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R Prabakaran

Officer on Special Duty,
Advanced Institute for
Integrated Research on
Livestock and Animal Sciences
(AIIRLIVAS), Government of
Tamil Nadu, India

S Ezhil Valavan

Professor, Poultry Research
Station, TANUVAS, Chennai,
Tamil Nadu, India

Breeding strategies for native chicken production in India

R Prabakaran and S Ezhil Valavan

Abstract

Native chicken farming improves the nutritional status of rural poor; rural people have a traditional affinity towards native chicken and are well versed with its husbandry practices. Native chicken rearing is gaining momentum now among jobless youth, school dropouts, etc., in rural and semi-urban areas. Commercial production of native chicken like Aseel, Kadaknath, etc. offers greater scope as they increase premium price over broilers. Small and medium farmers are not aware of breeding strategies to improve the economically important traits. This present review discusses about different breeding strategies to improve the important economic traits of native chicken.

Keywords: native chicken, breeding, farmer, institution, corporate levels

Introduction

Chicken was the first poultry species to domesticated, which happened in 5400 BC in China. In India, archaeological discoveries points out that chicken had been domesticated by 5400 BC. But it is not known whether these birds made much contribution to modern domestic fowl. Chickens from the Harappan Culture of the Indus Valley (2500-2100 B.C.) may have been the main source for diffusion through the world (Crawford, 1990a and b) ^[1, 2]. Birds were first domesticated for cultural and entertainment purposes, until much later birds were utilized as a source for human food (Crawford, 1990b) ^[2]. From there they gradually spread to the east and to the west from there they eventually encircled the globe. Two scientific names are in use for chicken, namely *Gallus gallus* and *Gallus domesticus*. The first implies that chickens were domesticated exclusively from the Red jungle fowl (*Gallus gallus*) and the second that more than one of the wild jungle fowl species namely grey jungle fowl (*Gallus sonnerati*), Ceylon jungle fowl (*Gallus lafayettei*) and green jungle fowl (*Gallus varius*) contributed to the evolution of domestic fowl. However, the red jungle fowl is the species that most closely resembles chicken so that there is no doubt that it was the main ancestor, although it may not have been the only one Collias and Collias (1996) ^[3].

It is a need for systematic study to characterize all the native breeds to find out the uniqueness among them so that those traits can be exploited to design breeding and conservation strategies. All native chicken are low productive in nature, hence the improvement of native chicken through selective breeding is required for enhancing the productivity of backyard and free range system of production. All native chicken breeds need to be identified, demarcated and notified so that improved varieties can be propagated in non notified areas for improving the productivity of backyard farming. Genetic improvement of native chicken breeds and reintroduction could be used to increase the productivity of backyard/free range farming without increasing the production cost or loss of biodiversity (Magothe *et al.* 2012) ^[4]. Therefore, characterization and improvement in performance of native chicken through selective breeding for growth or production is the need of the hour to enhance the productivity of low input backyard poultry farming in a sustainable manner.

Poultry industry outlook

India being in the tropical region of the world, the prevailing macro-climatic conditions is mostly congenial to poultry production. Among the many subsectors of agriculture, livestock sector is gaining momentum in India and within the livestock sector, poultry occupies a premium position. The poultry sector in India witnessed a rapid growth from 1951 to 2019 and the percentage of growth observed in 1951 was 28.98 and in 2019 was 16.8 per cent. Chicken alone contributes about 90 per cent of the total population in India as well as at world level and

Corresponding Author:

R Prabakaran

Officer on Special Duty,
Advanced Institute for
Integrated Research on
Livestock and Animal Sciences
(AIIRLIVAS), Government of
Tamil Nadu, India

the population of ducks, geese, guinea fowl, pigeons and turkey are meager. Ducks account for 7 per cent of poultry population and are mostly found in coastal states of the country. As per 20th livestock census (2019), the total poultry population in India was 851.81 million and 4.5 per cent increase in commercial poultry have been noticed during this period (Anon, 2019) [5].

The total egg production of India was about 5.65% of the total egg production of the world and about 93 per cent of the total eggs produced around the world are from chicken and the remaining is from other birds (Anon, 2018) [6]. The total egg production in India during 2018-19 was 103.32 billion eggs and the national average per capita consumption of egg was 79 (Anon, 2019) [5].

The growth in the broiler segment is expected to remain strong due to consumer preference for poultry, increasing income levels, and changing food habits. The live market sale of broiler meat still constitutes more than 90-95 per cent of total volume of sales; the processed chicken meat segment comprises only about 5 per cent of total production. Broiler farmers are opting for integration to remain protected from market uncertainties.

Most of the poultry farms are simple open sheds while only a few large poultry integrators have controlled-environment housing with automatic feeding and drinking systems. The statistics indicates that the major contribution of the meat from poultry has also been obtained from the chicken which accounted for 99.31 per cent in India and 89.40 per cent around the world. The total meat production in India was 8.11 million tones.

The total meat production (including poultry) has increased by 6 per cent when compared to previous year (7.7%). The meat production from poultry was 4.06 Million tones, contributing about 50 per cent of total meat production. The poultry meat production has increased by 7.8 per cent over previous year (Anon, 2019) [5].

Status of native chicken

Native chicken constitutes rural poultry that offers many advantages and attracts the farming community, entrepreneurs, self-help groups, etc., Native chicken farming can be reared with very low investment, even illiterates can adopt it as it requires much less skill.

Native chicken are sturdier and well adapted to local climatic conditions, can be sustained entirely in free range for both eggs and meat. As per 20th livestock census (2019), native chicken population was 317.07 million and 45.78 per cent increase have been noticed during this period (Table 1).

Native chicken layer population and egg production showed increasing trend due to huge demand in urban and semi-urban areas. Few private players are involved in commercial native chicken farming and supply day old native chicken to contract farming, where commercial native chickens are reared under intensive conditions.

Desi birds population and egg production and top five states desi population in India are presented in table 2 and 3 respectively.

Table 1: Desi birds population between census-2012 Vs 2019

Year	No. of Desi birds (Million)
2012	217.49
2019	317.07

(Source: Anon, 2019) [5]

Table 2: Desi birds population and egg production

Year	No. of desi birds (000)	Egg production by desi birds (Billion)
2015-16	106657	10.6
2016-17	110012	10.5
2017-18	104321	11.2
2018-19	109218	11.9

(Source: Anon, 2019) [5]

Table 3: Desi Birds populations -Top five states in India

States	2017-18 (000)	2018-19 (000)
West Bengal	27637.34	30011.81
Andhra Pradesh	10442.84	10702.21
Telangana	8879.70	9404.06
Maharashtra	7799.21	7926.50
Tamil Nadu	6023.19	6233.48

(Source: Anon, 2019) [5]

Advantages of rearing Native Chicken

Native chicken constitutes rural poultry that offers many advantages and attracts the attention of policy makers.

- Provides subsidiary income to the rural families
- Can be easily adapted even by resource poor facilities with very low investment.
- Even illiterates can adopt it as it requires much less skill.
- Native chicken are more sturdy and well adapted to local climatic conditions.
- Can be sustained entirely of free range
- Both eggs and meat of native chicken fetch 100 to 150% more price compared to those of commercial hybrids, as they occupy specific market segment.
- They help to improve the nutritional status of rural poor.
- Rural people have a traditional affinity towards native chicken and are well versed with its husbandry practices.

Native chicken breeds

The Indian birds are mostly nondescripts, and are of very little value as layers. A large number of flows of different size, shapes and colours, and for the most part resembling the jungle fowls, are found all over India. They vary in appearance according to the locality in which they have been bred. National bureau of Animal Genetic Resources (ICAR-NBAGR), Karnal, Haryana has recognized 19 native breeds of chicken (Table 4). They are Ankaleshwar, Aseel, Busra, Chittagong, Denki, Daothaiger, Ghagus, Harringhata black, Kadaknath, Kalasthi, Hansli, Kashmir Faverolla, Miri, Nicobari, Punjab brown, Tellicherry, Mewari, Kaunayen and Uttara. They are also some more unrecognized breeds of native chicken like Dumasil, Kalahandi, Phulbani and Gujuri in Odisha. The phenotypic characteristics of native breeds of chicken are given in table 5.

Table 4: Native chicken breeds of India

S. No.	Breeds	Home Tract
1	Ankaleshwar	Gujarat
2	Aseel	Chhattisgarh, Orissa and Andhra Pradesh
3	Busra	Gujarat and Maharashtra
4	Chittagong	Meghalaya and Tripura
5	Danki	Andhra Pradesh
6	Daothigir	Assam
7	Ghagus	Andhra Pradesh and Karnataka
8	Harringhata Black	West Bengal
9	Kadaknath	Madhya Pradesh
10	Kalasthi	Andhra Pradesh
11	Hansli	Odisha
12	Kashmir Faverolla	Jammu and Kashmir
13	Miri	Assam
15	Nicobari	Andaman & Nicobar
15	Punjab Brown	Punjab and Haryana
16	Tellichery	Kerala
17	Mewari	Rajasthan
18	Kaunayen	Manipur
19	Uttara	Uttarakhand

Table 5: Phenotypic characteristics of native breeds of chicken

Name of the breed	Home tract	Purpose	Special future	Phenotypic characteristics			References
				Feather	Comb, wattle, eye, etc.	others	
Aseel	East Godavari, Visakhapatnam, Vizianagaram districts, Dantewada district of Chhattisgarh, Uttar Pradesh and Rajasthan.	Meat and eggs	Aseel meaning pure or thoroughbred. It is noted for its pugnacity, high stamina, majestic gait and dogged fighting qualities.	Colour is brownish-red followed by reddish brown and black	Pea comb, wattle bright red, eye are compact, well set and present bold looks	neck is long, uniformly thick but no fleshy. The tail is small and drooping. The legs are strong, straight, and set well apart	Pandey <i>et al.</i> 2005 [7]
Kadaknath or Kalamasi	Districts Jhabua and Dhar, Madhya Pradesh. Geographical Indication given to Kadaknath during March 2018	Meat	Black colour of muscle and tissue is due to deposition of melanin pigment known as Fibromelanosis. Internal organs show intense black colouration, which is pronounced in trachea, thoracic and abdominal air-sacs, gonads and at the base of the heart and mesentery. The blood is darker than normal	Jet-black pencilled and Golden colour. Day-old chicks are bluish to black with irregular dark stripes over the back. Adult plumage varies from silver and gold-spangled to bluish-black without any spangling	Single comb, purple wattle	Skin, beak, shanks, toes and soles of feet are slate like in colour	Geographical indications Journal NO. 104, 28th March, 2018, Geographical Indications Registry, Intellectual Property, Government of India Rights building, G. S. T. Road, Guindy, Chennai-32.
Nicobari	Nicobar and Andaman group of Islands	Egg	compact body, short leg	Black, brown and white. The plumage pattern is solid	Mostly single red coloured comb, Wattles and ear lobes are pinkish in colour	The shank and skin is pinkish white. Short and thick neck, medium sized tail and long saddle feathers fitting well with tail. Wings are large, strong and well folded. Lower thighs and shanks are small and as a result the birds walk with a sweeping movement	Vijh <i>et al.</i> 2006 [8]
Kashmir Favrolla	Anantnag, Baramullah, Budgam, Kupwara, Srinagar and Pulwama districts of Jammu and Kashmir	Meat and eggs	Can survive and produce during subzero temperature. Normally feathered, naked neck and/ or bottle jawed.	No specific plumage color	Ear lobes are mostly white and single, pea, walnut comb red in color. Tufts of	Feathered shank, black shank and mutiple spurs	Tantia <i>et al.</i> 2005a [9]

					feather over earlobes.		
Daothigir	Bodoland region of Assam	Meat and eggs	Breed derives its name from the name of a plant 'Thigir' (<i>Dillenia indica</i>)	Black interspersed with white feathers	Ear lobe is red, white or white mixed with red. Wattle and comb are red colour.	Neck and back has golden yellow or brown feathers in brown coloured birds. Skin is creamish in color slightly towards pinkish appearance. Wings and tail has black or brown feathers. Tail is short and almost in level with the back.	Vij <i>et al.</i> 2006 ^[10]
Tellicherry	Kannur district of Kerala, Mahe district of Puducherry	Meat	Body confirmation is similar to Red Jungle fowl	Black with shining bluish tinge on hackle. Few have golden mixed with bluish feathers on neck.	single Comb is red, and large in size. Wattles and ear lobe are red in colour	Beak is blackish, shank is featherless and blackish grey in colour.	Vij <i>et al.</i> 2005b ^[11]
Ghagus	Kolar district, Karnataka Chittoor and Anantapur district of Andhra Pradesh	Meat and eggs	Birds might have derived its name by a peculiar sound and locally known as Desi or Ghegu	Brown followed by black Cocks have shining bluish black feathers on breast, tail and thighs	Comb is red and pea or single Ear lobes, wattles are in red colour	Ghagus look mixture of Aseel type and Desi egg laying birds	Tantia <i>et al.</i> 2005b ^[12]
Ankleshwar	Bharuch and Narmada districts of Gujarat	Meat and eggs	Production performance is poor	Plumage colour ranges from white and light grey to brown and golden	Red colour single comb, white earlobe. Eyes are black with yellow reddish ring.	Beak is small and yellow in colour. Skin is yellow or pinkish in colour. Shank is yellow in color.	Tantia <i>et al.</i> 2006 ^[13]
Danki	Viziangaram district, Visakhapatnam district of Andhra Pradesh	Danki fight, meat	Gamey bird	Plumage colour is brown followed by black	Pea comb, some birds may have strawberry, red earlobe; wattle is absent	Spur is long and sharp	Vij <i>et al.</i> 2005a ^[14]
Busra	Nasik, SAKri, Navapur, Taloda and Dhadgaon- Maharashtra; Uchchal, Songadh, Ahawat, Dang- Gujarat	Eggs	Frizzle character is common	White mixed with black feathers on neck, back, tail. Few are solid white.	Red single comb, red wattle	Beak and shank are yellow	Vij <i>et al.</i> 2007 ^[15]
Punjab brown	Punjab and Haryana	Meat and eggs	Male have black spots / stripes on neck, wings	Mostly brown. Some birds have black or white coloured	Red colour single comb; ear lobe white/ grey	Skin is white; shank and beak are yellow	Vij <i>et al.</i> 2005c ^[16]
Kalasthi	Chittoor district of Andhra Pradesh	Meat and cock fighting	Fighting bird	Bluish black followed by brown	Red pea comb; wattle is small red in colour	Legs are long, Skin is white or pinkish in colour.	Vijh <i>et al.</i> 2005 ^[17]
Uttara	Kumaon region of Uttarakhand	Meat and eggs	Feathered shank	Black in colour	Red colour single comb; red colour wattle; About 18% of birds have bunch of feathers on head (crest/ crown)	birds are more noisy and flighty	ICAR- NBAGR ^[18]

Breeding Strategies

Different parameters are considered for selecting and improving the performance of commercial chicken for egg or meat. Breeding strategies hitherto assumed that many of these parameters are controlled by polygenic inheritance and followed assessment of the same in any gives population.

Pure breeding methods like mass selection, family selection, within family selection, index selection and their variants are adopted after assessing and apportioning the variance. Cross breeding is adopted at different levels where dominance contributes to the variance mostly. Specific inbred lines are produced and employed to fix some desirable characters.

Diallel crosses are used to estimate general and specific combining abilities.

Newer knowledge on molecular genetics and unraveling of chicken genome offer newer opportunities for faster, more accurate and using specialized poultry breeding programmes. Integration of emerging knowledge *viz.* MAS, QTL into existing breeding programmes is to the otting. However, commercial poultry breeding poses a danger to existing bio-diversity witnessed the chicken breeds.

Breeding Native Chicken

Breeding of native chicken need to be viewed as operating at three different levels (Prabakaran, 2014)^[19].

- i) At the farmer level
- ii) At the Institutions
- iii) By corporate poultry

i) At the Farmer Level

As the farmer rearing native chicken are rampant poor and are mostly illiterate, no planned breeding strategy is attempted. He continues to maintain the same flock strength of 5-20 birds bred from the same stock. Inbreeding is rampant. Egg production and fertility among cocks become poorer and poorer over subsequent generation. Birds become smaller the size; egg size gets small and the net become from backyard rearing of native chicken goes down, generation after generation.

ii) At the Institution Level

Several government institutes *viz.*, CARI, Izatnagar, DPR, Hyderabad, SAUs in many states *viz.* Karnataka, Kerala, Tamil Nadu etc., propagate pure breeds (or) improved varieties resulting from varied attempts and distribute them to the farmers for backyard rearing over the last two decades and more. The response from rural poor is growing even though the market acceptability for crossbred multi-colored strain has been comparatively lower than for purebred native chicken.

iii) By Corporate Poultry

Commercial utilization of native chicken germplasm is also on the rise, because of the premium price fetched by the native chicken the market and 10% market share that exists for native chicken in poultry meat industry. The industry is also interested the retaining the specific attributes of native chicken meat while planning their expansion strategies.

Purpose and Parameters

Before planning the breeding strategy for native chicken, we need to take into consideration the purpose for which it is reared and the parameters that and to be improved or sustained. Native chicken is mostly reared by rural farmers for dual purpose i.e both for egg and meat. (Breeding native chicken for cock fight is totally a different approach adopted by a few farmers and since cock fight is banned legally as a

village sport, let us not discuss the same here). Hence, the institutions also try to develop varieties that morphologically look like native chicken with multi-coloured plumage and improved egg production and growth potential. However, the corporate sector which is into commercial rearing of native chicken only for a few years now, is interested the developing native chicken for meat only because of the 150% more premium price fetched by country chicken meat in the market.

Parameters for Selection

- i) Selection strategy for native chicken should serve two purposes Improvement of economic parameters like body weight, egg number, fertility etc., so that the rural farmer gets maximum return out of his small sized backyard chicken units.
- ii) Maintenance of characters specific to native chicken *viz.*, appearance including plumage colour egg shell color, long shank and upright gaint especially among males, broodiness, disease resistance, egg and meat quality etc., So that native chicken retains its prime status in the market.

Selection strategies for native chicken

i) Farmer Level

The rural farmer level units are very small in size and most of the farmers lake any scientific knowledge to undertake planned breeding of native chicken. To avoid inbreeding and its all effects are reproductive parameters, small holder farmer units can exchange their cocks every year with another unit under veterinary supervision so that birds from a diseased flock is not brought in and also to maintain the purity of the flock.

ii) Institution Level

At the institutions, commercial breeding strategies based on quantitative inheritance of economic parameters can be continued to improve the performance of native chicken. It may be selective breeding within the purebreeds or cross breeding with improved strains of exotic breeds, without jeopardizing the appearance and other specific qualities of preference among native chicken. They include colored plumage, brown egg shell, long shank length etc. Hence, restrictions need to be applied in selection where necessary to ensure that the appearance, meat and egg quality are retained in the native chicken.

Selection also need to be practiced keeping in mind the housing and feeding environment under which the progeny of the selected population are to be reared.

Seasonal attempts have been made at the institution level to develop and distribute improved varieties for backyard rearing. They included different types of crosses, with exotic breeds / synthetic hybrid and some of the germplasms developed and distributed are:

1)	CARI, Izatnagar		
	CARI Devendra	-	Dual type
	CARI Gold	-	Dual type
	CARI Nirbhik	-	Egg type
	CARI Shyama	-	Egg type
	UPCARI	-	Egg type
2)	DPR, Hyderabad		
	Vanaraja	-	Dual type
	Gramapriya	-	Egg type
3)	CARI, Port Blair		

	Nicor	-	Dual type
	Nishibari	-	Dual type
4)	KVAFSU, Karnataka		
	Giriraja	-	Dual type
5)	KVASU, Kerala		
	Grama lakshmi	-	Egg type
	Grama shree	-	Dual type
	Krishnapriya	-	Dual type
6)	TANUVAS, Tamil Nadu		
	Nandanam Chicken 1 & 2	-	Meat type
	Namakkal Chicken 1	-	Egg type
7)	JNKV, Jabalpur		
	Krishna J	-	Egg type

However, attempts on developing strains by selective breeding within pure breeds of native chicken were not many even though we often make a claim that all modern breeds of chicken around the world had their origin in *Indian Jungle Fowl* which implies that the native chicken has the required genetic potential.

iii) Industry Level

The industry has not taken much care about developing improved strains of native chicken so far, because of the lower and distributed demand.

A few fringe players adopt different yardsticks. Some lay emphasis on faster growth while some concentrate on appearance and meat quality. Breast angle shank length and egg number are some of the additional parameters considered.

Conclusion

Considering that the market for native chicken meat and egg is growing, it is necessary that the scientists take care in maintain the purity of native breeds while improving their performance. Hence, it is imperative that selective breeding with in pure breeds available locally should be the obvious choice. The institutions need to gather and raise a base population of the native breed stabilize the same, assess the variance in the parameters of choice, apply restrictions where necessary while selecting for multiple characters and adopt conventional breeding strategies to develop new improved strains within each breed. Distribution of the germplasm to the farmers backyards and assessment of their performance and acceptability is also required before the developed strain is released for propagation. This approach will also help the maintaining the biodiversity that is prevalent among stocks maintained by the rural farmers. It will also ensure that the native chicken retain their prime position in the market to offer maximum economic advantage to the resource poor rural farmers and help the objective of retaining the biodiversity to meet the future challenges too.

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