PHENOTYPIC CHARACTERIZATION AND PRODUCTION PERFORMANCE OF MUSCOVY DUCK (NAG-HANS) MAINTAINED UNDER INTENSIVE AND FREE RANGE PRODUCTION SYSTEMS OF CHHATTISGARH

Thesis

Submitted to the
Indira Gandhi Agricultural University, Raipur

by

Lalit Kumar Baghel

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

Master of Veterinary Science

in

Livestock Production and Management

June, 2007

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CERTIFICATE-I

This is to certify that the thesis entitled **"Phenotypic characterization and production performance of Muscovy duck (Nag-Hans) maintained under intensive and free range production systems of Chhattisgarh"** submitted in partial fulfilment of the requirement for the degree of **Master of Veterinary Science** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by **Lalit Kumar Baghel** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma or has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him.

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CERTIFICATE-II

This is to certify that the thesis entitled **"Phenotypic characterization and production performance of Muscovy duck (Nag-Hans) maintained under intensive and free range production systems of Chhattisgarh"** submitted by **Lalit Kumar Baghel** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfilment of the requirement for the degree of **Master of Veterinary Science** in the Department of Livestock Production and Management has been approved by the Student's Advisory Committee after oral examination in collaboration with the external examiner.

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ACKNOWLEDGEMENT

This is my privilege to express my sincere gratitude to respected ***Dr. Ajit Kumar Santra,*** *Associate Professor, Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, Anjora, Durg (C.G.) the chairman of my advisory committee for his overwhelming support, healthy criticism and invaluable suggestions.*

At the outset, I take this opportunity to express my profound sense of heartfelt gratitude and indebtedness to ***Dr. S. Jogi,*** *Dean, College of Veterinary Science and Animal Husbandry, Anjora, Durg (C.G.) for his expert, meticulous probity, tremendous contemplation, magnificent ecstasy, marvelous guidance and constructive criticism during the present investigation and preparation of the manuscript. By working under the authority like him, I have inculcated confidence and innovative thinking which will have a lasting influence on my career.*

A formal word of acknowledgement will hardly fulfill the end of justice while expressing my deep sense of gratitude to Dr. S.K. Chourasia, Professor and Head, Department of Livestock Production and Management for his interest, close supervision, pragmatic approach, unfailing help and precious suggestions. Finally I thank him from core of my heart for his blissful hand.

I sincerely acknowledge the help and inspiration rendered by the members of my advisory committee Dr. P.K. Sanyal, Professor and Head, Department of Veterinary Parasitology, and Dr. Keshab Das, Associate Professor, Department of Livestock Production and Management for their valuable suggestions and generous help on this endeavor.

I am extremely grateful to Dr. Sharad Mishra, Professor, Department of Livestock Production and Management and Dr. D. Bhonsle, Assistant Professor, Department of Livestock Production and Management for their enthusiastic and amicable behavior with incessant motivation and all possible help rendered by them.

I am most grateful and feel highly esteemed to thank, Dr. S.P. Tiwari, Professor and Head, Department of Animal Nutrition and Dr. Kishore Mukherjee, Associate Professor, Department of Animal Breeding and Genetics for the ever willing help and moral support rendered to me during this endeavor.

I wish to place to this record to the person who never showed any prosaic attitude in helping me at their best of skills. Among which is Dr. S.D. Hirpurkar, Associate Professor, Department of Veterinary Microbiology.

It is pleasant duty to express my sincere gratitude to Dr. M.K. Gendley, Assistant Professor, Department of Animal Nutrition for his healthy suggestions during the entire study.

In same sequence I would like to thanks to Dr. D. Patil Dean, Gundadhur Agriculture College, Jagdalpur and Dr. Khune Assistant Professor Gundadhur Agriculture College, Jagdalpur, Bastar.

I am extremely delighted to extend my special thank to Mr Afzal Khan owner of Bastar Poultry Farm, Gohar and Imran for their kind support and providing me help during my research work.

I am most grateful and feel highly esteemed to express my thanks to Dr. Prashant Shinde Project Director, BILDP and Dr. Gautam Roy, VAS, DANIDA Project, Jagdalpur for their out standing cooperation during research period.

I pay my special thank to Mr. Dilip Choudhary, Assistant Librarian, Shri Ramakant Tiwari, and Dharamraj Dewangan for their nice cooperation.

I am most grateful and feel highly esteemed to express my thanks to (Drs.) V.B.S. Ayam, Sumanta Roy and Mahesh Poyam.

I will never forget the memorable company offered by friends (Drs.) Jyocee Jogi, Sadhana Kurrey, Mamta Lakara, Ravindra Singh, C.K. Asati, Parag Bansod, Amit Singh, Ashish Dubey and Anil Sharma,.

I feel proud to express my cordial thanks to (Drs.) Mangesh Mate, J.M. Desai, Fateh Singh, S.K. Paikara, Sandeep Indulkar, Bhushan Sahu, Dhruvesh Jaiswal and Naresh Khunte for their ever willing help.

In the same sequence I am also equally thankful to Shri Sampatji, Shri Vishnuji, Ram Charan Singh Tahkur and Shri Dharmendra for their indefinite cooperation and well-timed help.

My profound regards are forwarded to my MOM and DAD for their eternal blessings, forever love and generous affection which has brought me up to this stage and most important of all for innumerable sacrifice as this study caused a period of great hardship to them.

I am thankful to the Almighty for giving me patience and strength to overcome the difficulties that crossed my way in accomplishment of this endeavor.

Anjora, Durg ***LALIT KUMAR BAGHEL***

Date:

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CHAPTER-I
INTRODUCTION

Ducks played an important role in the human civilization since time immemorial. The Egyption history recorded its usefulness in their socio-economic life even 3000 years back (Kalita and Radhe, 2006). The history also reveals that the Emperors of China prefer roasted duckling on dinning table. The Indian ancient history too throws light on this subject revealing the familiarity with fowl, duck, geese etc. since 3200 years back. All breeds of domesticated birds except Muscovy have descended from Mallard or wild ducks which are widely distributed all over the globe. Presently the world duck population is estimated to be more than 573 million. About 85% populations are concentrated in the Asian region. China possesses the highest duck population among Asian countries.

India with population of 22.08 million ducks, contributes 7.19% of the total poultry population (Panda and Padhi, 2004). The leading states of duck population in the country are Kerala, Orissa, West-Bengal, Tripura, Assam, Andhra Pradesh and Tamil Nadu. The availability of extensive inland water bodies forming an excellent natural habitat for the ducks to thrive and reproduce. Besides, India having a long costal line of 5700 km, ducks in this area are traditionally reared. Ducks contribute significant to the total GNP to the extent of Rs. 4 crores annually (Jalaluddin, 2003). About 95% of the total duck population is non-descript desi ducks (e.g. Pati, Nageswari and Kuttanard). The Muscovy duck is also known as “Nag-Hans” in Chhattisgarh. They are abundantly found in Bastar region of Chhattisgarh and adjoining tract of Andra Pradesh and Orissa.

The Muscovy duck grazes like goose and the males have no curled feathers in tail which distinguishes the sex in other breeds of domesticated ducks. The adult body weight varies from 4.0 to 4.5 kg and 2.0 to 2.5 kg in males and females respectively. Hen can set three to four times in a year with a clutch of 8 to 21 eggs. The incubation period ranges from 34 to 36 days. Therefore, Muscovy is the first choice of the small farmers for efficient meat production in the tropics (Bauer, 1983). In Chhattisgarh the total duck population is 51,277 (Das, 2005). There is a great demand of ducks particularly the Muscovy ducks among the tribal people in Chhattisgarh and can be exploited as a subsidiary income source.

Ducks belong to the family Anatidae in the order Anseriformes. All the domesticated ducks are divided into two types: Pekin or common duck (*Anas platyrhynchos*) and Muscovy duck (*Cairina moschata*). These species differ in their number of liver insulin receptors (Chevalier *et al*., 1996) besides phenotypic characteristics. However, most breeds of domesticated birds have descended from mallard or wild ducks which are widely distributed all over the globe. Although most of the duck population is non-descriptive ducks but recognized breeds like Khakhi Campbell and Indian Runner are also very common. The farmers mainly maintain native ducks because of their good egg size, hardiness, easy management and popularity of meat amongst rural consumers (Mohanta *et al*., 2000). Muscovy duck or mute duck on the other hand originated in South America. It was domesticated by the Colombian and Peruvian Indians and then introduced to the Old World by the Spaniards and the Portuguese in the 16th Century. The Muscovy ducks have been domesticated in many parts of the world. Nag-Hans, a local variety of Muscovy breed is abundantly found in Bastar region of Chhattisgarh

and adjoining tract of Andhra Pradesh and Orissa. There is a great demand of 'Nag-Hans' among the tribals of Chhattisgarh state (Mukherjee, 2001). Although no systematic work has been done on Muscovy duck, yet some farmers claim that they prefer rearing this avian species because of the rusticity and disease resistance. Moreover these ducks have an enormous potentiality for additional source of income to the rural farmers. Compared to other duck species the economic importance of the Muscovy duck as a meat type bird is growing popularity both in traditional extensive and in modern intensive husbandry systems. Due to its good foraging and incubation behavior, Muscovy ducks are easily kept in scavenging system. The state of Chhattisgarh, therefore, holds a vast scope of Nag-Hans production by utilizing the available resources and marshy lands.

As no systematic investigations have been undertaken on the rearing and the productivity of Muscovy ducks in India in general and Chhattisgarh in perticular, there is an ample scope for bringing these duck in the arena of scientific research.

Therefore, the present investigation has been undertaken with the following objectives.

- To study the phenotypic characterization of ‘Nag-Hans’.
- To assess the productive and reproductive performance at organized and field conditions.
- To study the various parameters of egg quality of ‘Nag-Hans’.
- To study the mortality percentage of different ages.

CHAPTER-II
REVIEW OF LITERATURE

The name Muscovy is reported to be derived from an odour of musk that pervades the skin and it disappears when cooked. However, it is also stated that the Muscovy was named after the Muscovite Trading Company which plied its trade on the South American Coast. They are the only domestic birds that are not derived from mallards. A unique duck, Muscovies are tree birds rather than water birds. This means that they do not need a pond to swim in. Muscovy can be distinguished from other birds by its various characteristics such as head, colour of feathers and other reproductive features. They have been domesticated in many parts of the world. Traditionally farmers reared Muscovies mainly for meat production. Under good management with proper feeding, these ducks can be an important income generating avenue for the huge rural masses. Due to its hardiness and robustness, Muscovy has able to adapt to different climates and habitats. Therefore, there is a great scope to exploit these birds both for domestic and commercial purposes.

2.1 Phenotypic characterization of Muscovy duck:

Phenotypic characterization of an animal is primarily studied in order to distinguise from other animals. It also helps in classifying into different groups according to the phenotypic characters.

2.1.1 Colour of feathers:

Bauer (1983) observed both white and black colours Muscovy ducks. However, most of the ducks were pure white in colours. The author also reported ducks having a full range between black and white colours.

Panda and Mohapatra (1989) reported two common varieties namely white and dark Muscovies. However, white, white and black, blue, chocolate and white colour birds have also been observed (Anon, 1999). Many colour variations observed in the domestic form ranging from pure white through greys and browns to the black and white original colours (Dye and Stai, 1999).

White, black and white, blue (a light grey colour) and white, and bronze and white colours have also been reported by Backyard and Blitz (2000). A fawn with white colour was reported to be less common. The Philippine Muscovy duck was reported to have two distinct colours - the white and the black or brown group (Limson, 2000).

Nowland (2004) reported several colour varieties of Muscovy ducks. The common colours were white, black and black with white wings as reported by the author. 90 per cent white Muscovy was used for commercial production because of its white flesh. The drake unlike in other breeds devoid of curl feather in tail.

2.1.2 Colour of bill:

Barua (1990) reported the colour of bill as yellow and black with some red shading lighter towards the tips.

2.1.3 Head:

Bauer (1983) reported that all the Muscovy ducks have red flesh around their eyes and at the base of their bills. The author concluded that in older drakes it may even appear on the back of the neck and wings.

Barua (1990) reported featherless face, bright red skin and a knob on the head appearing like a crest in the drake.

Dye and Stai (1999) observed a black and /or red mask covering less facial area. The male Muscovy duck was found to have a well developed caruncle at the base of the beak just behind the eyes which was more prominent during the mating season (Anon 1999).

The Muscovy duck can easily be distinguished from other birds by its face which is devoid of feathers, bright red, fleshy and carunculated (Backyard and Biltz, 2000). Limson (2000) reported black spots on the head and blue eyes in Philippine Muscovy duck.

Nowland (2004) observed that the head was rather large as compared with the rest of its body and the face was devoid of feathers. It was also reported that the red caruncles were present on the face and at the top of the bills.

2.1.4 Leg:

The pure black variety with colour feet has been reported (Limson, 2000).The short and thick shanks and feet were reported to be orange colours (Nowland, 2004). The Muscovy duck was found to have sharp claw at the end of the toes (Elfick, 2007).

2.1.5 Body:

Nowland (2004) observed the rectangular body with slightly arched on top in Muscovy duck.

2.2 Productive Performance:

Muscovy is basically a meat purpose breed of duck and it is commercially exploited based on its production performance. The supplementation of feed is important in order to achieve good growth. Usually conventional feed such as broken rice and soybean meal have been used in diets for Muscovy ducks. The commercial duck industry is built around the meat breed. This is because much genetic improvement has taken place with the breed and it reaches market weight early than other breeds. Quality of feed is also very important especially in the first three weeks of duckling life. Feed is vital for future growth and the ration should be in high in protein.

2.2.1 Feeding and growth:

Bauer (1983) reported that under good management with proper feeding the ducks reached a body weight ranging from 4.0 to 4.5 kg in males and 2.0-2.5 kg in females at 16 weeks of age. The study recommended that 3 kg feed should be given for the first six weeks for ducklings in order to achieve proper growth. However, after 6 weeks ducks were fed entirely on locally produced feed such as sweet potatoes, banana, pumpkin etc. Other studies (Dong and Phuoc, 1994; Phuoc *et al.*, 1994) indicated that the F1 crosses of Muscovy ducks (imported crossed with local) had a good performance when fed with cereal-based concentrates.

The better feed conversion efficiency of Muscovy than Pekin breed was observed by Bogrene and Mihaly (1994).

A trial was conducted to determine the performance of Muscovy duck raised with available local feed resources (Dong *et al.,* 1996). The ducks supplemented daily with waste fish and water plants grew significantly faster than those supplemented once or twice weekly. Daily weight gain was reported to be 25.0 g/day. The study concluded that Muscovy duck raised on the traditional scavenging system and with daily supplementation of paddy rice, waste fish and water plants had better growth rate and were more profitable than when supplementation was done intermittently. The finding also asserted that F1 crosses of local and the French Muscovy ducks had a better performance as compared to the local Muscovy ducks under the poor farmer household conditions. The authors were of the opinion that by using more efficiently the feed resources for feeding Muscovy ducks the products could compete in price and quality with those produced by the better-off farmers in the urban areas. Finally the study recommended that raising of Muscovy ducks using local feed resources is a way in which landless farmers lacking of capital can improve their livelihood.

Dong (1996) observed that Muscovy ducks fed with local feed resources under on-farm studies showed a great potential for improving income of poor farmers.

Men *et al.* (1998) observed no significant difference in daily weight gains between the diet with 100 percent duckweed replacing soybeans and the conventional diet. The feed conversion ratio was significantly improved in the restricted broken rice diets.

Noor (1999) observed that the feed conversion ratio in male Muscovy duck was 2.7:1. The principal feed resources such as cereal brans (rice, sorghum and maize), local brewer's grains (sorghum and rice) and residues from the preparation of indigenous alcohol were the principal feed resources for the farmers (Mopate *et al.,* 1999). Despite supplementing feeds, the scavenging system or rearing remained dominating.

Ngamsaeng (2004) reported that total dry matter intake, live weight gain and feed conversion were better when the ducks were fed supplemented broken rice with duckweed than water spinach.

The adult body weight of male and female Muscovy duck was found to be 4.5-5.50 kg and 2.25-3.00 respectively (Nowland, 2004).

A study on the performance of Muscovy breed in Bangladesh (Bhuiyan *et al*, 2005) indicated that the final live weight was found to have 1225.0 g/duck under farmer's management upto the 9 weeks of age. The observation also revealed that the total feed consumption upto the brooding period was 1652.06 g/duckling and the respective feed conversion ratio was 2.91.

2.3 Reproductive performance:

Reproductive performance of a bird is considered to be one of the important factors in poultry production. The profitability of a farm is dependent of certain reproductive traits such as age at sexual maturity and egg production. Therefore, the investigation on these parameters is always important for further improvement of the present stock.

2.3.1 Clutch size and hatching:

Average clutch size 13.6 eggs with a range of 9-21 eggs has been reported by Markum and Baldassarre (1989). However, Leopold (1959) and Wetmore (1965) reported somewhat lower clutch size (8-10 eggs per clutch).

Mopate *et al.* (1999) reported average clutch per year was 2.6±1.2 with a mean egg number of 33±12 and a mean clutch size of 14 or 15 eggs. The mean age at culling of males is 2.6±1.2 years. Backyard and Blitz (2000) observed a clutch of 15-18 eggs.

Nowland (2004) however, revealed that Muscovy ducks laid their eggs in batches of about 20 and the first few eggs of the first batch was small. The author was of the opinion that those eggs should not be set for incubation. The observation also highlighted that Muscovy can be satisfactorily hatched out under broody hens than artificial incubation. Banga-Mboko *et al.* (2007) reported that the average number of eggs laid by Muscovy duck was 13.2±5 per clutch and the hatchability was close to 80.5±13%.

2.3.2 Maturity, incubation period and hatching season:

The generally accepted incubation period of Muscovy eggs was 35 days as reported by Delacour (1959) and Bolen (1983). Johnsgard (1978) found a correlation between nesting and the rainy season.

Bauer (1983) reported that the age at maturity for laying eggs was 8.5-9 months under village condition and the female laid 10-20 eggs per clutch. The author also observed no particular laying season. The incubation period was reported to be 35-37 days. However, Woodyard and Bolen (1984) observed that the success rate of hatching was 88 per cent.

Korotkova (1985) suggested that during the first three days the temperature should be maintained at 38.0^0C.

Wilson *et al.* (1987) reported 84% hatchability in Muscovy ducks. The incubation period was reported to be 4.6±0.15 weeks. Nesting behavioural data on wild Muscovy duck indicated an average incubation period of 30 days. (Markum and Baldassarre, 1989). Hatchability percentage in Muscovy duck was reported to be 54% by the same authors.

The study revealed that hatchability varied from 80 to 85% during the rainy season and from 59 to 78% during the dry season. The mean brooding period was observed 63±28 days (Mopate *et al.,* 1999).

Study carried out on the temperature regime on the surface of naturally hatched Muscovy duck eggs with the aim of its specifying during artificial incubation revealed that the surface temperature of the naturally hatched Muscovy duck eggs varied between 35.75 and 38.87^0C (Nickolova, 2005).

Duru *et al.* (2006) found that age at first laying was 7.7±0.44 months. Some farmers observed 80-90% hatchability in their flock. The study also highlighted that the temperature increased of the upper egg surface after the 20^{th}-23^{rd} day of the embryonic development to 37.92-38.87^0C was due to the use of yolk fats by the embryos leading to the release of more heat.

2.4 External evaluation of egg:

The external evaluation of an egg is done for judging its quality. The quality largely determines consumer's satisfaction, feasibility of transportation and storability.

2.4.1 Colour of egg:

Eggs were glossy white in colour, with some had a slight green or buff sheen (Markum and Baldassarre, 1989).

Nowland (2004) observed that the colour of egg was off-white slightly on the greenish side.

2.4.2 Egg length and diameter:

Bauer (1983) reported the diameter of a Muscovy duck was 45 mm. Egg length and diameter were measured for 110 Muscovy duck eggs by Markum and Baldassarre (1989). They found that the overall length and diameter was 61.25 ± 0.17 x 44.55 ± 0.12 mm which were smaller than the 67 x 44 mm average reported by Leopold (1959). However, the range in egg measurements found by Markum and Baldassarre (1989) was 55.5-65.5 x 51.7-46.9 mm which was similar to the 56.5-67.5 x 42.7- 48.0 mm range reported by Wetmore (1965).

2.4.3 Egg weight:

Markum and Baldassarre (1989) reported that average weight of Muscovy egg was 66.4 ± 0.71 with a range of 58.0-75.0 g.

2.5 System of duck management:

Several studies (Williamson and Payne, 1959; NRC, 1991) demonstrated that domesticated ducks were best maintained on free range. A survey on Muscovy duck rearing based on interviews was carried out in order to characterize keepers, husbandry practices, the socio-economic exploitation and the constraints (Mopate *et al*., 1999). The study revealed that 53 per cent men, 39 per cent women and 8 per cent children were engaged in duck keeping. Another important observation made by the researchers that 93 per cent farmers had small-

sized duck-homes of mud built in a corner of the homestead. Cleanings were ensured irregularly by the farmers. The average flock size was 9±6 birds. The similar flock size was reported by Kuit *et al*. (1985).

Duru *et al* (2006) reported a mean flock size of 10.9±10.8 birds occurring at the ratio of one drake to six females. The study also revealed that 74 per cent farmers had Muscovy duck. The findings by the same authors asserted that all the farmers provided supplementary feed such as kitchen leftover, maize bran and brewer's residues. It was also observed that 86 per cent of the farmers provided housing (mostly mud-huts) while 14 per cent did not provide housing in whatever form for their flock.

Banga-Mboko *et al.* (2007) observed that duck were mainly kept by men (80%). The study also highlighted the common observation on traditional poultry keeping such as scavenging during the day and housing overnight. The flock size was 7.7±3 ducks per unit.

2.6 Mortality of duck:

Diseases (57%) of the Muscovy ducks were the major production constraints as reported by (Mopate *et al.,* 1999). Paralysis of growing ducks, inflammation of the pigial gland, diarrhoea and respiratory symptoms were responsible for duck mortality.

Backyard and Blitz (2000) reported that Muscovies have less ailments and hardier than other domestic duck breeds. Mortality in Muscovy ducks due to highly pathogenic avian influenza virus of H7N1 subtype has been reported (Capua and Mutinelli, 2001).

A low mortality of 4 per cent in Muscovy ducks under farmer's condition in Bangladesh was reported by Bhuiyan *et al*.(2005).

A high mortality (80%) due to poor feeding, lack of veterinary care and housing conditions was observed in indigenous Muscovy ducks in Congo-Brazzaville (Banga-Mboko *et al.*, 2007).

Duru *et al.* (2006) revealed that the Muscovy duck was apparently more resistant to disease that regularly decimated other poultry. The authors were of the opinion that high resistant to diseases was the reason for Muscovy duck for which villagers favoured them.

CHAPTER-III
MATERIALS AND METHODS

Muscovy ducks are found in Chhattisgarh state. They are very popular among tribals as meat purpose duck. The farmers primarily rear these ducks because of their hardiness and quality of meat. Many small farmers have their preference for 'Nag-Hans' as meat purpose breed than other ducks.

3.1 Place of work:

The present study was carried out during 2006-2007 with Muscovy duck population at the College Duck Unit (College of Veterinary Science and Animal Husbandry, Anjora, (Durg), Gundadhur Agriculture College (Jagdalpur) and in the few pockets of Chhattisgarh state where Muscovy ducks were found abundantly and reared under free range production system.

3.1.1 College duck unit:

A total number of thirty three ducks were available for the study. Ducks were reared by intensive rearing system. They were maintained in close premises with no access to water ponds. Experimental rations prepared by the Chhattisgarh Feed Manufacturer's Association were given two times feeding e.g. morning and evening based on their total diet requirement. The ration was fed as wet mash. Every morning the experimental house was cleaned with fresh water. Feeders and drinkers were cleaned and dried daily before use. Data were recorded on initial weight (g/ducklings), fortnightly growth records (g/ducks) and feed efficiency (Bhuiyan *et al.,* 2005). Similarly weighing of adult birds (parents stocks) were performed in order to estimate the average live weight.

Information relating to number of eggs laid, number of ducklings hatched etc. were collected.

3.1.2 Gundadhur Agriculture College, Jagdalpur:

A total number of eighteen birds were available for study in Gundadhur Agriculture College, Jagdalpur and thirty eight birds from Bastar Poultry Farm, Adawaal, Jagdalpur. Muscovy ducks were maintained under intensive system of rearing. They were access to near by water bodies located in the farm. The other management system followed the same as incase of College Duck Unit, Anjora, Durg.

3.1.3 Study at fields:

Data on various parameters were also collected from various pockets in Chhattisgarh. The location of various pockets were selected based on the numbers of Muscovy ducks available in abundantly in those pockets. Farmers kept ducks in homesteads traditionally. The survey was conducted within homesteads in presence of duck flocks in order to better fix the attention of duck keepers and to precise flock sizes and other parameters. For this a structured questionnaire was prepared to cover some important aspects of duck production such as management, breeding, reproduction, nutrition, heath, marketing and utilization. Farmers were randomly selected to constitute the largest population from different locations in the study area. The questionnaire was administered through personal interview with the farmers.

3.2 Phenotypic characterization:

The Phenotypic characterization of Muscovy ducks was recorded by studying individual birds. The parameters studied in the present study includes

colour of feather, colour and shape of bill, colour of skin, eye and shank colours, length of neck and presence or absence of knob. Measurements were taken on adult birds.

The shank lengths were recorded in cm as the right and left shanks. Measurements were recorded from the outer hock joint to a point between the pad and outer toe of the birds after they were laid on the table (George *et al.,* 1979). Keel bone lengths were recorded in cm as the length of sternum. Breast width was recorded in cm from middle of sternum.

3.3 Production and reproduction parameters:

The production and reproduction parameters were studied under the following heads.

3.3.1 Body weight:

The body weight of day old chicks was recorded fortnightly upto 16 weeks of age. The feed consumed by bird was recorded daily. Age at maturity in female was recorded upto first laying of egg.

3.3.2 Physical evaluation of egg:

The physical evaluation of egg was studied under the following parameters: colour of egg, weight of egg, egg length and width and shape index of egg.

The colour of egg was recorded after studying the individual egg colour. The weight of the egg was recorded in grams nearest to 2.5g accuracy with the help of a 250g capacity balance (Das *et al.*, 2000). The egg length and diameters (calipers, nearest 0.05 mm) was done as per Markum and Baldassarre (1989).

Shape index was measured to be a ratio between the width of the egg to its length and expressed in percentage (Shultz, 1953).

Incubation was assumed to begin on the day following clutch completion and hatching date was determined by actual observation of ducklings in the nest box. The incubation period was registered.

3.4 Mortality of duck:

The information on mortality was recorded at different studied sites.

3.5 Statistical methods:

The mean and standard error for the different parameters of Muscovy duck was determined using standard statistical formulae given by Snedecor and Cochran, 1967 along with determining the frequency of occurance of different characteristics of Muscovy duck.

CHAPTER – IV
RESULTS AND DISCUSSION

4.1 Phenotypic characterization:

Muscovy ducks are basically wild ducks which have been domesticated in some parts of India like, Orissa, Ranchi (Jharkhand) and Southern parts of Chhattisgarh region, but, till today they have been classified under the category of domestic duck. However, for all technical purposes they are domesticated ducks and are reared in free range system. These ducks especially the females have got capability to fly at one stretch for more than three hundred meters. Males being heavier in body weight usually do not fly for more than thirty meters. These birds are though semi aquatic but they do thrive very well in intensive system of rearing. The only requirement in such a case is that they should be fed with either moist food or liquid food, as they are unable to swallow the solid mass without water. Normally each flock of 10 to 12 females is lead by one robust male. The other males if present in a flock also follow the females and only when opportunity comes they also breed with the females. When breeding season comes the plumage colour of male and female becomes dark and shiny in appearance and the colour of the bill also becomes dark red. Usually each female lays about 9-10 eggs within a span of 12 to 15 days times. Then she or her other laying partners sits on eggs for incubation. If provided by laying basket normally 2 to 3 females simultaneously sit for incubation in one basket for hatching of eggs. Eggs are being hatched in 30 days time along with 70-80% hatchability as far as fertility of an egg is concerned, no sooner there is a development of an embryo inside the

egg, the normal colour of an eggs turns blue. Thus it is easy to work out the fertility without the eggs being candled. Normally the fertility is 80-85%. Every female repeats of its laying soon after it is free from hatching as out of two to three females sitting on eggs for hatching, only the robust female takes the charge of the chicks. Soon after 10-25 days these females again start laying in a similar fashioned as mentioned earlier and such of phases occur in a year for about three times. Thus it is clear that from one female one could expect about 25 to 35 eggs in a year. Some of the females have been reported to lay about 50-60 eggs in a year. In nut shell there are lot of variations in these Muscovy ducks, with regards to size, shape, body weight, colour pattern, colour of eyes, and colours of webbed. Thus, it is very much needed that a common phenotypic characterization for these Muscovy ducks should be done for which the present investigations have been undertaken. Though these ducks are Muscovy ducks but in local languages of Chhattisgarh and Orissa there are being designated as Nak-Hans, Moti-Hans and Nag-Hans. These designations are so derived as over there nose on beak, there is presence of knob (Nak-Hans), multiple knobs giving a pseudo appearance of comb, (Moti-Hans) and the males as well as the females incubating the egg produce a hissing sound like that of a snake, they are being designated as Nag-Hans.

4.1.1 Colour of the feather:

On the basis of phenotype with regard to colour of feathers the study was conducted on Muscovy ducks at Anjora, Jagdalpur and in field conditions under three categories: namely Colour of Head, Colour of Throat and Colour of Neck. The results of the same are being depicted in Table No. 1, Table No. 2 and Table

No. 3 along with Figure No. 1, Figure No.2 and Figure 3. As far as the colour of head is concerned Black colour dominated in all the three places followed by, Brown Black colour, White colour, Brown colour, Black White colour, Brown White colour and Levandor colour. The frequency of Brown White colour was only observed in field conditions. However, White colour gene was observed at Jagdalpur as well as in field conditions. The Levandor colour existed only at Jagdalpur. Thus, it could be concluded that at Jagdalpur and field conditions colour variations of head were more in comparison to Anjora Farm. This is quite logical as at these places farmers have been raising Muscovy ducks for table purpose since long time. Head colour variations of Muscovy duck strongly suggest that the colour variations is governed by quantitative genes and there are lot of chances for selection on these basis if these colour patterns could be correlated with production traits and some gene could be marked out. The present findings are in close agreement with the reports of Das (2006).

In Table No. 2 the results of frequency of different throat colours of Muscovy ducks are presented (Fig. No.2). The colour of the throat was reported to be highest for White gene followed by Brown White, Black White, Levandor, Levandor Brown and Brown Black colour pooled for all the three places. However, the different frequencies for various places of experimentations have been presented in Table No. 2. Which did not reveal any systematic colour pattern? For neck colour pattern also (Table 3 and Fig. No.3) the frequency of White colour was highest followed by Levandor colour, Black White colour, Brown colour and other colour patterns respectively. The neck colour also did not follow any systematic pattern. Since these Muscovy ducks have been reported

only at parts of Orissa and South Chhattisgarh, not much of studies have been conducted on these birds and therefore, the results could not be compared with the findings of previous workers.

4.1.2 Colour of bill:

Muscovy ducks showed a wide range of bill colour patterns at Anjora Farm 66.63% animal showed pink white black colour pattern followed by pink black colour (27.31%) and alternate pink black colour (6.06%) at Anjora Farm. Jagdalpur Farm showed eight varieties of bill colour pattern highest frequency for pink white black colour (30.35%) followed by alternate pink colour (26.78%), pink black colour (14.28%), pinkish white colour (12.5%), pure pink colour (8.92%), white black colour (3.57%), white pink colour and white black white colour (1.78% each). In field conditions the white pink colour pattern was absent. However, other colour patterns were present as depicted in Table No. 4, Fig. No.4 and Fig. No. 12. The colour of the bill pattern could not be correlated with colour pattern of head, throat and neck. Hence no conclusion could be drawn about the existence of bill colour pattern with that of colour of feathers. The only advantage of these colour pattern of bill might be that incase of male the colour of bill is usually darker in comparison to female. These colour patterns of bill also become brighter and shiny at the time of either laying or breeding season. However, incase of broody hens these colours are pale. The present findings, however, are not in agreement with the observation by Barua(1999).

4.1.3 Length of bill of Muscovy ducks:

Presented in Table No.5 are the results of length of bill in cm for Muscovy ducks reared at three different places under study. The overall length of bill was

found to be 5.14±0.05 cms in length. The maximum length of bill was recorded in field farm followed Jagdalpur and Anjora farms. Statistical analysis showed non-significance difference among various.

4.1.4 Width of bill of Muscovy ducks:

Presented in Table No. 6 are the results of width of bill in cms for Muscovy ducks. The overall mean value for width of bill was found to be 2.59±0.02 cms. The maximum width of bill was observed incase of field farm data followed by Anjora and Jagdalpur farm data. On statistical analysis it was found that the data did not differ significantly amongst various farms under study. Both length and width of bill is important incase of Muscovy ducks as the feed intake is being done by the bill. Animal gathers maximum food inside the bill and for swallowing it they dip their bill inside the water and it is only through intake of water the food is being swallowed. Therefore, proper development of bill is indication of sound health and maximum points should be given while fixing any selection criteria.

4.1.5 Shape of bill:

With regard to shape of bill of Muscovy duck at all the three places under study did not show any change and the shape followed a typical “U” pattern as described by Das (2006).

4.1.6 Shape of bean:

With regard to shape of bean of Muscovy duck at all the three places under study did not show any change and the shape followed a typical “Oval” shape as described by Das (2006).

4.1.7 Colour of skin:

Presented in Table No. 7 and Fig. No. 5 is the frequencies of different skin colours of Muscovy ducks. As has been observed in the present study conducted at three places their exists three colour patterns of skin in Muscovy duck. The frequency of pinkish white colour was highest at all the three places (>90%) followed by pink colour and white colour. Generally white colour was observed when ducks were out of breeding then there starts development of small amount of pink colour. Which ultimately gets matured into pinkish white colour which is sign of healthy breeding birds. The presented findings are in-closed agreement with the report of Das (2006).

4.1.8 Colour of shank:

The colour of shank pattern of Muscovy ducks showed four definite colour patterns at all the places under study. The black colour pattern of shank (Table No.8 and Fig. No. 6) was observed to be highest followed by brown black colour, black green colour and yellow brown colour. The frequency of yellow brown colour was lowest and at times it is resultant of cross between an ordinary duck male with Muscovy duck females. Usually such Muscovy duck females are sterile and thus breeding of such birds should be avoided as far as possible. Normally when kept together along with ordinary ducks, the male duck mates frequently with female Muscovy duck resulting into this colour pattern. Since the study was limited to small number of animal population, this statement requires further studies in larger population and the results of the present investigations must be used with caution. The present findings do not corroborate with the earlier worker (Nowland, 2004).

4.1.9 Colour of eye:

The present investigation with regard to eye colour showed only two colour patterns of the eye incase of Muscovy duck. Presented in Table No. 9, Fig. No. 7 and Fig No. 13 is the results for different colours of eye incase of Muscovy duck. Brown black colour had the maximum frequency at all the three places under study (>85%) followed by yellow black colour. No definite correlation could be established with eye colour and other productive traits. However, Philippine Muscovy duck was found to have blue eyes (Limsom, 2000).

4.1.10 Presence or absence of knob:

Incase of Muscovy duck the identification of sex is mainly governed by the presence or absence of knob. All the male Muscovy birds have a well developed knob, however the same is absent incase of Muscovy female. The colour of the knob incase of males varies from pink to dark red and finally to blackish red. In early ages when the males are not sufficiently matured the colour of knob is pink but specially at the breeding season the colour of the knob changes to bright shiny red colour. This is probably for an attraction of females. The more brighter and shiny is the colour of knob, the more versatile and dominant is the male. In later ages when the body testosterone level goes down the colour of the knob changes to blackish. The present findings have the similarity with the reports of Bauer (1983).

4.1.11 Length of neck:

Presented in Table No. 10 are the results of length of neck in inches of Muscovy ducks studied under three places as mentioned. The mean length of neck measured from first cervical to last cervical vertebrae was observed to be 3.78 ±

0.08 inches. The highest neck length was recorded at Jagdalpur flock followed by field flock and Anjora flock. Statistical analysis revealed a significant difference ($P<0.05$) among the neck length of Muscovy duck. There was a significant difference between Anjora flock and Jagdalpur and Field flock. However, there was a non-significant difference among the Jagdalpur and field flocks. This variation might be due to age differences as Anjora farm rears ducks under intensive system and frequent culling is practiced as the birds grow old.

4.1.12 Length of keel bone of Muscovy duck:

Presented in Table No. 11 are the results of length of keel bone in inches of Muscovy ducks. This is an important trait as development of keel bone is directly related with the dressing percentage. The average mean length of keel bone in inches was measured as 5.47 ± 0.06 inches. Highest keel bone length was observed at Anjora farm followed by Jagdalpur and field farms. All the values under study were found to be non-significant on statistical analysis.

4.1.13 Breast width of Muscovy duck:

In Table No. 12 are shown the results of width of breast in inches of Muscovy ducks. The maximum width of breast muscle was measured at the broadest point of breast muscle area. The mean breast width was observed to be 5.18 ±0.05 inches. The maximum breast width was observed at Jagdalpur farm followed by field and Anjora farm. Statistical analysis revealed a non-significant difference among various farms.

4.1.14 Length of thigh:

The results of length of thigh measured in inches for Muscovy ducks under study at three different farms have been depicted in Table No. 13. Length was

measured in inches from head of the femur to the distal extremity femur bone. The overall mean length of thigh was observed to be 5.15±0.04 inches. Highest length was observed incase of field farm followed Anjora and Jagdalpur farms. Statistical analysis revealed non-significant difference among three farms under study.

4.1.15 Colour patterns of webbed feet

During the study conducted at three different places the different colours patterns of webbed feet found were black, yellow black with black spots, cream with greyish spots and pale yellow with algae green spots.

4.2 Physical evaluation of egg:

The eggs of Muscovy ducks have been studied under various heads such as weight, length, width and shape index. In one laying season a single hen laid about 35 to 55 eggs with two or three breaks of 10 to 12 eggs per laying season. It has been observed that more than 75 per cent of Muscovy duck owners belong to below poverty line and are tribals. They have got there own customs and taboos. Muscovy ducks are their major source of side income. Therefore, they do not sale or consume the eggs obtained from these Muscovies ducks and only use these eggs for hatching purposes. It is their belief that if these eggs are being handled by any human being, then the birds will not sit for hatching. Therefore they do not allow these eggs to be touched by any one. Under this circumstance, the study of the internal parameters of eggs was not possible hence this becomes the limitation of this study. However, the other study of physical character has been laid at greater length as fallows.

4.2.1 Weight of eggs in (g) of Muscovy ducks:

Presented in Table No. 14 and Fig. No. 14 are the weights of eggs in grams of Muscovy ducks obtained from Jagdalpur and Anjora farms. The overall egg weight was observed to be 62.66±0.77 g. Highest mean egg weight was recorded for Anjora farm which was observed to be 66.60±0.82 g, whereas 60.26±1.0 g mean egg weight recorded from Jagdalpur farm. Both Anjora and Jagdalpur farm mean egg weight differed significantly ($p<0.05$) amongst each other. These variations are usually observed because of the fact whether the eggs are being laid for the first time (pullet egg or adult egg). Usually the pullet eggs are lighter than the adult eggs. It is just possible that when the study was being conducted, the laying stage of two farms might have differed. However, it could be concluded that the egg weight normally varies from 60.26±1.0 g to 66.61±0.82 g. These results are comparable with the reports of Das (2006).

4.2.2 Length of eggs of Muscovy ducks:

Presented in Table No. 15 and Fig. No. 15 are the results of mean length of eggs in cms of Muscovy ducks for Anjora and Jagdalpur farms. The overall mean length of eggs was measured as 5.98±0.04 cm. Highest length was observed for Anjora farm followed by Jagdalpur farm and both Anjora and Jagdalpur farm differed significantly ($p<0.05$) for length of eggs. The cause of variation in length for two farms might be the same as explained for weight of eggs.

4.2.3 Width of eggs of Muscovy ducks:

The mean width of eggs in cm for Muscovy ducks are presented in Table No. 16 and Fig. No. 16 for Anjora and Jagdalpur farms. The overall mean width of eggs of Muscovy duck was observed as 3.93±0.05 cm. Incase of width also

maximum width was observed for Anjora farm followed by Jagdalpur farm. Both Jagdalpur and Anjora farm differed significantly ($p<0.05$) for width of eggs. The cause of variation in width could be the same as incase of length and weight of eggs.

4.2.4 Shape index of eggs of Muscovy ducks:

Presented in Table No. 17 are the results of shape index of eggs of Muscovy ducks for Anjora and Jagdalpur farms. As per definition the shape index of an egg is a ratio of width of egg to the length of egg expressed in terms of percentage. Better is the shape index healthier will be the embryo. The overall mean shape index of egg of Muscovy ducks was observed to be 66.32±0.73 per cent. Shape index was highest for Anjora farm followed by Jagdalpur farm. These results were expected as both width and length of Anjora farm were higher in comparison to Jagdalpur farm. The two farms differed significantly ($p<0.05$) amongst each other as far as the shape index of egg was concerned.

4.2.5 Frequency of different colours of eggs of Muscovy ducks:

Presented in Table No. 18, Fig. No. 8 and Fig. No. 17 are the results of different colour patterns of egg of Muscovy ducks reared under Anjora and Jagdalpur farms. As per the present study, there existed four different colour patterns of egg of Muscovy ducks. Highest numbers of eggs were pale white in colour followed by reddish white, dusty white and bluish white colour. These colour patterns are usually governed by the colour of skin and colour of feathers. Appearance of bluish colour indicates formation of an embryo.

4.2.6 Different seasons of egg production of Muscovy ducks:

The data for the present investigation for different seasons of egg production has been collected by questionnaire method and results for the same have been presented in Table No. 19 and Fig. No. 9. The study reveals that laying existed almost for the whole year in which pre-monsoon season experienced highest laying followed by monsoon, summer and winter seasons. These findings are in conformation with the reports of Das (2006).

4.2.7 Different system of rearing of Muscovy ducks in field conditions:

The data for the present investigation for different systems of rearing of Muscovy ducks has been collected by questionnaire method. According to the answers received there exist on two systems of rearing, namely free range system and semi-intensive system. These results are summarized in Table no 20 and have been depicted in Fig no 10. About 72.5 per cent people reared Muscovy ducks in free range system, whereas about 27.4 per cent people reared birds in semi-intensive system. Persons residing near by river, nala, tank or any other water source usually kept these birds in free range system with a no of 8 – 10 birds each. These are the persons who are below poverty line and cannot afford any feed to their birds. Normally grazing is being done in and around water source and then at the time of sun set birds return to their respective homes where they are sheltered in small huts, over the roof or over the tree.

4.2.8 Different timings in laying of Muscovy ducks:

Depicted in Table No 21 and Fig No 11 are the results obtained by questionnaire method for different times of laying. Like any other ducks, most of

the laying was completed either in early morning or in night hours. However, certain amount is experienced during evening time followed by afternoon hours.

4.3.1 Body weight gain at 15 days interval and feed conversion efficiency:

All the day old chicks were weighed and their body weights were recorded. After this at every 15 days interval average body weight of birds were also recorded till the age of 135 days. The amount of feed consumed for 15 days body weight gain was worked out. Thus gain in body weight per day was also worked out.

Presented in Table 22 are the results of gain in body weights of Muscovy ducks at 15 days interval, right from day old to 135 days time along with gain in body weights in grams per day and the amount of feed consumed for 15 days time by an individual bird. From zero days to 15 days time the average gain in grams was recorded to be 177.23± 27.29 with an average gain per day of 11.81 g. During this period the average consumption of feed was recorded to be 531.69 g. From 15 to 30 days time the average gain was recorded to be 146.66± 17.49 g. The average gain in grams per day during this period was recorded to be 9.77 g with average feed consumption of 139.98 g for15 days. This was the time when birds under study were exposed to new feeding schedule and they did not consume proper feed and the growth was also adversely affected. From 30 to 45 days time grams gain in 15 days was recorded to be 173.84± 42.18 g with an average grams gain per day of 11.58 g. During this fortnight the average feed consumption was recorded to be 518.06 g. From 45 to 60 days time all these three measurements i.e. Grams gain in 15 days, grams gain per day and average feed consumed in 15 days time , were recorded as 191.15± 61.78 g, 12.74 g and 569.63 g respectively.

Maximum gain in 15 days time was recorded for 60 to 75 days time. During this period the birds gained about 765.41± 293.43 g with an average gain per day of 51.02 g. During these 15 days the birds consumed about 2.53 kilograms of feed. During 75 to 90 days time these three readings were recorded as 487.5±220.87 g, 32.5 g and 1.31 kilograms. From 90 to 105 days time the birds consumed 1.20 kilogram of feed with an average gain per day of 28.77 g. They gained 431.66.37g during 15 days time. From 105 to 120 days the gain in 15 days time was recorded as 156.12± 37.7 g with 10.4 g gain per day gain. The average feed consumed for 15 days time was recorded as 1.2 kilograms. Lastly from 120 to 135 days average gain for 15 days was recorded as 114.3± 83.18 g with an average gain per day of 7.62 g. The feed consumed during these 15 days was recorded to be 1.3 kilograms. From zero to 135 days time the total gain was observed to be 2.65 kilograms by consuming about 7.57 kilograms of feed. Thus we can conclude that the feed efficiency was 1:2.856 which is comparable with the reports of Das (2006).

4.4.1 Mortality of Muscovy duck:

A low mortality of Muscovy duck was observed in the present study. Two ducklings were found dead in Anjora farm. There was no precise data on mortality of Muscovy duck in the field. However, farmers reported that a low mortality was observed in the farmers flock. Therefore, the conclusion could be drawn from the study that the Muscovy ducks were apparently more resistant to diseases.

CHAPTER -V

SUMMARY, CONCLUSIONS, SUGGESTIONS FOR FUTURE RESEARCH WORK

Studies were carried out during 2006-07 with Muscovy duck populations in the College Duck Unit, Anjora, Gundadhur Agriculture College, Jagdalpur and in few pockets of Chhattisgarh region. Results showed that Black colour head dominated in all the three places followed by Brown Black colour, White colour, Brown colour, Black White colour, Brown White colour, and Levandor colour, Brown White colour was only recorded in field conditions. However, Levandor colour was only observed at Jagdalpur farm.

Throat colours of Muscovy duck was found to be highest for white gene followed by Brown White, Black White, Levandor, Levandor Brown and Brown Black colour pooled for all the three places. The frequency of White colour neck was highest followed by Levandor colour, Black White colour, Brown colour and other colour patterns, respectively.

Pink White Black colour pattern of bill was observed to 66.63 per cent followed by Pink Black colour (27.31%) and alternate Pink Black colour (6.06%) at Anjora Duck Unit. However, eight varieties of bill colour pattern was observed in Jagdalpur farm. The highest frequency for Pink White Black colour i.e. 30.35% was recorded in that farm. The White Pink colour pattern, however, was absent in the field.

The shape of bill of Muscovy duck was observed a typical “U” pattern in all the studied units. The shape of bean of Muscovy duck at all the three places under study did not show any change and the shape followed a typical “Oval” shape. With regard to colour of Skin, the frequency of Pinkish White colour was highest at all the three places (79%) followed by Pink colour and White colour.

With regard to Shank colour, the Black colour pattern was recorded to be highest followed by Brown Black colour, Black Green colour and Yellow Brown colour. The eye colour showed only two colour patterns i.e. Brown Black and Yellow Black colours.

All the Muscovy ducks under study had a well developed Knob. The colour of Knob varied from Pink to dark Red and finally to Blackish Red. With regard to length of neck, the mean length of neck was observed to be 3.78±0.08 inches. The highest neck length was recorded at Jagdalpur flock followed by field flock and Anjora flock. The average mean length of Keel Bone was measured as 5.47±0.06 inches. Highest Keel Bone length was observed at Anjora farm followed by Jagdalpur and field farms.

With regard to Breast Width, the maximum width of Breast muscle was measured at the broadest point of Breast muscle area. The mean Breast Width was observed to be 5.18±0.05 inches. The overall mean length of thigh was observed to be 5.15±0.04 inches. Highest length was observed in field farm followed in Anjora and Jagdalpur farms.

The overall egg weight was observed to be 62.66 g. Highest mean egg weight was recorded for Anjora farm which was observed to be 66.61 g, whereas, 60.26 mean egg weight recorded from Jagdalpur farm.

The overall mean length of egg was measured as 5.98±0.4 cm. Highest length was observed from Anjora farm followed by Jagdalpur farm. The overall mean width of eggs of Muscovy ducks was recorded as 3.93±0.05 cm. Maximum width was observed for Anjora farm followed by Jagdalpur farm.

The overall mean shape index of egg of Muscovy duck was found to be 66.32±0.73 per cent. Shape index was highest for Anjora farm followed by Jagdalpur farm. Four different colour patterns of egg of Muscovy duck were observed. Highest numbers of eggs were pale white in colour followed by reddish white, dusty white and bluish white colour.

Different season of egg production revealed that premonsoon season experienced with highest laying followed by monsoon, summer and winter season.

The system of rearing, namely free range system and semi intensive system were observed. About 72.5 per cent people reared Muscovy ducks in free range system followed by 27.5 per cent people reared birds in semi intensive system. Farmers residing nearby tanks, river or any other water bodies normally kept Muscovy ducks in free range system with a number of 8-10 birds each.

Different timings of laying are recorded in Muscovy duck revealed that most of the laying was completed in early morning or in night hours. However, some ducks were reported laying during evening or afternoon hours.

Body weight gain at 15 days interval and feed conversion efficiency revealed that maximum gain (765.41±293.4 g) was recorded for 60 to 75 days time with an average gain per day of 51.02 g. During these period the birds consumed about 2.53 kg of feed. The findings also revealed that from zero to 135 days time the total gain was observed to be 2.65 kg by consuming about 7.57 kg of feed. Therefore, the feed conversion ratio was found to be 1:2.856 in the present study.

Muscovy duck was observed to be more resistant to avian diseases.

CONCLUSIONS:

01. Muscovy ducks are though semiaquactic but they do thrive well in intensive system of rearing. Usually each flock of 10 to 12 females is lead by one robust male. Each female normally lays about 9-10 eggs within a span of 12 to 15 days times. Eggs are being hatched in 30 days time along with 70-80% hatchability as far as fertility of an egg is concerned.

02. The head colour was observed different colour patterns such as Black, Brown Black, Black White, Brown White, White and Levandor. The Black colour was dominated. Head colour variation strongly suggests that the colour variation is governed by quantitative genes.

03. The Throat colour was reported as White, Brown White, Black White, Levandor, Levandor Brown and Brown Black colour. The bill colour was observed as Pink White Black, Pink Black and alternate Pink Black colour. The colour of the bill pattern could not be correlated with colour pattern of head, throat and neck.

04. “U” shaped bill and “Oval” shaped bean were reported in Muscovy duck. Pinkish White colour was highest followed by Pink and White colours. No definite correlation could be established with eye colour and other productive traits.

05. The brighter and shiny Knob colour has the relationship with dominancy. However, in the later ages when the body testosterone level goes down the colour of the Knob changes to Blackish. A significant difference among the neck length was observed. All the values on length of Keel Bone under

study were found to be non-significant. Both thigh length and breast width revealed a non-significant difference among three farms under study.

06. The overall egg weight was found to be 62.66±77 g with highest mean egg weight recorded at Anjora farm followed by Jagdalpur farm. The variations were due to various stages of laying occurred in two places.

07. The overall mean length of egg was measured as 5.98±0.04 cm. The overall mean width of Muscovy egg was observed to be 3.93±0.05 cm.

08. The shape index is a ratio of the width of egg to the length of egg expressed in terms of percentage. The overall mean shape index was found to be 66.32±0.73 per cent. The two farms differed significantly ($p<0.05$) amongst each other.

09. Four different colour patterns of eggs, namely pale white, reddish white, dusty white and bluish white were observed. The colours of eggs are usually influenced by colour of skin and colour of feathers. Appearance of bluish colour indicates formation of an embryo.

10. The findings regarding different seasons of egg production revealed that laying existed almost for whole year in which premonsoon season experienced highest laying followed by monsoon, summer and winter season.

11. Farmers reared Muscovy ducks under free range and semi intensive systems recorded 72.5 and 27.5 per cent respectively. Farmers are basically below the poverty line and cannot afford any feed to their birds.

12. Like any other ducks most of the laying was completed either in early morning or in night hours in case of Muscovy ducks.
13. From zero days to 15 days time the average body weight gain was recorded to be 177.23±27.29 g with an average gain per day of 11.81 g. However, form zero to 135 days time the total gain was observed to be 2.65 kg by consuming about 7.57 kg of feed. So the feed conversion efficiency was 1:2.856.
14. Muscovy ducks were found to be more resistant to diseases.

SUGGESTIONS FOR FUTURE RESEARCH WORK:

01. There is much potential to raise the productivity level of Muscovy duck in Chhattisgarh. Therefore, more emphasis should be given from free range system to semi intensive systems with improvement in nutrition and health.

02. The existing duck rearing practices with health related problems and production parameters deserve a through investigation.

03. A detailed socio-economic survey of farmers adopting Muscovy ducks as subsidiary income is needed in order to generate a data base so that a development programmes would be designed for the benefit of Chhattisgarh farmers through interventions in the domains of technical assistance and advice to duck farmers.

04. Farming systems research involving Muscovy duck, other broiler birds and animals deserve attention for increasing income generation of the farmers.

05. Molecular characterization of these ducks are to be under taken to determine their linkages with their fraternity as well as with other domesticated birds.

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“Phenotypic characterization and production performance of Muscovy duck (Nag-Hans) maintained under intensive and free range production systems of Chhattisgarh”

By

Lalit Kumar Baghel

ABSTRACT

A study was conducted during 2006-07 with Muscovy duck population in different studied areas. The phenotypic colour of head showed seven colour patterns with dominated Black colour. The throat colour was observed as White, Brown White and Black White etc. The Pink White black, Pink Black and alternate Pink Black colours bills were recorded. The highest frequency (79%) of Pink colour skin was observed. The colour of shank pattern of Muscovy ducks showed four definite colour patterns at all the places under study.

The present investigation with regard to eye colour showed only two colour patterns of the eye in case of Muscovy duck. All the studied Muscovy population had well developed knobs. The females were devoid of knobs. The mean length of neck and breast width were measured as 3.78±0.08 and 5.18±0.05 inches respectively. The average mean length of keel bone was recorded as 5.47±0.06 inches. The overall mean length of thigh was observed as 5.15±0.4 inches.

The overall egg weight was found to be 62.66 g. Anjora flock has highest mean egg weight (66.61g) followed by 60.26 g in Jagdalpur farm. The highest egg length was recorded in Anjora farm followed by Jagdalpur farm with overall mean length 5.98 cm. The overall mean width of eggs was observed as 3.93 cm.

The overall mean shape index of egg was recorded as 66.32 per cent. There are four different colours namely pale white, reddish white, dusty white and bluish white colours were observed. However, pale white colours were found to be more in numbers. Similarly premonsoon season experienced with highest laying followed by monsoon, summer and winter.

Regarding system of rearing, 72.5 per cent farmers reared Muscovy ducks under free range system whereas 27.5 per cent farmers reared under semi-intensive ducks. Most of the laying was completed either in early morning or in night hours.

Maximum body weight gain (765.41g) was observed for 60-75 days time with an average gain per day of 51.02 g. Birds consumed about 2.53 kg feed during these periods. The feed conversion efficiency was found to be 1:2.85 in the entire study period. Muscovy ducks were apparently found to be more resistant to diseases.

Chairman

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Figure 1: Frequency of different head colours of Muscovy duck

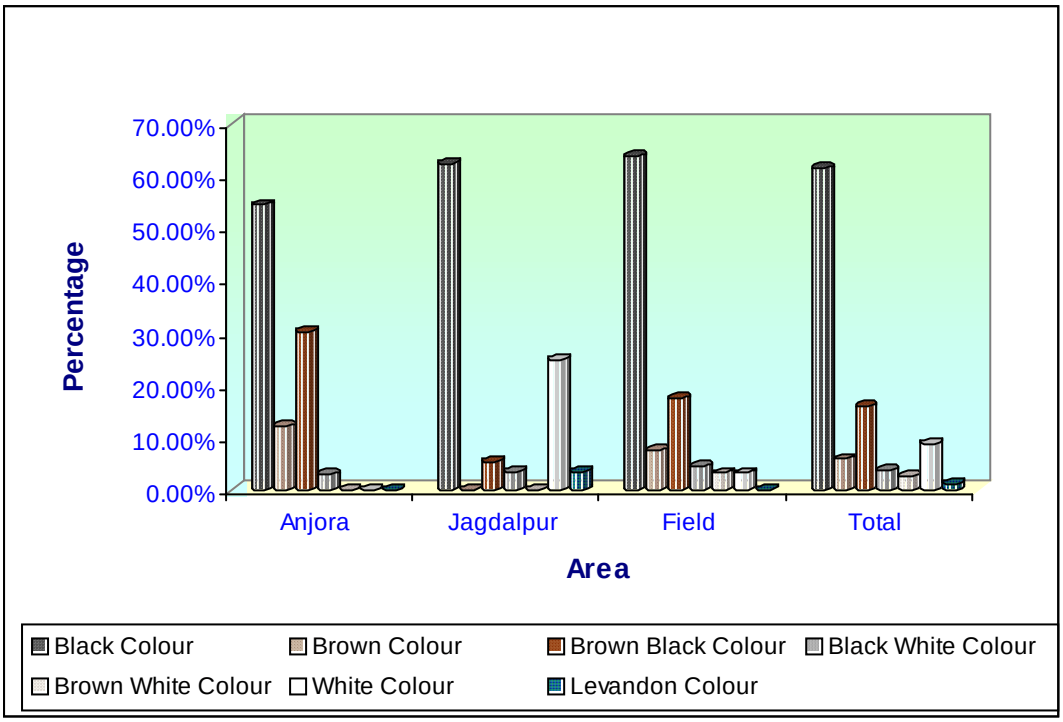


Fig. 2: Frequency of different throat colours of Muscovy duck

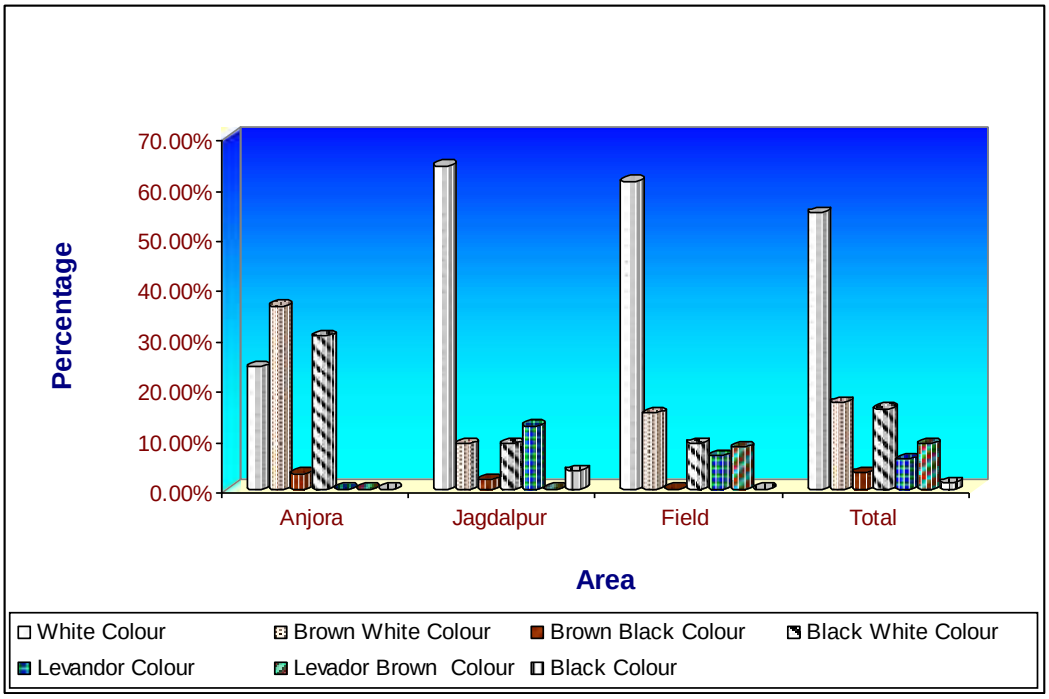


Fig. 3: Frequency of different colours of neck of Muscovy duck

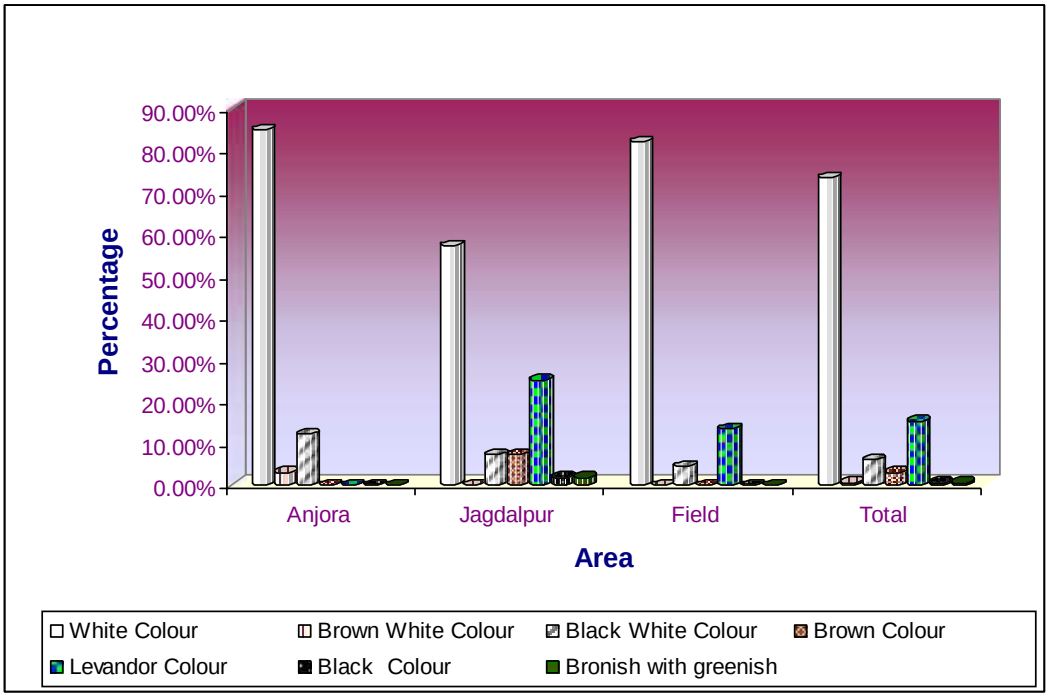


Fig. 4: Frequency of bill colour in Muscovy duck

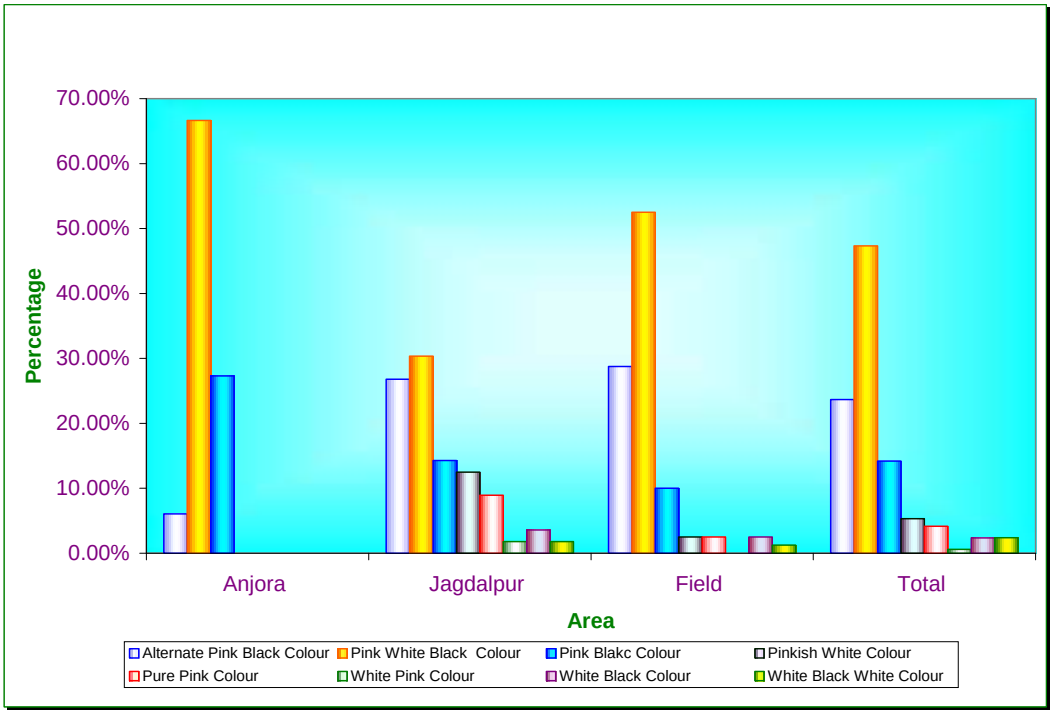


Fig. 5: Frequency of different skin colours in Muscovy duck

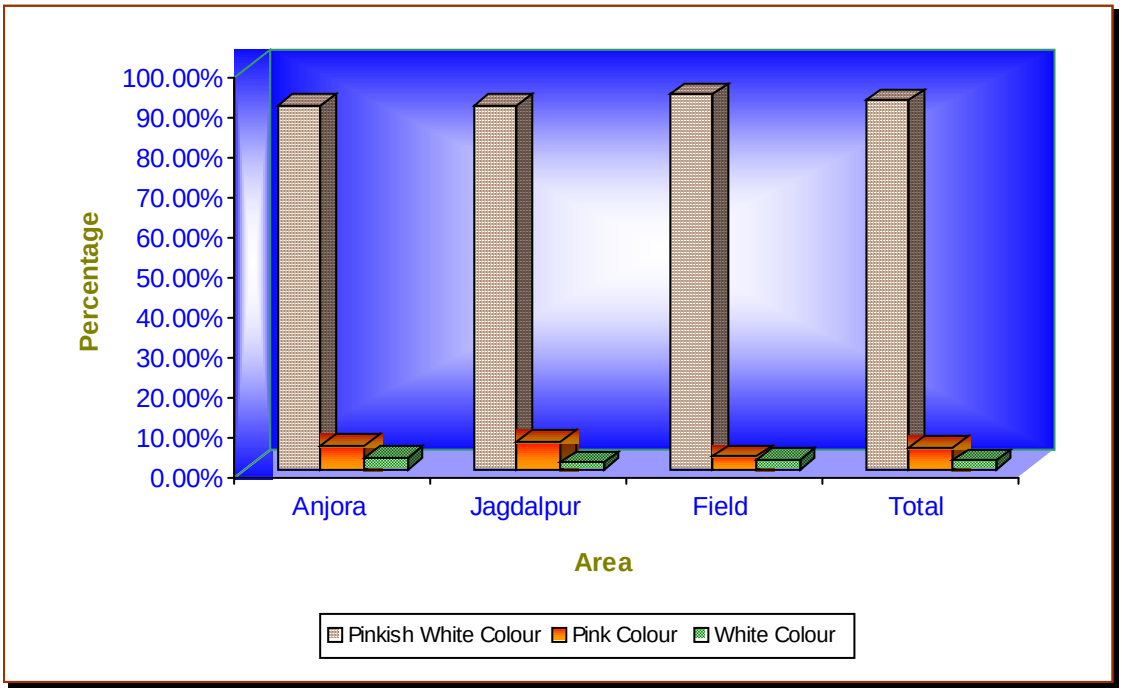


Fig. 6: Frequency of different of colours of shank of Muscovy duck

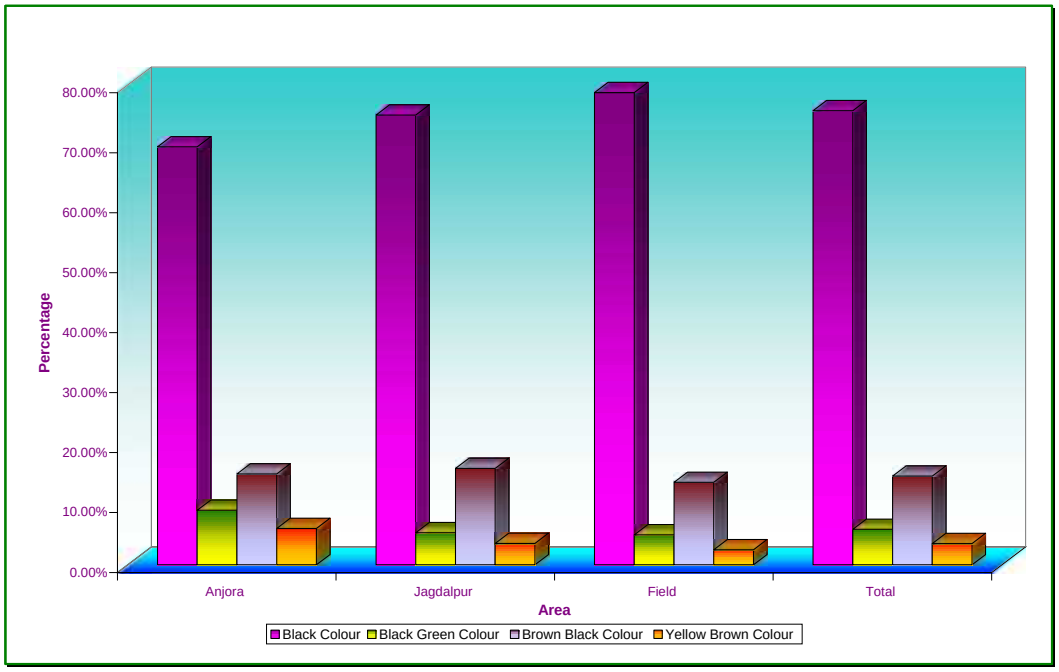


Fig. 7: Frequency of different eye colour of Muscovy duck

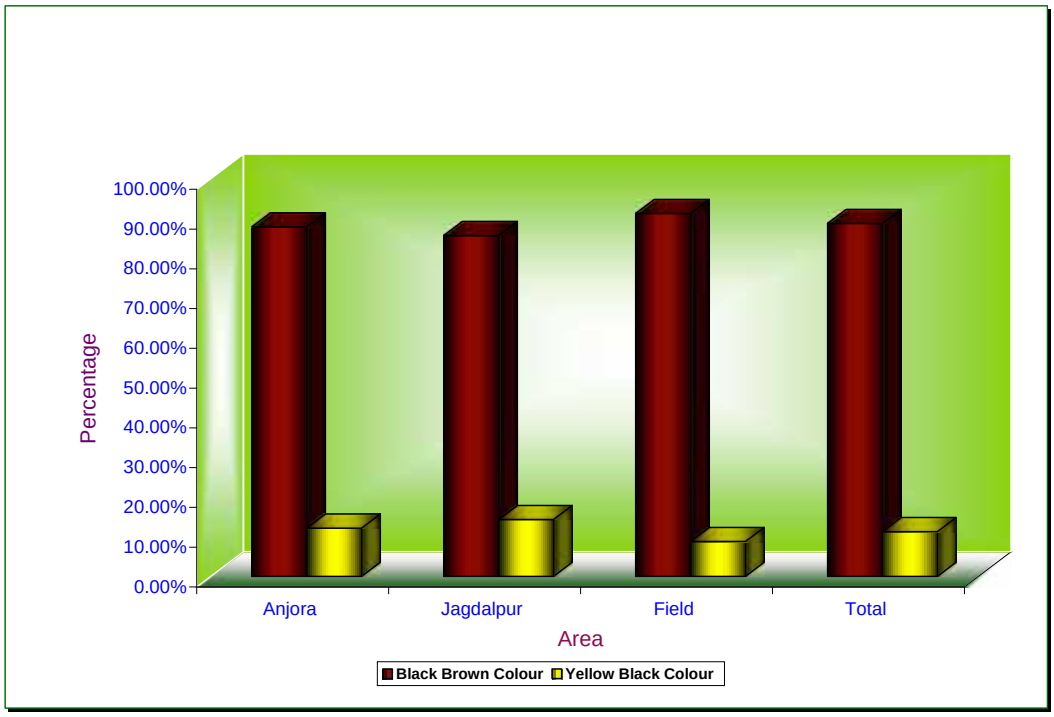


Fig. 8: Frequency of different egg colour of Muscovy duck

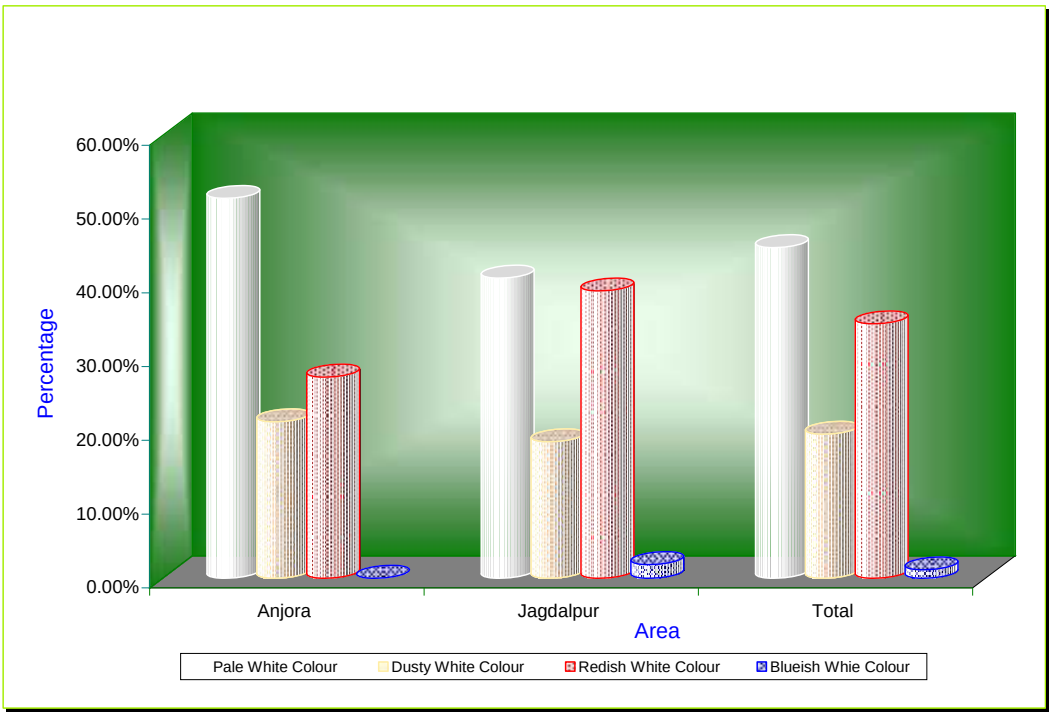


Fig. 9: Different seasons of egg production of Muscovy duck

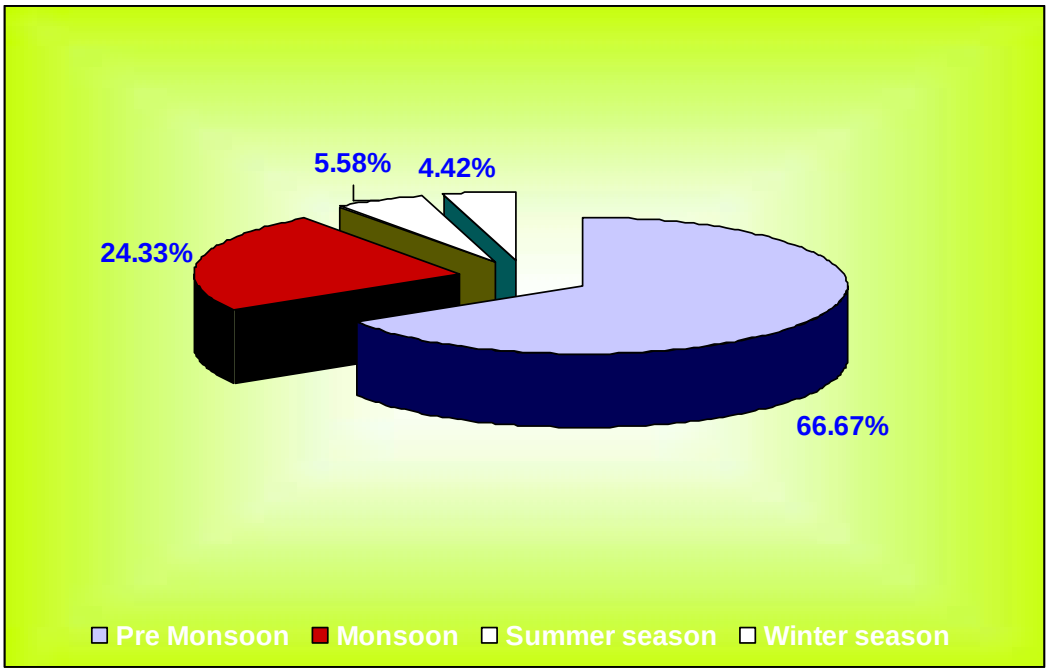


Fig. 10: Different systems of rearing of Muscovy duck

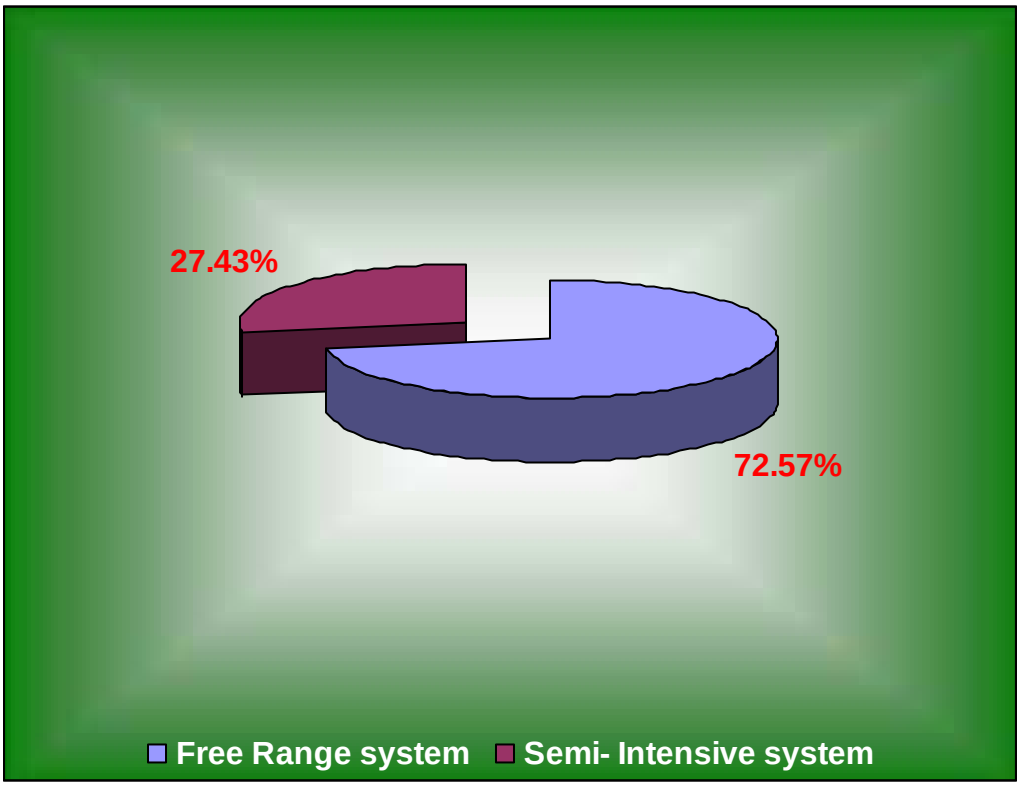


Fig. 11: Different timings of laying eggs in Muscovy duck

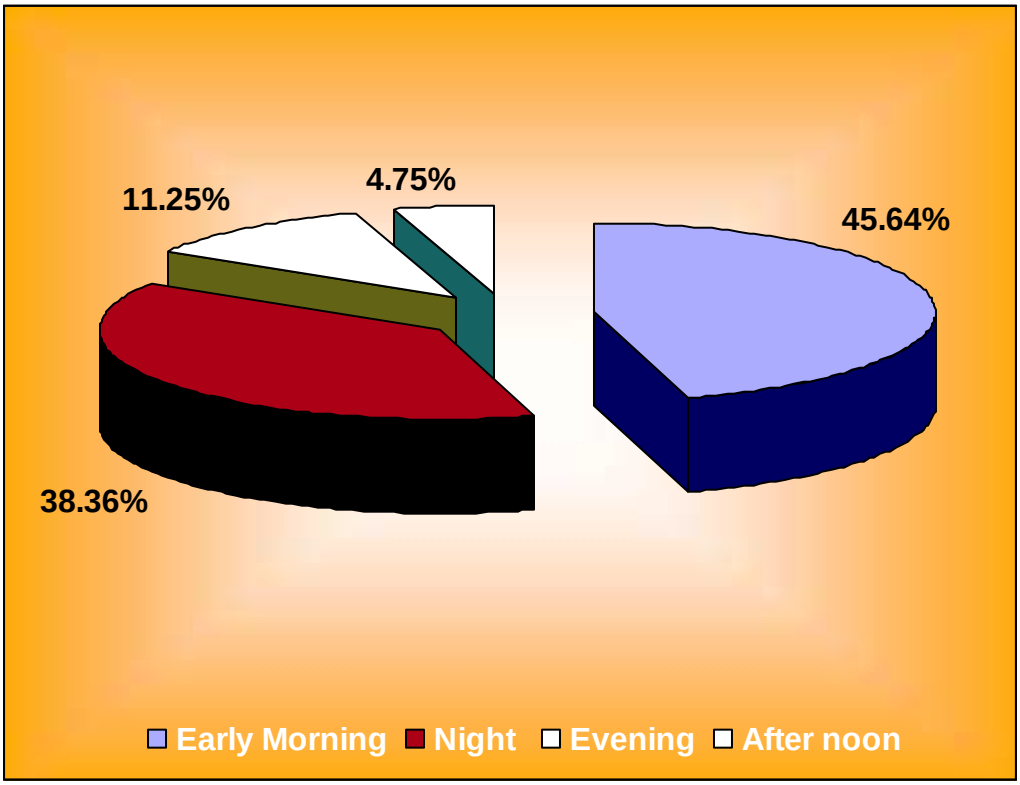


Table 1: Frequency of different head colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	Black colour	54.54%	62.5%	63.75%	61.53%
02.	Brown colour	12.12%	-	7.5%	5.91%
03.	Brown Black colour	30.30%	5.35%	17.5%	15.97%
04.	Black White colour	3.03%	3.57%	4.5%	3.75%
05.	Brown White colour	-	-	3.25%	2.59%
06.	White colour	-	25%	3.25%	8.87%
07.	Levandor	-	3.57%	-	1.18

Table 2: Frequency of different throat colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	White colour	24.24%	64.28%	61.25%	55.02%
02.	Brown White colour	36.36%	8.92%	15%	17.15%
03.	Brown Black colour	3.03%	1.78%	-	3.18%
04.	Black White colour	30.30%	8.92%	9%	15.92%
05.	Levandor colour	-	12.53%	6.5%	5.9%
06.	Levandor Brown colour	-	-	8.25%	3.55%
07.	Black colour	-	3.57%	-	1.18%

Table 3: Frequency of different neck colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	White colour	84.84%	57.14%	82%	73.37%
02.	Brown White colour	3.03%	-	-	0.59%
03.	Black White colour	12.12%	7.14%	4.5%	5.91%
04.	Brown colour	-	7.16%	-	2.95%
05.	Levandor colour	-	25%	13.5%	15.24%
06.	Black colour	-	1.78%	-	0.59%
07.	Brownish with greenish	-	1.78%	-	0.59%

Table 4: Frequency of different bill colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	Alternate Pink Black colour	6.06%	26.78%	28.75%	23.66%
02.	Pink White Black colour	66.63%	30.35%	52.5%	47.33%
03.	Pink Black colour	27.31%	14.28%	10%	14.20%
04.	Pinkish White colour	-	12.5%	2.5%	5.32%
05.	Pure Pink colour	-	8.92%	2.5%	4.14%
06.	White Pink colour	-	1.78%	-	0.59%
07.	White Black colour	-	3.57%	2.5%	2.36%
08.	White Black White colour	-	1.78%	1.25%	2.4%

Table 5: Size of bill (length) of Muscovy duck

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	5.0455	±0.1028
02.	Jagdalpur	56	5.1518	±0.0708
03.	Field	31	5.2355	±0.0959
04.	Total	120	5.1442	±0.0500

Note: Non-significant

Table 6: Size of bill (width) of Muscovy duck

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	2.6061	±0.0474
02.	Jagdalpur	56	2.5679	±0.0355
03.	Field	31	2.6226	±0.0367
04.	Total	120	2.5925	±0.0230

Note: Non-significant

Table 7: Frequency of different skin colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	Pinkish White colour	90.90%	91.07%	93.75%	92.30%
02.	Pink colour	6.06%	7.14%	3.75%	5.33%
03.	White colour	3.03%	1.78%	2.5%	2.36%

Table 8: Frequency of different shank colours of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	Black colour	69.69%	75%	78.75%	75.73%
02.	Black Green colour	9.09%	5.35%	5%	5.92%
03.	Brown Black colour	15.15%	16.07%	13.75%	14.79%
04.	Yellow Brown colour	6.06%	3.57%	2.5%	3.55%

Table 9: Frequency of different colours of eye Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Field	Total
01.	Brown Black colour	87.87%	85.71%	91.25%	88.75%
02.	Yellow Black colour	12.12%	14.28%	8.75%	11.24%

Table 10: Length of neck of Muscovy duck in inches

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	3.0152	±0.0909 [b]
02.	Jagdalpur	56	4.1518	±0.1026 [a]
03.	Field	31	3.9194	±0.1522 [a]
04.	Total	120	3.7792	±0.07956

The values of Jagdalpur and Field are significantly ($p<0.05$), higher than the values of Anjora, where as the values of Jagdalpur and Field were similar

Table 11: Length of keel bone of Muscovy duck in inches

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	5.6152	±0.1283
02.	Jagdalpur	56	5.4268	±0.0987
03.	Field	31	5.3871	±0.1263
04.	Total	120	5.4683	±0.0665

Note: Non-significant

Table 12: Breast width of Muscovy duck in inches

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	5.1303	±0.1065
02.	Jagdalpur	56	5.2089	±0.0849
03.	Field	31	5.1774	±0.1025
04.	Total	120	5.1792	±0.0555

Note: Non-significant

Table 13: Length of thigh of Muscovy duck in inches

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	5.1667	±0.0804
02.	Jagdalpur	56	5.1071	±0.0670
03.	Field	31	5.1935	±0.0918
04.	Total	120	5.1458	±0.04483

Note: Non-significant

Table 14: Weight of eggs of Muscovy duck in grams

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	66.6061	±0.8187[a]
02.	Jagdalpur	54	60.2593	±1.0056[b]
03.	Total	87	62.6667	±0.7692

Table 15: Length of eggs of Muscovy duck in cms

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	6.1276	±0.0413[a]
02.	Jagdalpur	54	5.8844	±0.0467[b]
03.	Total	87	5.9767	±0.0352

Table 16: Width of eggs of Muscovy duck in cms

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	4.4397	±0.0209[a]
02.	Jagdalpur	54	3.6241	±0.0255[b]
03.	Total	87	3.9334	±0.0461

Table 17: Shape index of eggs of Muscovy duck

S. No.	Area	Observations	Mean	Standard Error
01.	Anjora	33	72.7682	±0.4915[a]
02.	Jagdalpur	54	62.3741	±0.7211[b]
03.	Total	87	66.3167	±0.7272

Table 18: Frequency of different colours of egg of Muscovy duck

S.No.	Colour Pattern	Anjora	Jagdalpur	Total
01.	Pale White colour	51.5%	40.7%	44.82%
02.	Dusty White colour	21.21%	18.5%	19.54%
03.	Reddish White colour	27.27%	38.95%	34.5%
04.	Bluish White colour	-	1.85%	1.14%

Table 19: Different seasons of egg production of Muscovy duck

S.No.	Seasons	Field
01.	Pre-monsoon	65.67%
02.	Monsoon	24.33%
03.	Summer season	5.58%
04.	Winter season	4.42%

Table 20: Different systems of rearing Muscovy duck

S.No.	Systems of rearing	Field
01.	Free range system	72.57%
02.	Semi-intensive system	27.43%

Table 21: Different timings of laying eggs of Muscovy duck

S.No.	Time	Field
01.	Night	38.36%
02.	Early morning	45.64%
03.	Evening	11.25%
04.	After noon	4.75%

Table 22: Gain in body weight of Muscovy duck at different intervals:

S. No.	Rate of gain/day from	Grams gain in 15 days	Grams Gain/day	Feed consumed
1.	0 to 15 days	177.230±27.298	11.81	531.69 grams
2.	15 to 30 days	146.66±17.494	9.77	139.98 grams
3.	30 to 45 days	173.846±42.187	11.58	518.06 grams
4.	45 to 60 days	191.153±61.784	12.74	569.635 grams
5.	60 to 75 days	765.416±293.439	51.02	2.53 kg
6.	75 to 90 days	487.5±220.871	32.5	1.316 kg
7.	90 to 105 days	431.66±372.786	28.77	1.208 kg
8.	105 to 120 days	156.125±37.7	10.40	1.2 kg
9.	120 to 135 days	114.3±83.186	7.62	1.3 kg
10.	0 to 135 days	2651.51±400.7	-	7.5733 kg



Fig : 12 *Different pattern of bill colours of Muscovy duck*

Fig. 13 (Color plate) Corneal ulcer with hypopyon in the left eye of a cat

(Color plate) Corneal ulcer with fibrin in the eye of a cat



Fig. 14 Weighing of egg using an egg weighing balance



Fig : 15 Measurement of egg length using Vernier caliper



Fig. 18 Measurement of egg width using Vernier Caliper



Dusty white colour of eggs of Muscovy duck



Fig : 17 Pale white colour of eggs of Muscovy duck



Fig : 18 Different colours of webbed feet of Muscovy duck

Muscovy duck (*Cairina moschata*)

(Meg-Hans, Moh-Hah-Meh-Hans)