Biodiversity is severely affected by pollution, pesticides and climate change (Prakash and Verma, 2014; Chaudhary *et al.,* 2021; Goel *et al.,* 2022; Singh *et al.,* 2023).

Habit and habitat

Wild Muscovy ducks can be found from Northern Mexico to Argentina in coastal and lowland environments. They are found in large numbers at West Bengal, Odisha, Kerala, Assam, and Mizoram in India. Muscovy duck is a tropical bird, but it adapts well to colder regions. Most of the time, Muscovy bucks breed in forested areas near lakes, lagoons, mangrove swamps, and slowly moving streams, though they occasionally nest in open areas if nest boxes are available. Muscovy ducks inhabited wetlands and agricultural areas and can also be found in urban and suburban areas near water sources. They are often seen on ponds, rivers, and even in trees where they roost (Anonymous, 2022). Muscovy ducks are considered an invasive species in the State of Florida (Johnson and Hawk, 2012). This means that they are not native to the region and may have negative impacts on the local ecosystem. (Downs *et al.,* 2013) conducted a study in Florida where they used GPS monitoring to track the movements and habitat usage patterns of a single Muscovy duck.

Size and appearance

Muscovy ducks are indeed large birds with a notable size difference between males and females. Males can have a wingspan of up to sixty-four inches and weigh up to fifteen pounds, while females are smaller, typically weighing between 6 to 7 pounds. Muscovy ducks are described as enormous domestic ducks with red caruncles on their faces and bills. They have different average weights for males and females, with females weighing around 1.5 kg and males averaging 2.7 kg (Raji *et al*., 2009). They have a distinctive appearance with wide, long bodies and outspread, flat tails in males. The wild Muscovy species has a blackish color with distinct white patches on the wings, a dark red or blackish face, yellowish-brown eyes, and a black bill with pale pink spots. The legs and feet of the wild Muscovy duck are black. In terms of juveniles, they have a duller coloration that might or might not include the white markings on the wings. The domesticated breeds of Muscovy ducks can vary significantly in coloration. Most of them are black and white or dark brown, particularly around the head and neck. However, other color variations such as pale white and lavender also exist among domesticated Muscovy ducks. Both male and female domesticated ducks generally have a red or red-black face. This variation in coloration is a result of selective breeding and domestication, which have led to the development of unusual color patterns and variations within the Muscovy duck population. They make use of trees in the hollows or crowns of moriche palms (Wildfowl Trust, 2008), for roosting and nesting. They breed close to these wetland stream areas and prefer freshwater (Bouglouan, 2011).

Food and Feeding

The diet of Muscovy ducks includes both plant and animal products. They eat grasses, water lily seeds, larval insects, tiny fish, etc. tipping forward in shallow water or dabbling at the surface, they feed by grabbing larger prey and straining organic debris. Moreover, farmed Muscovy ducks graze on corn and other grains in farm fields; park visitors give them food scraps. In captivity, Muscovy Ducks can be kept as pets, and their diet should be managed to ensure their well-being. Commercial duck food is commonly used, but a diet consisting of chopped greens, grains, and a small amount of meat or poultry can also be provided. Clean water should be available for drinking and bathing, as ducks require water not only for hydration but also for grooming.

Behavior

Muscovy ducks display a variety of behaviors. Muscovy ducks first breed at the age of 1-2 years. The mating

partner keeps a fierce eye on other male couples. The mating pair finds new companions each year rather than being together forever (Dye and Stai, 2004). Ducks are fascinating birds with a variety of behaviors and adaptations. Unlike many other duck species, Muscovy Ducks have a strong preference for perching in trees, especially at night. They can grasp branches because of their powerful claws. This tree-perching behavior is unique among ducks and resembles the behavior of geese more than typical ducks.

Foraging behavior

Ducks have evolved several different foraging techniques to fit their ecological niche. The lesser scaup (*Aythya affinis*) and the ruddy duck (*Oxyura jamaicensis*) are two duck species that dive for food (Tome and Wrubleski, 1988). These ducks sift through underwater muck, sometimes in murky circumstances, in search of aquatic invertebrates. Others, like the duck, eat by scrounging for food on the water's surface or "dabbling" (dipping their heads into the water to graze). Most ducks employ a method of straining food from muck or water, which is facilitated in part by specialized mouth morphology. Beak morphology and feeding ecology are strongly correlated, with broader "duck-like" beaks being linked with filter feeding, according to research on beak curvature in waterfowl (Olsen, 2017). Ducks frequently forage in low-light situations, which suggests that tactile sensitivity as well as beak shape are important for foraging (McNeil *et al.*, 1992).

Roosting and Pairing

Roosting and pairing behavior in Muscovy ducks, native to Central and South America, is intriguing. These ducks exhibit a unique roosting pattern, often perching high in trees to sleep at night, a behavior uncommon among other duck species. This adaptation offers them protection from ground predators. Additionally, Muscovy ducks display strong pair-bonding tendencies during the breeding season. Males and females form monogamous pairs, remaining together throughout the breeding period. This pairing behavior facilitates cooperative nesting and rearing of their offspring. Such behaviors underscore the social complexity and adaptive strategies of Muscovy ducks in their natural habitat. Some species of ducks are known to roost in tree branches, especially during the night. This behavior helps keep them safe from ground predators. Ducks often roost in pairs or small groups, which can provide them with both social interaction and added protection.

Vocalizations and Tail Wagging

A variety of vocalizations are used by ducks to communicate with one other. While the low-pitched sounds you mentioned might be part of their communication repertoire, ducks also make various quacks, whistles, and other noises to convey different messages. Tail wagging can be a form of communication as well, and it might serve multiple purposes, such as showing excitement, displaying dominance, or warning off predators.

Shyness and Aggression

Wild ducks are indeed known for their shyness and tendency to avoid close human contact. Additionally, unpleasant treatment of farm animals can cause man avoidance, a fear-related behavioral reaction that is thought to be a stress response (Rushe *et al.*, 1999). This behavior is a survival strategy to protect themselves from potential threats. However, when they feel threatened or cornered, they can become surprisingly aggressive in an attempt to defend themselves.

Courtship behavior

Male ducks, or drakes, do have the ability to fly, but their flight patterns can vary based on the species. Some ducks, especially those adapted for diving and swimming might have a different flight profile compared to those who spend more time dabbling on the water's surface. However, ducks are capable of flying and use it as a means to escape danger and find suitable habitats. The male muscovies are promiscuous, mating with any female that is ready to mate and keeping other males away by fighting furiously with bills (Burton and Burton, 2002). Males exhibit a variety of displays during the courtship phase, including as nodding their heads back and forth and raising their crests. Also, there are particular cries and stances, such as holding one's head and tail up (Dye and Stai, 2004). However, the female can mate with other men.

Sexual behavior

The female reaches sexual maturity at 28 weeks, whereas males do so at 29 weeks. The process between the sperm penetrating the ovum and the merging of the male and female pronuclei is known as fertilization. Growth hormone (GH) has a significant role in various differentiation processes in different target tissues, including promoting growth and development (Verma, 2017). Additionally, GH may play a role in reproductive functions in both males and females, as

well as in steroidogenesis and gametogenesis, as suggested by many studies (Martínez-Moreno *et al*., 2011; Hull and Harvey 2000; Komisarek *et al*., 2011; Bachelot *et al*., 2002). The Muscovy's breeding season can span from August to May. LH stimulates the gonads to produce sex hormones (e.g., testosterone in males, and estradiol in females), which are essential for reproduction. During breeding season, muscovies are non-territorial, but outside of that, they are opposed to one another The development of early blood vessels and embryonic tissue in eggs that have been incubated for longer than 48 hours is typically enough to prove fertilization (Sellier *et al*., 2005). Fertilized eggs may not hatch, or ova may not be fertilized are the two main causes of hatching failure.

Brooding behavior

The duck's incubation behavior is distinguished by persistent nesting, turning the head backward, clucking, and nest defense (Wu *et al*., 2014). Since Muscovies are less messy than conventional ducks, some people keep them inside with their hens, and the arrangement seems to be effective enough. Prolactin participates in regulating various physiological processes, including incubation behavior. Long incubation times and high broodiness in muscovy ducks have reduced egg output and hampered the growth of the Muscovy duck industry (Jiang *et al*., 2010). Most birds have the behavior of being broodily, which is caused by the interaction of the hormonal system and the environment in which the birds lay their eggs (Sharp, 2009). clutch can include up to sixteen eggs. When the 35-day incubation period is through, she will delicately hatch her eggs. Several females will frequently brood together. The complex process of moving from the egg-laying to the brooding phase results in gonadal regression, modifications to neuroendocrine patterns, the development of brooding behavior, and the cessation of ovulation (Romanov, 2001).

Life cycle

A low quantity for ducks, Muscovy produces 60–120 big, white eggs annually. The number of broods a female may have annually depends on the environment, but as long as she consumes enough protein. Really, there is not much of a courting ritual other than a lot of tail waggling and raising the head crest. For the chance to mate with the females, men have been known to battle. Although a male may assist in watching over the nest and ducklings, they are polygamous. They do not like ground-sitting duck homes, thus the female will build her nest in a huge hollow in a tree, a perfectly safe ready-made nest box above the ground, or an elevated duck house. To be warm and secure, the ducklings will remain close to their mother for 10 to 12 weeks. Clutch can include up to sixteen eggs. When the 32-35 day incubation period is through, she will delicately hatch her eggs. Several females will frequently brood together. After the eggs hatch, the mother continues to protect and care for the ducklings. She leads them to water, where they can begin to forage for food, and she provides them with warmth and protection. They will be acquiring all the survival skills necessary throughout this period. Parental Care by Both the male and female Muscovy ducks play a role in raising the ducklings, but the female typically takes the lead in caring for them. The ducklings will reach a fair size at 12 weeks (Anonymous, 2022). Ducklings fledge (develop flight feathers) around 8-12 weeks of age and become increasingly independent. They will eventually leave the nest area to find their own territories.

Hormones and behavior

Indeed, Muscovy ducks, like many animals, display a variety of behaviors that are influenced by hormones. Hormones play a crucial role in regulating their reproductive, social, and territorial behaviors. For example, during mating season, hormone levels can impact courtship displays, aggression between males, and nesting behavior in females. Understanding the hormonal control of behavior is important for studying and managing these ducks in various contexts, such as agriculture or wildlife conservation.

GH may play a role in reproductive functions in both males and females, as well as in steroidogenesis and gametogenesis, as suggested by numerous studies (Hull and Harvey 2000; Bachelot *et al*., 2002; Komisarek *et al*., 2011; Martínez-Moreno *et al*., 2011). The Muscovy's breeding season can span from August to May. LH stimulates the gonads to produce sex hormones (e.g., testosterone in males, and estradiol in females), which are essential for reproduction. Divergent amounts of male testosterone may also be responsible for variations in duck fertility and reproductive success. In ducks and other seasonally breeding birds, a correlation between testosterone levels and the performance of drake sexual behaviors has been well established (Ball *et al.,* 2004). Changes in relationships with the other sex in turn frequently give input to the endocrine system, which impacts the amounts of circulating testosterone (Pinxten, 2003). Increased fertility and successful reproduction in

ducks are thought to be closely correlated with higher testosterone levels. The development of early blood vessels and embryonic tissue in eggs that have been incubated for longer than 48 hours is typically enough to prove fertilization (Sellier *et al*., 2005).

According to Sirsat *et al*. (2016) and Sirsat and Dzialowski (2016) endothermy quickly develops in precocial hatchlings like the Pekin duck. Prior research demonstrates that ducklings rapidly increase heat generation, mitochondrial respiration, resting oxygen consumption (V O2), and heart mass right away after hatching (Sirsat *et al*., 2016). In precocial birds, the levels of circulating plasma thyroid hormones peak during the peri-hatch period (McNabb, 2007). At hatching, there is a linkage between the rise in thyroid hormone levels and the physiological modifications linked to enhanced metabolic capacity and endothermy. This relationship suggests that thyroid hormones have a role in modulating the development of endothermy, the respiratory system, and skeletal muscle function linked to an increase in aerobic metabolism (De Groef *et al*., 2013). They also support the role of thyroid hormones in regulating endothermic development and transitioning to post-hatch life (Sirsat and Dzialowski, 2020).

Broodiness is the ardent desire of a female bird to incubate eggs. Altered levels of reproductive endocrine hormones, such as GnRH, GH, PRL, LH, progesterone (P), and estradiol (E2), can influence the occurrence of broodiness. In other words, changes in the hormonal balance of these hormones can trigger or affect the incubation behavior in poultry (Romanov, 2001; Chaiseha and Halawani, 2015).

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