



## Status of duck breeding in India

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### ABSTRACT

Duck is the second most important species of poultry after chicken in India. Due to its many advantages, it is popular in the coastal states and states having large water bodies. Different indigenous and exotic breeds that are being evaluated and reported through research findings are summarized in this review. The history of import of exotic breeds to the country with breeding programme initiated for these breeds in India are discussed with reference to the status of breeds in respect to meat and egg production improved through selection in other countries. The status of purebred selection and breeding programme in indigenous duck being undertaken in our country are very few and being documented with reference to world scenario. Crossbreeding experiment using indigenous and exotic breeds in the countries are reported in respect to growth, conformation traits, production, reproduction, carcass quality, egg quality, egg weight and feed conversion ratio. Performance of the crossbred improved in respect to different traits measured compared to the indigenous breed showing heterosis in positive direction. General combining ability, specific combining ability and reciprocal effects are found to be significant for most of the traits studied in a 3×3 diallel cross using indigenous duck of Odisha, Khaki Campbell and White Pekin. The importance of availability of quality germplasm and performance improvement through duck breeding in India is to be taken on priority. Besides this, the conservation and documentation of all the indigenous breeds and variety is need of the hour. Commercial exploitation of indigenous duck breeds as they are well adapted to our harsh climatic conditions needs to be explored.

**Keywords:** Crossbreeding, Duck, Duck breed, Duck breeding, Indigenous duck, Selection in duck

Chicken production in most of the countries including India has taken a quantum jump with commercial production using state-of-the-art technological interventions. However, the progress achieved in the chicken sector could not be replicated in duck production in the world and in our country. Duck has been considered as viable livelihood option for small and marginal farmers and is an important poultry species after chicken due to their hardiness to disease, long production year, ease to train, large sized egg, early morning egg laying character and natural tendency for foraging. Ducks usually forage on aquatic weeds, algae, green legumes, fungi, earthworms, maggots, snails, various types of insects, etc. Foraging habits of ducks reduce feed cost and perform well in marshy and wetland where most other poultry birds are not able to produce. Ducks along with other species play a critical role in meeting daily protein need and providing household income to farm families in the mixed farming system.

### *Duck production status*

The total duck population in the country was 23.5 million as per 19<sup>th</sup> livestock census in 2012 which has reduced from

27.6 million in 2007. There is decrease in duck population (-4.1%) during 2007-2012. However, as per 20<sup>th</sup> livestock census, total duck population in the country was 33.51 million and there was an increase of 42.35% compared to 19<sup>th</sup> livestock census. In world, the total duck population was 1075 million in 2014 and it increased slowly up to 2019 and reached 1191 million, however in 2020 the world duck population was 1.155 billion (FAO 2020). The world duck population was increased by 7.04% in 2020 compared to 2014. The largest duck populations are found in China, Vietnam, Bangladesh, and Indonesia (FAO 2020). In India, total duck populations reared under backyard poultry were 32.5 million and only 1.01 million were reared under farms. As per Basic Animal Husbandry Statistics (BAHS) 2022, amongst ducks, layer desi ducks (9.60 million) constitute more than 87% of total duck layer population (10.76 million) in India under backyard system. Average yield of desi ducks under backyard and commercial farms were 116.87 eggs and 168.19 eggs per annum; whereas under similar condition the egg productions of improved duck were 179.54 and 209.65 eggs. The production of egg in different desi ducks vary highly, indicating the scope for improvement of duck in the country. As per FAO stat (2019), the total meat of duck in India was 43941 tonnes and the average of carcass yield was 1069 g. The number of meat duck slaughtered in 2019 was 33.80 million. Per capita

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availability of duck meat in India was 89.13 g per annum. In 2020, India ranked fifth amongst the world in respect of duck population, whereas China is number one with 682.94 millions duck followed by Vietnam (86.56 million), Bangladesh (59.72 million), Indonesia (58.24 million) and India (35.51 million). In world, for the meat type duck, market weight for domestic grower meat ducks typically ranges from 2.75 to 4 kg (Chen *et al.* 2021). The Pekin ducks reach this market weight and are slaughtered around 4 to 5 weeks of age, while Muscovy and Mulard ducks (Hybrid Pekin and Muscovy crossbreed) reach this weight around 10 weeks of age (Chen *et al.* 2021). However, in India, the weight of the meat type duck is considerably low and this may be due to lack of suitable breeding and selection programme to improve duck for meat purpose.

#### *Breeds of duck in India*

In India, different indigenous duck breeds are being reared by the farmers in backyard since many years. Besides these indigenous ducks, different exotic breeds were introduced to the country in 1970s and 1980s also being used for duck production by the farmers. According to Bhat *et al.* (1980), ducks constitute about 6% of total poultry population and there are about 20 breeds and 34 varieties of ducks. Indigenous breeds are Indian Runner (white and white fawn), Sylhet Meta (light brown with black feathers tip and yellow beak) and white breasted Nageswari (black body with white breast and throat). An exhaustive survey of indigenous breeds of duck has not been made. Exotic varieties of duck include White Campbell, Khaki Campbell, Dark Campbell, Muscovy, Pekin and Aylesbury. Ornamental duck variety like Rouen and Shelkrake are small and beautiful and are stocked in zoos, parks, garden and sanctuaries. Exotic breeds like Pekin (White) and Campbell (Khaki) are now available in India and can be regarded as adopted natives. Exotic breed's characteristics are the same as in their country of origin except that performance will vary with environment and management. Bhat (1981) also reported 20 breeds of ducks in India. Indigenous breeds of ducks have acclimatized themselves to the environment of different regions and are restricted to different parts of the country. The duck are popular in some states due to duck products, eating habit of the human population, suitability of climatic condition and availability of cheaper inputs, entrepreneurship skills of farmers and availability of larger water bodies. Details of information on duck breeds of India have been reported (Panda and Padhi 2003, Panda *et al.* 2008, Naik *et al.* 2022, Kamal *et al.* 2023). However, it is important to record them here in short before reviewing the status of duck breeding programme in India.

*Pati*: Pati duck is most commonly reared by rural people of Assam and it was recognized by ICAR-NBAGR (Accession number INDIA\_DUCK\_0200\_PATI\_11001) (Kaushik *et al.* 2021). These ducks are mainly used for the meat, egg and ritual sacrifice.

*Maithili*: This duck breed is mostly found in middle

Gangetic plain of Bihar and is registered by ICAR-NBAGR (INDIA\_DUCK\_0300\_MAITHILI\_11002). The average egg production of Maithili duck was 54.6 eggs per year (Kamal *et al.* 2020a).

*Nageswari*: This breed is distributed in the Barak valley basin of India and Bangladesh. They are mostly egg type duck. Annual egg production of duck was 140-150 (Islam *et al.* 2002).

*Kuttanad ducks*: The Kuttanad ducks have different colours like grey, brown, bronze, white, black and spots. They can lay on an average of 200 eggs and age at first egg laying is about 129 days with egg weight of 70 g (Harikrishnan and Ponnuvel 2012). There are two varieties of Kuttanad ducks, viz. Chara and Chemballi.

*Indigenous duck of Tamil Nadu*: In Tamil Nadu, mostly non-descript type of ducks with wide variations are being kept. In the southern district, the farmers choose replacement stock from Kollam areas of Kerala and hence it is called Kollam variety, whereas northern districts of Tamil Nadu prefers to purchase stock from Arni area called Arni variety (Gajendran and Kartikeyan 2009). Murugan *et al.* (2009) reported in Tamil Nadu, two popular indigenous duck varieties, viz. Sanyasi and Keeri available with distinct plumage colour and pattern. Mean duck day egg production per annum is 40-50%.

*Indigenous ducks of Odisha*: Different colour variety of Indigenous ducks of Odisha were found. The study on different aspects of indigenous duck of Odisha are available in literature (Padhi 2010, Padhi 2014). Mohapatra *et al.* (2006) reported population of Indigenous Orissa duck which is a dual purpose bird of about ₹2 lakhs and the duck egg and meat are sold at higher price than chicken. Panda *et al.* (2008) reported that native layer ducks were found to have similarity with the Indian Runners in the morphological characters and production potentiality.

*Kuzi duck*: As the name suggests these ducks are not able to stand in erect posture like Indian Runner and have slightly upright body. The body weight after one generation of selection for higher eight week body weight was 1818 g in male and 1628 g in female and eight week body weight in male and female were 1388 and 1230 g, respectively (Padhi *et al.* 2022a). The eight week body weight after two generation of selection was 1445 g in male and 1429 g in female (Padhi *et al.* 2023c) The annual egg production was 218 eggs (Padhi *et al.* 2021b) and recently 251 eggs have been reported (Padhi *et al.* 2022b).

*Local duck of Andaman and Nicobar Islands*: The drakes of Andaman local duck have plumage colour varying from grey brown to blackish brown, Bill colour orange and feet colour bright orange. The ducks produce 110 eggs per annum with egg weight of 60 g (Senani *et al.* 2005). Sujatha *et al.* (2021) reported that the plumage colour pattern of Andaman Local ducks is grey, black and chocolate in different parts of the body, and a white band on the neck was commonly found.

*Kashmir duck*: Kashmir duck is an indigenous duck locally known as 'Batuk', and is reared for meat and eggs

in all districts of the valley. Egg production per year is 138.67 eggs (Hamadani *et al.* 2023).

*Indigenous duck of Jharkhand:* Though detailed reports are not available, however one research paper shows that average age at first egg in native duck of Jharkhand is 187 days and the egg production is 50 to 70 eggs per annum (Kamal *et al.* 2020c).

*Indigenous duck of West Bengal:* Though the state tops the list in respect of duck population, but research information on different breeds is very limited. Age at first egg production of Desi ducks available in Murshibabad district was 196 days and the average annual egg production was 79 eggs (Roy *et al.* 2017).

*Indigenous duck of Tripura:* Majority of the farmers in Tripura is rearing Pati or desi ducks. The average egg production per duck per annum was 108 eggs and age at first egg was 6.115 months (183.5 days). Body weight of mature ducks was 1.47 kg (Das and Rahman 2019).

*Indigenous duck of Andhra Pradesh:* One report has documented that migratory scavenging duck production system is practiced in Andhra Pradesh. The age at first egg of the flock is about 180 days and the egg production is 120 to 150 eggs/year with 20 to 30% rate of lay (Rao *et al.* 2009).

*Indigenous duck of Chhattisgarh:* Not much information is available. One report says the age at sexual maturity of the duck is 156 days (range 145-185) and egg production per bird is 52 to 111 per annum (Kamal *et al.* 2020c)

*Muscovy/ Moti/ Cina hanh:* Muscovy duck are available in India in different states like Odisha and Chhattisgarh known as Moti Hans, Assam as Cina Hanh and may also be available in other states having more duck population. Where and how these ducks migrate to the states is not known. However, this duck breed is mostly reared for its excellent meat. Mohapatra *et al.* (2006) reported population size of Moti ducks, 15000 in four tribal districts of Odisha. They reported variety in plumage colour as black, white and brown. Moti hans lays 50 to 80 eggs per annum with egg weight of 50-65 g. The age at sexual maturity is 6 to 8 months, adult male weigh 3.5 kg and female 2.5 kg. Padhi *et al.* (2009f) reported 20 week body weight of Moti duck male and female as 3.07 kg and 1.72 kg, respectively. The age at first egg of the flock was recorded at 198 days of age and the number of eggs produced up to 40 and 50 weeks of age were 11.20 and 24.30, respectively. In Assam, the age at sexual maturity of Muscovy was 300 to 315 days and annual egg production 50-60 eggs (Islam *et al.* 2002). Cina hanh attained sexual maturity at the age of 286 days with an average annual egg production of 55.94 eggs. The 8 week body weight in male and female was 847 and 765 g, respectively (Islam *et al.* 2009).

*Exotic breeds:* Different exotic breeds of duck are available in our country. They are mostly imported from other countries. Two main breeds being imported to our country are Khaki Campbell for egg type and White Pekin for meat type. Naik *et al.* (2022) reviewed about the description of Khaki Campbell, White Pekin and Indian

Runner ducks. The Khaki Campbell which is an excellent layer but the production varies largely and research reports of 300 eggs per annum is lacking in India. Similarly the research report of body weight more than 2.5 kg at 6 weeks of age in Pekin duck in our country is lacking, whereas in other countries the body weight of White Pekin are quite more like 3.32 kg at 6 weeks of age in China (Li *et al.* 2020) and 3.150 to 3.400 kg in Poland at 7 weeks of age (Kokoszynski *et al.* 2019).

#### *Duck breeding*

Bulbule (1985) gave excellent details on duck development programme in India which is being reproduced here in short. Duck development programmes commenced on a small scale in India during the early 1960s. In the mid-1960s, 3000 Khaki Campbell ducklings were imported and the regional duck breeding farm at Haringhata, West Bengal, was established. However, the entire flock was wiped out. Under the rural development programme, acknowledging the importance of duck raising, effort were made to encourage large farms of improved varieties of ducks and accordingly in 1971, 8190 Khaki Campbell ducklings were imported from UK. After that the regional duck breeding farm was established near Agartala (Tripura), and the Central Duck Breeding Farm (CDBF) at Hesaraghata, Bengaluru was sanctioned. In 1981, 2978 Khaki Campbell ducklings were imported from the UK and the farm became fully functional from 1982.

As reported in management guide on ducks by Central Duck Breeding Farm, it also imported meat type ducklings VIGOVA SUPER\_M from Vietnam under bilateral programme between Government of India and Vietnam during the year 1996. So, in the country whatever stocks of Khaki Campbell or White Pekin are available, are probably from Central Duck Breeding Farm which is presently known as Central Poultry Development Organization and Training Institute (CPDOTI), Bengaluru.

Breeding programme in Khaki Campbell established at Central Duck Breeding Farm, Bengaluru by selecting breeders each year, each strain on the basis of an index developed using scoring of Osborne (1957). Breeding of ducks for high egg production, the supply of quality ducklings to farmers and replenishment of the foundation stocks of state duck farm was the main activity at that time of the CDBF, as duck eggs are much more popular in the country than duck meat (Bulbule 1985). At CDBF, three lines were developed from the base population egg production line, egg weight line and control line (Kalita *et al.* 1992). Egg production line (EPL), Egg weight line (EWL) and Control line (CL) were formed from a base population. The EPL was selected first for annual egg production with higher egg weight and while EWL selection was practiced for egg weight; both the lines underwent selection for improvement of egg production up to 240 days of age. The genetic parameters or other genetic effects of Khaki Campbell duck in India are very few. Though it is being reported that the Khaki Campbell

are producing 300 eggs but the present production performance needs to be evaluated. Presently in India, no selection programme is being practiced. Similar condition has prevailed in White Pekin stocks. So it is high time that a suitable breeding programme may be developed to improve the duck population/breed of the country.

In India, there is not much report on selection programme being practiced in indigenous ducks till 2018. In free range condition, no breeding programme is possible; the farmers either select by physical characteristics of the male duck for the parent to produce fertile eggs which are to be hatched for regeneration of the stock or by mostly using broody hen. Large farmers interested for supply of duck germplasm might be using custom hatching or artificial incubation using hatcher and setter. Gajendran and Karthickeyan (2009) reported large variation in indigenous ducks of Tamil Nadu and absence of any specific selection and breeding system applied in the flocks. Recently, some selection programme is being initiated for the improvement of indigenous duck for higher body weight in Kuttanad duck of Kerala (Cyriac *et al.* 2020a). In this stock, the selection criteria was high eight week body weight and individual selection was practiced in a pedigreed population. An improvement of 270.51 g could be recorded in S3 generation. They also reported that the selection for body weight also improved dressing percentage at 8 weeks of age in this stock. Cyriac *et al.* (2020b) reported that the Kuttanad duck selection programme was used in full sib programme. The heritability estimates for body weight at 8 weeks of age based on sire plus dam components ( $h^2_{s+D}$ ) were 0.251, 0.313 and 0.243 in S1, S2 and S3 generation, respectively. Positive and high genetic and phenotypic correlations were observed between body weights. The expected response in S2 and S3 generation was 79.63 and 66.61 g, respectively but the corresponding observed response was -24.43, 82.28, 212.66 g. Padhi *et al.* (2022) reported one selection programme in Kuzi ducks of Odisha which is being produced using 40 sires and 160 dams and selection criteria was higher 8 weeks body weight and the heritability estimates using half sib analysis for body weight at 2, 4, 6 and 8 weeks of age were 0.34, 0.42, 0.68, and 0.55, respectively. Similarly the heritability estimates at 8 week of age for shank length, keel length and bill length was 0.14, 0.27 and 0.41, respectively. The genetic correlations between the traits are positive and moderate to high in magnitude. Padhi *et al.* (2021a) reported that there was an increase of 125 g body weight in S2 generation compared to S1 generation in this stock. The above reports on breeding and selection programme being practiced in indigenous duck, is for body weight but it is to be mentioned here that both Kuttanad duck and Kuzi duck are good layers and the selection for higher eight week body weight in both the breeds may affect the production performance of the breed in long run. However, production of 218 eggs and 251 eggs up to 72 weeks of age in S1 and S2 generation, respectively were reported and there was improvement in egg production (Padhi *et al.* 2021b, Padhi *et al.* 2022a). The corresponding egg weight at 40

weeks of age in in Kuzi stock was 64 and 71 g, respectively. In White Pekin, recently one breeding programme entitled Breeding for development of mycotoxin tolerant meat type duck initiated at Regional station of ICAR-DPR (Mishra *et al.* 2021). In the country, no systematic breeding programme is being reported in White Pekin and the results of selection programme and estimation of genetic parameters is lacking.

#### *Crossbreeding experiment in duck in India*

In India, different crosses of exotic with indigenous duck germplasm were carried out and are documented in the literature. Das *et al.* (2000a) reported significant higher egg weight (57.61 g) in crosses than Desi (52.56 g) and lower than Khaki Campbell (61.49 g) at 40 weeks of age. Egg weight albumen index, Haugh unit was significantly higher in crosses of Khaki Campbell and Native ducks of Odisha compared to native ducks at 72 week of age (Padhi *et al.* 2009a). The egg weight shows the presence of over-dominance as the weight is more than both the parents. Padhi *et al.* (2009b) reported that the 8 week body weight was significantly higher in crosses of Khaki Campbell and Desi than purebreds. Carcass characteristics of spent Khaki Campbell and its crosses with indigenous ducks revealed that the male Khaki Campbell drakes and its cross has significantly higher edible carcass percentage, eviscerated carcass % compared to spent female ducks (Panigrahi and Sahoo 2006). Das *et al.* (2000b) reported performance of K, D of Assam and their cross (KD) under field condition. Meat production of Khaki Campbell, Pati and their cross was reported by Baruah *et al.* (1991). The cross of Khaki and Pati recorded significantly higher eviscerated yield than the Pati, indicating the effect of heterosis. Padhi *et al.* (2009c) reported performance in respect to different traits of Khaki Campbell (K), Desi duck of Odisha (D) and its two crosses (KD, DK). For most of the traits the crosses performed better than Desi and for some traits better than both the parents. Baruah *et al.* (1991) reported the meat production of Khaki Campbell, Pati and their cross at 12 week of age and highly significant eviscerated yield observed in Khaki Campbell followed by crossbred and lowest in Pati. Padhi and Sahoo (2011a) reported production performance of Native, Khaki Campbell and their crosses (DK, KD) for second cycle from 72-124 weeks of age. Egg production was significantly higher in DK amongst all the genetic groups. Egg weights increased in second cycle, but the egg quality decreased towards the end of the experiment. The results revealed that DK cross might be more suitable for egg production amongst crosses and Khaki Campbell in purebreds for the second year laying performance.

Nageswar *et al.* (2005) evaluated indigenous duck (ID), Khaki Campbell (KC) and their reciprocal crossbred layer from 19-58 weeks of age under semi-intensive and extensive system of management. In comparison to KC, ID were superior in terms of age at first egg, age at 50% egg production, egg weight, hatchability, eggshell thickness with higher egg shape index. KC ducks were superior

to ID in body weight, egg production and feed/kg eggs. Egg quality was similar among the genotypes. Crosses were superior to their parent breeds in age at first egg, egg production and feed/kg eggs. They were also superior to KC in egg weight and egg-shell thickness with a higher egg shape index. Significant heterotic effects were recorded for age at first egg, age at 50% egg production, egg production per duck-day, feed efficiency and egg weight in crosses. Performance was similar in the reciprocal crosses, but superior to their parent breeds.

A 3×3 diallel experiment was carried out at Regional station of ICAR-CARI, Bhubaneswar using indigenous duck (D), Khaki Campbell (K) and White Pekin (W) and crossbreeding genetic parameters for body weights and conformation traits were reported. Significant differences between genetic groups were observed for all the traits measured, like body weight at 2, 4, 6 and 8 weeks and shank and keel length at 8 weeks of age. Direct genetic effect, maternal effect and heterosis were significant for all the traits studied (Padhi and Sahoo 2012). Heterosis was in desirable direction in all the traits. The results revealed that crossbred performed significantly higher than the purebreds. Significant general combining ability (GCA), specific combining ability (SCA) and reciprocal effect (RE) were observed for all the traits indicating importance of both additive and non-additive genetic effects as well as maternal/sex linked effects. Heterosis % for body weight showed decreasing trend with increase of age (Padhi *et al.* 2019). In the same experiment, body measurements like bill length, keel length and shank length and carcass characteristics were recorded and significant effects of crossbreeding were seen in the crosses and most of the crossbred showed higher value than the parent breed. Most of the crosses showed positive heterosis for different conformation traits studied (Padhi *et al.* 2009d, Padhi *et al.* 2010). GCA, SCA and RE were found to be significant for most of the traits studied (Padhi and Sahoo 2011b). In the same experiment growing and laying period body weight as well as production performance, feed conversion ratio and mortality during laying period showed significant difference between genetic groups and in general crossbred performed better than the purebreds. GCA, SCA and RE were significant for body weight, production and egg weights measured at different weeks where for SCA was only significant for laying period mortality most of the crossbreds recorded heterosis in desirable direction for majority of the traits. Overall results revealed that crossbreds performed well in respect to different traits than the purebreds and may be used to take advantage of heterosis. It also indicates that purebred selection with development of specialized sire and dam line followed by crossing may be of importance to enhance the performance of crosses (Padhi 2010). Different egg quality traits were also measured at 40 and 60 weeks of age and significant difference between genetic groups were recorded for all the egg quality traits, studied irrespective of the age of measurement. Heterosis % in different crossbreds were

in desirable direction for most of the traits measured (Padhi *et al.* 2009e). Padhi (2014) reviewed the research results on evaluation of indigenous duck of Odisha and its crosses and different research results indicated that the Indigenous duck (male with Khaki Campbell Female) perform better in respect to egg production.

Performance of Desi ducks of Odisha and Desi × Khaki Campbell (DK) cross were evaluated under extensive system and the DK recorded significantly higher body weight than Desi. The results suggest that the crossbred may be used for extensive duck farming for better profit (Mallick *et al.* 2009). Crossbred of Indigenous Kuzi and Khaki Campbell ducks perform better in respect to egg production and recently more than 300 eggs up to 72 weeks were recorded in one cross which needs reevaluation with larger population size (Padhi *et al.* 2023b).

More recently, evaluation of Kuzi ducks (D) of Odisha with Khaki Campbell (K), White Pekin (W) pure breeds and crosses of Kuzi with Khaki Campbell and White Pekin (DK, KD, DW, WD) in respect to juvenile body weights was carried out. All the genetic groups recorded more than 1000 g of weight at 6 weeks of age. From the results, it was observed that Kuzi as one parent with White Pekin showed significant improvement in body weight in crosses indicating Kuzi and White Pekin crosses may be used for meat purpose at 8 weeks of age as they attain body weight of more than 1800 g at that age (Padhi *et al.* 2022c). In the same experiment, growing period body weight showed that amongst the purebreds W recorded highest body weight followed by D and K, irrespective the age of measurement. Similarly amongst the crosses W as one parent with D recorded better body weight. Amongst purebreds DK and KD reached the different production level earlier than the other two crosses and purebreds, showing the effect of heterosis in desirable direction (Padhi *et al.* 2023a).

#### *Breeding strategies for duck improvement in India*

The major constraints of duck production in the country as reported by Jalaludeen (2013) are lack of opportunities or capital to increase farm size, limited assets and therefore limited access to credit, lack of investment, limited land availability, reduced access to common land, higher unit cost than those of large producers and restricted opportunities to market produce owing to physical distance or barriers imposed by quality and safety requirements thereby preventing many small scale farmers in many places from expanding or intensifying their production. Non availability of inputs, viz. quality ducklings, biologicals, feed and technological intervention are also some of the constraints affecting duck production. There is lack of large firms in India specializing in duck breeding. Large scale production of ducks need more efforts for high efficiency and for improving product quality by breeding, nutrition, and management according to the requirement of animal welfare and environment protection. The small duck farmers should have more access to improved income and food security. In contrast to the extraordinary development in the

field of chicken production in India, the duck production continues to remain neglected in the absence of attention from research workers, developmental agencies and private sector (Jalaludeen 2013). Some breeding strategies for duck production (Padhi 2022) are summarized here: i) For quality ducklings supply/availability; breeding farm/rearing farm needs to be established (if available needs to be strengthened) in state having duck production potential at strategic location for year round supply. They should get the elite parent stocks to be maintained in their respective locality; ii) Suitable breeding programme with selection in both meat and egg type ducks needs to be initiated in the country, if possible All India Co-ordinated Research project on duck production may be initiated at different location having demand for ducks and potentiality. Suitable location specific duck variety may be developed using both exotic and indigenous duck breeds. It is to mention here that no selection programme in duck are being practiced since long resulting in considerable decrease in production in exotic Khaki Campbell and White Pekin ducks compared to their potentiality when they were introduced in our country; iii) Quality parent stocks may be supplied to the states for production of ducklings and supply to the farmers; iv) Conservation, evaluation, improvement and utilization of indigenous duck germplasm of the states may be taken up to popularize indigenous duck germplasm which may well adapt to our environment and are hardy as compared to exotic germplasm. Some desi ducks are reported to be good layers and therefore offer promise to develop in to a prolific layer if suitable breeding techniques are adopted. Naik *et al.* (2022) reported that the research carried out on ducks is very limited and more attention should be given on various aspects of duck research. Suitable duck breeds or varieties need to be developed for rural backyard duck farming.

In India, as mentioned earlier, breeding, selection and development of lines in Khaki Campbell was initiated in Central Duck Breeding farm, Hessarghata, Bengaluru, but the research finding is very scanty though improvement was recorded. At Kerala and Odisha, some improvement programme for body weight in Kuttanad and Kuzi duck was initiated. But, this is not desirable, as the breeds are good layers and by selecting for higher juvenile body weight they are showing good improvement but in a long run, the egg production may come down as body weight and egg production are negatively correlated. So necessary facilities for breeding and selection programme for higher egg production is to be created to improve the egg production of our native breeds. As we know, in our country, duck egg is more preferred than the meat, for meat purpose, if indigenous breeds are to be encouraged then the breeds producing less egg and having higher body weight may be selected. After selection, suitable line may be developed to supply improved crossbred germplasm to exploit heterosis. Here it is to be mentioned that before supplying crossbred improved germplasm or exotic germplasm, the indigenous duck breeds and variety must be conserved as they are very

much adapted to our harsh climatic condition. From the status of breeding, it is imperative that crossbreeding is one of the important tools to get immediate improvement by exploiting heterosis, but caution has to be taken to conserve indigenous breeds. If our indigenous ducks respond well to selection programme then the same may be selected and specialized sire and dam line in the same breed may be developed to supply the hybrid of the same breed, so that the breed can be conserved. For intensive farming the exotic breeds like Khaki Campbell for egg and White Pekin for meat may be popularized, but suitable improvement programme for these two breeds needs to be taken up. If possible, the elite germplasm may be imported from other countries and then the same stock may be adopted in our country with suitable breeding and selection programme. But before import of the germplasm suitable infrastructure for breeding and other aspects should be created. It is mentioned earlier that in India there are 20 breeds and 34 varieties of ducks but that needs immediate documentation, evaluation and conservation. Further, the Muscovy ducks available in the country are very well adapted to the backyard system which may be developed for the meat type birds under backyard system.

#### Conclusion

Status of different indigenous breeds of duck in India is not well documented, though it was reported that in the country 20 breeds and 34 varieties of duck are present, but these are to be documented. Only two duck breeds in the country are being registered and another 12 or more indigenous ducks in different states are being reported but this needs detailed studies for its registration and conservation. Breeding and selection programme in both indigenous and exotic ducks are almost nil, except a few, which needs much attention. Infrastructure for breeding programme in ducks needs to be developed so that the same may be carried out for improvement of egg type duck. Though crossbreeding seems to be beneficial to improve performance in crosses than the indigenous ducks, but that needs to be carried out by conservation of indigenous duck germplasm before large scale supply of crossbred ducklings, as it may mix up genetic makeup of our indigenous ducks which are being exposed to natural selection since years and are well adapted to our harsh climate and poor management conditions under backyard.

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