

Review article

The Potentials of Raising Muscovy duck (*Cairina moschata*) in Bangladesh- A Review

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A B S T R A C T

Bangladesh is a developing country where duck production could play an important role for the rural economy, nutrition and health of the coastal people. Crop production in coastal areas is challenging and crops being deficient in many micronutrients, plant-based complementary foods are insufficient to meet the deficient micronutrients. Further, Bangladesh being a riverine country of the south Asia, many rivers, haors, coastal areas, marshy lands, ponds, lakes, water reservoirs, wetlands, canals and creeks are available, where muscovy ducks can be reared easily, but chicken production is not sensible or feasible at all. Climate of Bangladesh is especially suitable for rearing them. Many people of Bangladesh like duck meat more than the chicken meat. Meat and eggs are the most important sources of dietary protein for the people of Bangladesh. Ducks could play an important role in providing animal protein (meat and egg) and income sources for the rural people. In this connection, the Muscovy duck could be a special one in contributing greater amount of meat, as it is comparatively bigger in size than the indigenous ducks (4.6-6.8 kg for male). Moreover, the duck is well- fleshed, light dark carcass, good flavored meat with less fat than the other common ducks. Their egg size is bigger and egg production is 100-125 per year under good management condition. An adult muscovy provides more meat than the similar aged chicken. They can survive better in hot, humid weather than the other common ducks. The per unit price of muscovy duck meat is more than the other duck meats. Therefore, raising muscovy duck either in small or large scale production might be a promising enterprise in Bangladesh.

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1. INTRODUCTION

The muscovy ducks are large sized duck native to Mexico and central South America (Woodyard and Bolen, 1984; Stahl et al., 2006; Stahl, 2008; Marie et al., 2017; Schaaf et al.,

2018). The title “Muscovy” does not come from Russia but is thought either to be a corruption of “Musk” duck, from its musky scent or of “Miskito” duck, after the Mosquito coast of South America (Darwin, 1868). They produce eggs and meat which are valuable on farms and

smallholdings for reducing pests (Serjeantson, 2006). They belong to the family Anatidae and order Anserioformes. Plumage is brownish black with green and purple in dorsal plumage and with white wing patches. Characteristically they have broad bill, which is black and speckling of pale pink (Kear, 2005; Oguntunji and Ayorinde, 2015a). In the bill base, there is a blackish or dark red color knob. They have web feet like other duck. Fleshy protuberances are present in their face. They have long claws on their feet and a wide flat tail. In case of domestic drake, the usual length is 86 cm and weight is 4.6-6.8 kg, whereas the domestic hen is much littler at 64 cm in length and 2.7-3.6 kg in weight. However, large muscovy males frequently weigh up to 8 kg and females up to 5 kg. Their life span is 7-8 years (Wójcik and Smalec, 2008). Domesticated muscovy ducks are much less wary of humans and are regularly seen in parks (Downs et al., 2017; Marie et al., 2017).

Human started domestication of muscovy duck about hundred years ago (Donkin, 1989). Muscovy ducks had been tamed by different local American cultures within the America when Columbus arrived within the Bahamas (Donkin, 1989). The first few muscovy ducks were brought to the Columbus transport Santa Maria where they sailed back to Europe by the 16th century (Woodyard and Bolen, 1984). Muscovy ducks have been tamed for centuries, and are broadly exchanged as "Barbary duck". Population status of muscovy duck is little known. Wetlands International gauges their absolute population somewhere in the range of 100,000, and recommends that they are declining. The International Union for Conservation of Nature IUCN red list of threatened species records this duck as a types of least concern. In spite of numerous preferences, muscovy duck generation is not significant in numerous nations of the world due to the longer raising period, higher prophylaxis and maintenance cost, comparatively lower egg production, moderate feed conversion efficiency compared to Pekin duck (Banga-Mboko et al., 2007; Ogah and Momoh, 2013). Systematic studies on muscovy ducks in Bangladesh are scarce (Hamid, 2019). This study, therefore, aims to focus on current status, prospects or potentials of raising muscovy ducks in Bangladesh.

Habitat

Wild muscovy ducks live in the coastal and lowland habitats from northern Mexico to Argentina. Within the 1980s they elevated them expand to incorporate the lower Rio Grande Valley of Texas (Downs et al., 2017; Schaaf et al., 2018). In this portion of their range they live in intensely forested ranges of the waterway absent from urban regions. They, as a rule, breed in lush environments along lakes, tidal ponds, mangrove swamps, bogs, and slow-moving streams, but they may settle in open living spaces on the off- chance that settle boxes are displayed. They settle in brackish wetlands, but incline toward freshwater wetlands. Household assortments of the muscovy ducks are common on lakes in urban parks throughout numerous states of USA. Along the gulf coast and in Florida they have formed self-sustaining feral populations (Stahl et al., 2006; Anderson, 2012; Schaaf et al., 2018).

Behavior

The muscovy ducks are active and fast fowls. They are non-migratory and are dynamic amid the day, while at night they regularly perch in trees. Days are went through eating by touching on the ground or dabbling in shallow water. The muscovy ducks incline toward to rest in water amid the night to easily elude. They utilize anti-predator reactions such as alarm calling, solidifying, and endeavoring to elude when disturbed. Known predators are dogs and ruddy foxes (Banks et al., 2016). They are social birds. They are frequently seen in sets or in little bunch. They are less noisy and marked as quackless duck. Being territorial in nature, they often become aggressive towards people and pets, fight over food, territory or mates (Baldassarre, 2014). But it is not common.

The females fight with each other less often. A few grown-ups will indeed peck at the ducklings in the event that they are eating at the same nourishment source. In order to communicate with each other, they sway their tails, raise and lower their heads and utilize different vocalizations including murmurs and quacks. Males have a moo breathy call, and females deliver a calm trilling coo (Baldassarre, 2014). No need to mention that, they are initially a tree inhabitant and accordingly can fly. So as to keep them from taking off, their wings should be

either cut or cut the greater part of the huge plumes of in any event one of the wings.

better result in their performance. Duckweed is a valuable ingredient for them for feed intake and final weight gain (Leng et al., 1995).

Nesting

The muscovy ducks build up their nests in cavities and hollows close to water body (Downs et al., 2017). The nest may be 10-65 feet above the ground. They once in a while settle on the ground in dense vegetation close water. The female may be loyal to a single settle location over her lifetime. They utilize huge settle boxes. They make large nest cavities. Nest boxes are approximately 2.0 feet tall and 1.5 feet in width and profundity, with an entrance hole that measures 8.0 inches over. These nests are normally furnished with a layer of sawdust or dried grass in the base of the home. Nesting behavior of the domesticated muscovy duck is similar to that of its wild ancestor (Harun et al., 1998a).

Weight gain

The muscovies are greater and heavier than the other ducks, and flying gives them expansive and capable breast muscles, and solid, substantial legs. Their breast looks like a fair-sized steak. The drakes are much bigger than the ducks. A full-grown drake weighs about 15 pounds, and a duck up to 9-10 pounds. At eight weeks of age, the mean body weights for both sexes are 2.0 kg. Average daily gain of The muscovy is significantly higher than the Sudani ducks (Solomon et al., 2006).

Maternity

The muscovy ducks are expert mother. They take good care of their ducklings. They become broody when the right time comes and brood their own egg. Their mother instructs them at an early age how to feed. Often, the male stays in close contact with the brood for several weeks. Females brood and ensure their youthful for 60 to 70 days, when they become independent. Males keep watch regions where females raise their broods. Some folks keep them in with their chickens since muscovies are not as mucky as a regular duck and the arrangement seems to work well enough. Clutch ranges from 10-15. They incubate their eggs for 35 days until they hatch. Often a few females brood together.

Feed efficiency

The muscovy ducks are superior in respect of feed conversion and growth rate. They are more efficient in converting feed to live weight gain (Solomon et al., 2006). They exhibited superior body weight, weight gain, feed conversion ratio, dressing and breast percentage compared to the other breeds (Hassan et al., 2018). They are superior in respect of feed conversion (Rashid et al., 2009). Selection on residual feed intake improves their feed proficiency without impeding capacity to produce fatty liver (Drouilhet et al., 2016).

Feed intake

The muscovy ducks are omnivores. They eat a variety of plant and animal feeds. Their diet consists of plant material, small fish, amphibians, reptiles, crustaceans, insects, and millipedes. In wetlands they scrounge on grasses, sedges, water lily seeds, mangrove seeds, tubers, creepy crawly hatchlings, insects, shellfish, mollusks, worms, and reptiles. For scavenging natural feeds, they move forward in shallow water or at the marsh surfaces (Men, 1997). Sometimes they graze along grassy shorelines. They forage in farm fields on corn and other grains. Nutritional plans with extension of energy protein relationship showed

Egg production

In scavenging backyard farming condition muscovy duck can lay 60-80 eggs per year. Under good management conditions it extends to 100-125 eggs per year. Color of egg is glossy white sometimes greenish and buff tint. Average weight of egg in the first reproductive year is 70.9 and in second year it is 79.3 (Niclova and Penkov, 2004). Egg length is 2.4-2.8 inches and width is 1.7-1.9 inches. Clutch size is 8-16. Highest hatchability 83.1-85.1 when egg weighed between 75 g and 84 g. Fertility is similar to Pekin but hatchability is low (Rashid et al., 2009). Hatching rate is influenced by the consistency and duration of laying period. Hatchability is higher in clutches with shorter reproduction cycle (Harun et al., 1998a, 1999). Egg production from the egg-laying strains is very high when groups are small. Hatchability of muscovy duck egg was always found lower when its egg incubated artificially. First ducklings hatched from eggs with lower weight

(Weis et al., 2011). Egg length and metabolic rate at days 21 and 28 of incubation were the most important predictor variable. An incubation temperature of 37.5C with spraying and cooling appeared beneficial for larger eggs (Harun et al., 2001).

Meat production

In the recent years, there has been a rapid increase in the world production of duck meat. In 2000-2017, duck meat production increased by 53.8 % (from 2.90×10^6 to 4.46×10^6 MT) which is more than the production of goose meat (34.0 %, from 1.88×10^6 to 2.52×10^6 MT) and turkey meat (15.8 %, from 5.13×10^6 to 5.94×10^6 MT) and less than the production of chicken meat (86.0 %, from 58.7×10^6 to 109.0×10^6 MT). In spite of such a high increment, in 2017 duck meat accounted for as 3.7% of the overall poultry meat production. Production of stuffing ducks is restricted by a need of convention of consuming duck meat and its arrangements in most nations of the world, the customer conviction that duck carcasses are tall in fat and vitality, the red colour of the meat, and the higher cost of carcasses, carcass components, and meat arrangements from ducks compared to broiler chickens (Kokoszynski et al., 2020).

Meat quality

The quality of duck meat has been progressively important, since tactile traits such as appearance and delicacy of the meat (Qiao et al., 2001; Wawro et al., 2004; Xiansheng et al., 2006; Banga-Mboko et al., 2007; Ogah and Momoh, 2013; Kokoszynski et al., 2020). The sensory characteristics of duck meat can be affected by factors intrinsic to age at slaughter, sex, strains, muscle type or production systems, food and pre-slaughter management and postharvest (Berri, 2000; Qiao et al., 2001). The muscovy ducks own their ubiquity not as it were to the adaptation characteristics but too to the somewhat higher substance of breast and leg meat, and a lower substance of skin with subcutaneous fat and stomach fat within the carcass, which was better meet the prerequisites of the shoppers of duck meat compared to Pekin duck carcasses (Kokoszynski et al., 2020).

The muscovy breeds are popular because they have stronger tasty meat. Sometimes their meat

is compared to roasted beef. The meat has a unique taste; it is lean, meaty, tender and flavorful. Its leanness and delicacy are being regularly compared to veal. The carcass of muscovy duck is heavier than the most other domestic ducks ranging from 4-7 lb, giving them the highest yield of any duck available. They produce 50% more breast meat than other ducks. The muscovy breast meat is 99% lean. Dressing percentage is 71.2% which makes it ideal for dinner table.

Males grow faster than the female. Female has the higher fat aggradation ability that of the male. White-feathered muscovy has good meat performance according to carcass traits and meat quality, which is worth of being exploitation (Xiansheng et al., 2006). Females displayed more precocious muscular maturity. The changes in organoleptic characteristics show a decrease in tenderness, juiciness and mellowness and an increase in flavor and stringiness with age. At any given age, female breast muscles show up less delicate, less succulent and less smooth but have a more intense flavor and seem stringier than those of males (Baeza et al., 2000).

Male and female muscovy ducks have significantly more water in breast and leg muscles and less fat in leg muscles compared to mule ducks (Kokoszynski et al., 2020). Regardless of genotype, males exhibit significantly more protein in leg muscles. The genotype-sex interaction is significant for the water and protein content of leg muscles. The muscovy ducks contained more water (75.5 %-77.1%), less protein (19.3 %-19.6%), and less fat (0.9 %-1.1%). Comparative water substance (71.64%), and lower protein substance (21.91%) in breast muscles of muscovy was found (Woloszyn, 2002; Wawro et al., 2004). Marzoni et al.(2014)detailed comparative protein substance and higher water substance within the muscles of muscovy ducks. The lower lipid and collagen content in the breast muscles of muscovy is evident elsewhere (Schiavone et al., 2004, 2010).

Breeding

Female ducks attain their sexual maturity at 26-28 weeks of age and male ducks at 27-29 weeks. They are polygyny and do not forms stable pair (Harun et al., 1998b, 1999). The dominant male mates only with those females who make nests

in his territory. Breeding usually takes place from August to May. They mate on arrive or in water. They have the tendency to breed around 3-4 times annually. They lay 24-30 eggs per season. Incubation period is 35 days. During non-breeding seasons, they fly through the forest to feeding areas in early morning and evening, stay in branch of favorite trees during the day, and take rest high in trees at night, often in group. They are regularly seen in sets, even though individuals have multiple mates. They display their courtship minimally. Males make hissing sounds and they raise their crests on their heads, shaking their tails, pumping their heads, or lifting their wings. Males may battle savagely with each other in lakes, making brief flights whereas striking each other with their wings. They carry on forcefully toward each other throughout the year, but don't protect breeding domains. The female guards the nest and cares for the nestlings. Male and female rhythmically bob their tail to show their interest in courtship (Harun et al., 1998b; a, 1999).

Semen quality

There are three strategies for getting semen from poultry, *i.e.*, the stomach rub strategy for turkeys and cockerels, the electrical incitement strategy for chickens and ducks the and the fake vagina strategy for the duck. Gerzilov (2000) effectively obtained ejaculates from 21 (70%) out of 30 birds. The period for getting ejaculates kept going 2-3 weeks and the genuine regenerative period endured from April to the end of July. Obtaining ejaculates included romance, bouncing over, mounting and situating, incitement of the female, evagination of the penis, coordinating the semen collector, brief term rub of the drake cloaca, erection and ejaculation. A slight vacuum was induced by the rubber muff that additionally stimulated erection.

The sperm quality of muscovy duck implies ejaculate volume, motility, viability, normal morphology, plasma membrane integrity and mitochondrial function of the sperms. Semen pH was slightly alkaline, ejaculate volume 1.16 ± 0.01 ml; sperm mobility $73.02 \pm 0.33\%$; sperm concentration $1799 \pm 33 \times 10^6$ /ml; pH 6.99 ± 0.01 ; methylene blue reduction test 332 ± 8 sec; normal living spermatozoa $79.43 \pm 0.74\%$; abnormal spermatozoa $11.34 \pm 0.47\%$ and dead spermatozoa $9.10 \pm 0.29\%$ (Gerzilov, 2000). The

rate of live, dead, typical and irregular sperms did not vary essentially between breeds conjointly between drakes of the same breed. The spermatozoa of the breed can withstand warm stun for 10 min and cold shock for up to 1h.

Genetic resource

The muscovy duck is a type of waterfowl that has relatively better performance than other ducks. They are resistant to common diseases and able to utilize low-quality feed, but have the drawback of low egg production. The advancement of muscovy duck as a maker of good meat can be done through two approaches, *i.e.*, the long-term and short-term. The long-term approach is carried out by selecting muscovy duck which has fast development rate and high meat quality. The determination can be done specifically on the nature of development and the quality of meat, and indirectly by choosing a marker of development (morphology, organic chemistry or differing qualities of DNA/ RNA). Short-term selection can be done by assortment of the superior muscovy ducks from the outside developed by the farmers (Tamsil, 2018).

Genome sequence

Cairina moschata specific primers for 22 genes involved in carbohydrate and lipid metabolism were outlined concurring to duck sequences. These primers permitted quantitative RT-PCR enhancement of RNA from muscovy ducks. Amplified cDNA items from both species were sequenced and were found to be exceptionally comparable to chicken groupings (94%). This work gives extra genomic assets and polymorphism data for a few qualities in duck species and speaks to begin with step towards quality expression investigations in muscovy ducks. Total mitochondrial genome of the muscovy duck was sequenced by long and exact polymerase chain response (LA-PCR) as well as the primer walking sequence method (Tu et al., 2014). The complete mitochondrial genome of muscovy duck was 16,610 bp in length. Quality composition and course of action acclimated to most birds, which contained the common structure of 22 tRNAs, 2 rRNAs, 13 protein-coding qualities and a non-coding locale (Zdori et al., 1995; Wang et al., 2012; Tu et al., 2017).

Genetic diversity

The genetic diversity and relationship of four muscovy duck population collected from distinctive states (Assam, Mizoram, Odisha and Kerala) of India utilizing mtDNA cytochrome b and atomic DNA CYP2U1 qualities. The outcomes appeared as hereditary differences among population for both the qualities. Kerala populace appeared noteworthy hereditary contrasts from the other three populations. To characterize and gauge genetic diversity within the ecotypes of the locally adjusted muscovy duck in Nigeria utilizing blood proteins (hemoglobin, transferrin and albumin) and protein (carbonic anhydrase) markers, hereditary inconstancy within the considered populace obtained for utilizing heterozygosity, viable number of allele and polymorphism. All the 13 allelic variants expressed at the four loci were expressed in the Derived Savanna ecotype (Oguntunji and Ayorinde, 2015b).

The length of 475bp mitochondrial DNA cytochrome b (Cyt b) locale from 31 people in two topographical populations of Chinese household muscovy ducks was sequenced. Six haplotypes (S1-S6) were decided which contained six special varieties. This limited genetic diversity coincided with the studies of domestic duck and the mitochondrial control region of domestic muscovy duck in China (Sun et al., 2012). Hereditary characterization of muscovyducks collected from two agro-ecological zones of Nigeria (guinea savannah and rain forest) was carried out utilizing Irregular intensified polymorphic DNA strategy. Seven random opened up polymorphic DNA primers were employed using blood sample from 50 birds from the two populations. High similarity was obtained between the populations (0.86%). Genetic distance was small 0.14 suggesting that they have common ancestor and evolved little adaptive variations as a result of distribution.

Economic viability

Ducks are larger and less likely to be sick than the chickens. Unlike chicken, ducks don't fundamentally require supplementary grain and maize. Ducks eat more vegetable as a species next to chicken. Like chicken duck gives hard-cash pay and makes business openings for the rustic agriculturists and landless ladies and could be produced within a short time at

reasonable cost. muscovy duck plays an imperative part in food security of developing country by its egg and meat and their products (Yakubu, 2013). The muscovy ducks are generally superior in terms of performance, carcass traits, and economic values. Further, they seem to be resistant to most common duck diseases (Yakubu, 2013).

Health

The muscovy ducks seem to be resistant to most of the common duck diseases. The common diseases of muscovy ducks are fowl cholera, duck viral enteritis, reovirus infection and parvo viral infection. The reovirus can cause immunosuppression of muscovy duck reovirus disease caused sickness in 30% and passing in 20% of ducks on poultry ranches in Israel. In China, reovirus disease has been detailed in muscovy ducklings, with a coming about passing rate of 10%-30% since 1997. The confined reovirus was exceedingly pathogenic to 1-day-old muscovy ducklings by exploratory disease. In another study, an old style muscovyreovirus was detached from a wiped out muscovy duck with white necrotic foci in its liver in Zhejiang, China, in 2000. This traditional reovirus was engendered in a fibroblast cell line (DF-1) of chicken with clear cytopathic impacts. Its genome was 22,967 bp long. The length of the genomic portions was like those of avian orthoreoviruses.

A test concrete on diseases with various genotypes of H5N1 in mallards and muscovy ducks have been led, where it was discovered that the mortality of the immunized muscovy ducks was in any event 80%, paying little mind to the infection strain utilized. Interestingly, the mortality of the mallards went from nil to 100%, which proposes that muscovy ducks are more powerless to HPAIV H5N1 contamination as far as ailment advancement and mortality. It was likewise discovered that higher infection titers created in indispensable organs of muscovy ducks contrasted with mallards (Dung et al., 2011).

Parvovirus disease of muscovy ducks brought about by a hereditarily and antigenically unmistakable infection has been accounted for from Germany, France, Israel, Hungary, some Asian nations and the USA. The neurotic changes incorporated those of degenerative skeletal muscle myopathy and myocarditis,

hepatitis, sciatic neuritis and polioencephalomyelitis (Glavits et al., 2005). The primary outbreak of fowl cholera happened in muscovy ducks in Okinawa Prefecture of Japan in November 1990. Fifty of 200 ducks in a cultivate passed on of an intense illness. Remaining birds recouped after treatment with oxytetracycline. *Pasteurellamultocida* subsp. was disconnected in unadulterated culture from all tissues tried from two dead winged birds (Nakamine et al., 1992).

2. CONCLUSION

The muscovy ducks are superior to many other common ducks in terms of habitat, behavior, performance, carcass quality, health, and economic traits. Introduction of improved muscovy variety, training of the duck farmers, regular immunization of the ducks, financial and technical packages for the duck rearers could increase the muscovy duck raising with expanded family wage and employment to youth, rural women and the small-holder marginal farmers. Thus, raising of muscovy ducks in Bangladesh may be prospective.

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