**Original Review Article**

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QUAIL SURVEY: ELABORATIVE INFORMATION AND ITS PROSPECTS**Khushboo Arya¹, Roshani Gupta², Vijay Laxmi Saxena^{1*}**

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ABSTRACT: The paper reviewed the primary literature and its geographical distribution of *Coturnix* quail species, and we have put our emphasis on the elaborative description and thus compiled the data of characterization related to its ecology, morphology, physiology for comparative purpose useful for economic and research purposes globally. Further sections deal with quail farming and its major diseases to understand overall scenario due to some knowledgeable gap in the control and maintenance of quail species population. For concluded factors, future observations and perspectives have been pumped out starting from its early detection, diagnosis and proper vaccination in aviary market causing the death of quails all over the world and thus must be recommended for safe and healthy global society with its sustainable development.

KEYWORDS: Quail, Distribution, Status, Diseases, Farming

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1. INTRODUCTION

The bird originated from a wild environment just as any other domesticated animal and was first domesticated in Japan in 1595. There are 45 species of quail worldwide. However, only two species of quail are widespread in India out of which the black-breasted jungle or rain quail (*Coturnix coromandelica*) found in the jungle and the brown-coloured Japanese quail (*Coturnix coturnix japonica*) which is bred for meat and used for commercial purposes. In India, quail keeping started in 1974 at Ijatnagar, when Central Avian Research Institute, introduced improved germplasm of domesticated quail varieties from Japan[1] and then in 1983 at Tamil Nadu. Thereafter, Agricultural Universities of Andhra Pradesh, West Bengal, Mizoram in Northeast India[2] veterinary colleges as

well as animal husbandry department played a vital role in the promotion of quail breeding as a farm enterprise.

2.RAIN QUAIL: FEATURES AND ITS MAINTENANCE

Rain Quail, also called Black-breasted Quail (**Figure 1**) found mainly in the Indus valley or the western parts of the Indo-Chinese peninsula, Bangladesh, Cambodia, India, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand and Viet Nam (**Figure 2**). Rain quail are closely related to harlequin quail, *Coturnix delogorguei*[3-6]. Their primary habitat is on grazelands, fields with grass and shrubs. Most of them migrate into the southern regions during the winters[7]. They used to shift their residence according to the rain, hence their common name[4]. Male is characterised by the presence of black breasted patch and distinctive head pattern bearing black and white patches and might be similar to European quail. The black patch on the female rain quail's breast is likely to be delicate. A taxonomical study of Rain quail is given below in **Table 1**.

Table 1: Taxonomical classification

Kingdom	Phylum	Class	Order	Family	Genus	Scientific name
Animalia	Chordata	Aves	Galliformes	Phasianidae	<i>Coturnix</i>	<i>CoturnixCoturnix coromandelica</i> (Gmelin,1789)



Figure 1. *Coturnix coturnix coromandelica* (©Nirav Bhatt)

Rain Quail • *Coturnix coromandelica* • (Gmelin, JF, 1789)

Order: GALLIFORMES Family: Phasianidae (Pheasants and allies) Genus: Coturnix Species: coromandelica

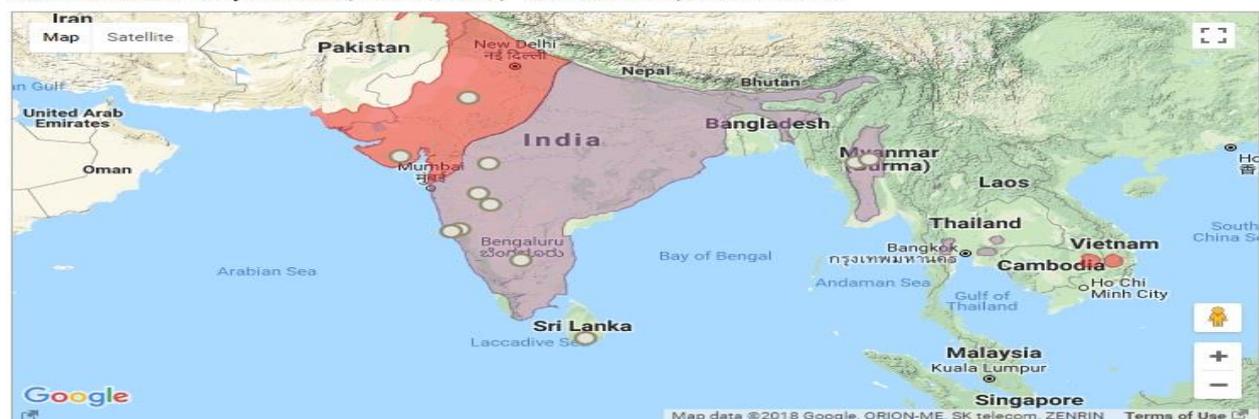


Figure 2: Map showing the geographical distribution of rain quail

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3. CONSERVATION STATUS OF QUAIL IN INDIA

The conservation status of species was assessed using the criteria proposed by Mace and Lande[8]. These criteria were widely known as the Mace-Lande Criteria. This species has an extensive range and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km² combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). The population trend appears to be stable, and hence the species does not approach the thresholds for Vulnerable under the population trend criterion (>30% decline over ten years or three generations). For these reasons, the species is evaluated as Least Concern. Some of the Indian regions quail has been discussed below in **Table 2**.

Table 2: Quail found in Indian regions and its conservative hierarchy

Common name	Scientific Name	Distribution	Threat Status
Himalayan Quail	<i>Ophrysia Supersiliosa</i>	Uttar Pradesh, India	Critically Endangered
Manipur Bush Quail	<i>Perdicula Manipurensis</i>	Northeast India, apparently Bangladesh	Vulnerable
Blue Breasted Quail	<i>Coturnix Chinensis</i>	Indian to Southeast Australia	Least Concern
Rain Quail	<i>Coturnic Coromandelica</i>	Indian Sub coordinate	Least Concern
Jungle Bush Quail	<i>Perdicula Asiatica</i>	Indian Sub coordinate	Least Concern
Rock Bush Quail	<i>Perdicula Argoondah</i>	Indian Sub coordinate	Least Concern
Painted Bush Quail	<i>Perdicula Erythrorhyncha</i>	Indian Sub coordinate	Least Concern

4. BREEDING

Rain quail breeds during August-September [9] followed by slow regressive phase and extended quiescent (preparatory) phase during the early part of the year (**Table 3**). Almost 18 breeds of quail and are widely distributed. Most of them are suitable for commercial meat production and some for egg production purpose. Bobwhite (American) and White Breasted (Indian) are broiler quail and are famous for their meat production business and marketing. Some high-value egg producing quail breeds are British Range, English White, Manchurian Golden, Pharaoh and Tuxedo.

Table 3: Rain quail breeding information

Population	Breeding interval	Breeding season	Hatching (in days)		Range of eggs per season	Time to get independent (month)	Range elevation	The extent of occurrence (Breeding/resident: EOO) (in km ²)
			Range	Average				
Widespread and common	Yearly	March to October (mainly August-September)	16	19	4-6	8	2500 (m) 8202.10 (ft)	51,0000-7,540,000

The commercial value of quail farming

Quail was first introduced in India in 1974 from California. Broiler quail can be sold at 5 weeks. Quail start laying eggs at the age of 6 weeks and continue laying eggs up to 24 weeks of age[10]. It becomes mature at the age of six to seven weeks then start laying eggs with a high rate of clutch up to 280. Due to its small size, it requires minimum space for rearing with low capital.

The Breeding stock

Fertility and hatchability were directly proportional to the egg weight[11]. There are two generalized methods practised for quail breeding. The one is with mix population of male and female quail with 1:2.5 ratios. This method is used for large-scale production but with a disadvantage of irregular laying rate. Aggressive pecking by males in the breeding group has also seen reported[12]. The other method is to keep individual male and females separately and cross them periodically. It is a good method for practising on small-scale breeding for achieving high fertility rate and breeding quality.

Incubation of eggs

The domesticated quail has lost the instinct of nesting, so the only way of breeding quail in an incubator or an alternative is to place the eggs under a broody hen for hatching. To reduce infection rate, eggs have been collected 3 to 5 times in a day, and only healthy looking strong shell without cracks or damage are kept to be incubated. The cool and dry place is used for storage, the egg trays with the storing temperature between 12-17 degree Celsius and the relative humidity around 70-80 per cent. Above 18 degree Celsius, development of the little embryos begins, and hatching eggs become useless, so it's essential to maintain the temperature because under- incubating (low temperature) results in late hatching and over-incubating (high temperature) results early hatching both conditions affect the chick health and immunity. After first 7days, eggs need to examine the fertile eggs, and empty quail eggs should be removed to prevent the transfer of infections onto the healthy eggs. After incubation of complete 15thday, turning mechanism should be stopped, the

temperature is maintained on 37.5 degree Celsius and hatching begins with 16th day while most of the egg gets hatched in 17 days. Any quail chick which hatched after 18th day has minimal chances to survive. It is necessary to keep the chick in the incubator until they become dry and fluffy and then, they should be placed into the preheated brooder up to 24 hours for preventing them early infection and death (Table 4).

Table 4: Showing a required amount of temperature and light for healthy development in different stages of the age of Quail chick.

Quail Age	Temperature(degree C)	Light(hours)
1 st Week	37.7	24
2 nd Week	35	24
3 rd Week	32.2	12

Raising Quail Chicks

Quail chicks are susceptible and need artificial heat and light management system for 2 to 3 weeks from birth. Adequate temperature, light exposure with proper airy place having enough hygienic space and feeding plays a vital role in healthy development. The weight of the egg is 6.7-13.8 gm. Quails require about 16-18 hours of light for optimum production of eggs. The proportion of yolk (the yellow inside part) to albumen (the white part) is 39:61 and is higher compared to chicken eggs. The female lays eggs every 16-24 hours for 8-12 months during the first year. Second-year egg production is 48% of the first year's production and falls drastically in subsequent years.

5.FEEDING

Feed is the essential factor for healthy development. For the healthy chicks, the breeder should be provided with optimum minerals and vitamins in their feed[13]. Feeding material should be small and homogenized. A 6-month-old quail consume 30 to 35 gms and 5 weeks old quail about 500gms per day. A quail need to be fed with 400grms for the production of 12eggs (Table 5).

Table 5: Feeding Formulation

Feed Ingredients	Chick mash	Grower mash
	0-3 weeks	4-6 weeks
Maize	27	31
Sorghum	15	14
Deoiled Rice Bran	8	8
Groundnut Cake	17	17
Sunflower Cake	12.5	12.5
Soya Meal	8	-
Fishmeal	10	10
Mineral Mixture	2.5	2.5
Shell grit	-	5

6. ECONOMIC IMPORTANCE

Chiefly terrestrial birds, they are easily trapped and provide gainful employment[14]. Thirty-five species of partridges, quails, francolins, snowcocks, guineafowl, and turkeys have been introduced to locations outside their natural range for purposes as diverse as ornamental collections, recreation, sport, and production of meat[15]. Quail eggs contain 13 per cent proteins compared to 11 per cent in chicken eggs. Quail Eggs contain 140 per cent of vitamin B1 compared to only 50 per cent in chicken eggs. Also, it provides five times as much iron and potassium. It is tasty and has high nutritional value and low-fat content[16]. Unlike chicken eggs, quail eggs do not cause allergies or diathesis[17]. The same reported observed that quails are quickly replacing the chicken broiler due to high nutritive value and medicinal properties. They are inexpensive forms of animal protein, contain all amino acids needed for human health, provide many vital vitamins and minerals[18] and compare favorably to chicken eggs in some nutrient values. The composition of quail eggs is given in **Table 6**. They are multi-coloured and heavily mottled with black, brown and blue (**Figure 3**). As these birds are having edible value, they are netted for the market in North-West India. It is reported that in some states of India poultry industries are developed to breed this bird, on commercial basis as agricultural species for egg and meat production[19]. It promotes body and brain development in young ones and suitable for blood pressure patients due to low cholesterol percentage and are also good for the pregnant and infant feeding women. Quails could reduce protein deficiency in developing countries because quail products have proven to be relatively cheap providers of proteins. In India, in the last two decades, quail have been introduced to the Indian sub-continent as an alternative avian species in the progressing poultry industry to mitigate chronic protein deficiency among the Indian population[20]. As a result, quail rearing has resulted in the alleviation of protein deficiency among the Indian population due to the per annum availability of 33 eggs and 770 grams of poultry meat per person[21].



Figure 3: Quail eggs (©Richard Bogdanowicz)

Table 6: Composition of quail eggs

Nutrients value per 100g	Energy (Kcal)	Protein (g)	Carbohydrates (g)	Fat(g)	Total ash (%)	Caloric value (Kcal)	Water (%)	Calcium (mg)	Iron (mg)	Folate (mcg)	Vitamin (mg)
Quail egg	158	13.05	0.41	11.09	1	649	74	64	3.65	66	0.150

7. REPORTED STUDY ON DISEASES

Diseases are less in quails as compared to other poultry birds. Most of the common quail diseases are caused by organisms which the birds pick up from the ground or contaminated droppings. While quails have a certain degree of resistance to some diseases, they are prone to some poultry diseases and pests[22]. Enteropathogenic bacteria are prevalent among quails[23]. According to the studies[24], quails are prone to the following diseases and pests as shown in (Table 7) and can be classified according to causal agents[25]. Viral disease includes Quail bronchitis, Newcastle disease (ND), Infectious bursal disease (IBD), Marek's disease, lymphoid leukosis, Encephalomyelitis, Pox disease etc. (Figure 4). Among the bacterial diseases, colisepticemia, fowl cholera, fowl typhoid, salmonellosis is found in Japanese quail. Some fungal diseases (Brooder's pneumonia, candidiasis etc.) and parasitic diseases also occur in Japanese quail[26]. It is very important to identify the diseases those are present in commercial quail farms of Bangladesh useful for sustainable quail farming. This will be helpful for the development of the poultry industry and the ultimate development of the country. Therefore, much research is needed to diagnose the bacterial and viral diseases of quail by observing the clinical signs, necropsy findings and histopathological changes in different tissues. Quail are more sensitive to mismanagement than chicken. Therefore, sound management practices are vitally important in preventing and controlling disease[27]. According to a report on quail production and management in Georgia [28], no medications are approved for quail, and there are no disease preventive vaccines. According to a document report by Wambugu ATC (2013), there are no quails vaccine and medication in the market.

Table 7: Reported diseases in quail, symptoms and their control

Types of infection	Diseases /pests	Symptoms	Control/prevention
Viral	IBD ND POX	Respiratory distress, sneezing and loose, watery droppings coughing	Vaccination
Bacterial	Salmonellosis	Partially closed eyes, ruffled	Antimicrobial drugs

	Colibacillosis Ulcerative enteritis	feathers diarrhoea, restlessness, retracted neck, drooping wings, anaemia and watery white faeces	
Mixed	Mycoplasmosis Aspergillosis Haemoprotus infection	Anaemia, lameness, poor growth and general weakness	Antimicrobial drugs
Parasitic	Coccidiosis	Birds go off feed, weak-legged, pale and die if not treated	Coccidiostat
Internal parasitic	Roundworms Tapeworms	Drop in egg production, an increase in hunger and diarrhoea	Anthelmintic



Figure 4: Quail infected with quail pox virus (©W.A. Dozier)

Recurrent Diseases of Quail

Quails, though suffer from various diseases are quite resistant to Ranikhet disease, fowl-pox, ascariasis, etc. According to a report [29], some important diseases, their causative agents, symptoms and control measures are described here (**Table 8**).

Table 8: Major diseases reoccurring in quail and their prevention

Problems	Causes	Prevention
Delayed laying	Protein supply low in the feed, delayed growth	Increase protein
No eggs laid	Less than 16 hours of light per day	Ensure lighting 16-18 hours per day
Light coloured eggs	Eggs not fertile or kept more than 10 days	Reduce the number of females per male, and change the males if they are too old. Keep the eggs less than 10 days before putting them in the

		incubator
Eggshells too fragile	Low calcium in the feed	Increase calcium
Eggs are small and fragile	Female is too young	Do not allow females to reproduce before the age of 6 weeks
Dead embryos	Wrong temperature	Monitor the temperature
	Eggs are not turned frequently enough	Mark the eggs and be sure to turn them daily
	Consanguinity	Swap the males, import new eggs
Chicks well developed but stayed in the eggs	Temperature too low, or suddenly too high, or too humid	Regularly monitoring the temperature and humidity
Deformations of beak or toes, eyes missing	Temperature rises	Monitor the temperature
Chicks hatching prematurely	Temperature rises	Regulate the temperature
Chicks hatching late	Temperature lowers	Regulate the temperature
Cannibalism	Density too high, low water supply, high light intensity	Regulate them vice versa

Preventive measures include treating with the help of Bacitracin, Chloromycetin and Streptomycin. Complete cure and protection may be served by dosage value of Streptomycin at the rate of 2 gm/4.5 litres of drinking water for 25 days or streptomycin sulphate at the rate of 1 gm/litre of drinking water for 10 days. Outbreak of disease can be administered by dose of streptomycin sulphate at the rate of 1 gm/4.5 litres of drinking water in chicks during the first four weeks of their rearing period, Bacitracin at the rate of 100 gm/tonne and Chloromycetin at the rate of 500 gm/tonne of feed give remarkable protection from the disease. Disease prevention, control and sanitary management practices are the best guarantees against disease and pests, and this can be achieved by keeping their house dry and clean, ensuring proper movement of light and air inside their house, keeping different aged quails separated from each other, separating the disease affected quails from the healthy one[30] burning the dead bird or burning them, not allowing other birds, animals or unknown persons enter inside quail house, ensuring hygienic and balanced feed supply and providing adequate fresh and clean water according to their demand as well as proper medication [31]. Hatching eggs can be disinfected with carvacrol, cinnamaldehyde or thymol [32]. To avoid the spread of diseases, care for the youngest birds should be before the oldest birds and care for healthy

birds should be before the sick birds [33]. According to Walker and Smith [34], little research specific to quail disease problems still to be needed and needs some experimental steps.

8. ACT AND REGULATION FOR QUAIL FARMING

Quail being a protected species, a government license is required to sell it commercially. In India, the Department of Animal Husbandry, Dairy and Fisheries are responsible for granting such license as delegated by the Ministry of Environment and Forests. Several quail licenses have been already issued (more than 500 in Maharashtra State only). As per Ministry of Environment and Forests, New Delhi, there are some important terms and conditions for Quail license which has to be followed by the trader or quail farmer. Presently, after a recent directive from the Centre, they removed Japanese quail from schedule IV of The Indian Wildlife Protection Act (TIWPA). Quail farming and trading are now legal in Tamilnadu and Karnataka. The state government has lifted a three-year-old ban. Till recently, the state forest department not only prohibited rearing and selling the bird but also booked those who sold it.

9. CONCLUSION

The factors which are discussed in the review influences quail range, its farming management and disease control which helps to emphasis on the social factors, management practices, nutritive and medicinal value having access to the market. These practices help in the multiple ways to the quail farmers as a source of food, income and employment. Thus, the need for well-defined procedures and policies for emerging challenges facing the community such as reoccurring diseases and animal dietary deficiency. Lack of organized propaganda about quail farming is one of the major issues which can be fulfilled by the proper management of quail chicks. Although quail suffered from fewer diseases but the diseases outcomes become harsh according to seasonal change. So, much more research still needed to rise the control and prevention if gets affected by severe symptoms. Poultry Welfare system gets more legislative attention in the European Union than many other regions in the world. And the scenario in India still needs much attention from its production up to its demand. Currently, there are numerous policies of legislation in the poultry department, which have not been reviewed and some are redundant, and some still are unexplored. Thus, this review will help to develop and strengthen the core of quail based poultry sector and to figure out the research pathway enforcing production, management, maintenance and marketing of quail issues and hence nurturing the poultry world.

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CONFLICT OF INTEREST

Authors have no conflicts of interest.

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