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Analyzing morphological variation and genetic diversity aiming to improve productive performance of kalij pheasant (*Lophura leucomelanos*) through better plan of nutrition

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Abstract

Pheasants are some of the most hunted bird species in Nepal. There are very few studies and findings done regarding Kalij Pheasant which are still insufficient to learn more scientifically about the kalij pheasant, especially in relation to utilizing its potential as a good quality source of meat but by not threatening to its genetic diversity (Garson *et al.* 2000). Eight species of pheasants are recorded in Nepal: Common Peafowl (*Pavo cristatus*), Red Junglefowl (*Gallus gallus*), Himalayan Monal (*Lophophorus impejanus*), Satyr Tragopan (*Tragopan satyra*), Blood Pheasant (*Ithaginis cruentus*), Cheer Pheasant (*Catreus wallichii*), Koklass Pheasant (*Pucrasia macrolopha*), and Kalij Pheasant (*Lophura leucomelanos*). Pheasants are commonly known birds in Nepal. There is a high degree of sexual dimorphism with the male bird being typically larger and more colorful than the smaller brown female. Up to the 8th week of rearing only the pheasants were fed with all-mash pelleted mixture starter, where 1 kg of feed contained 27.32% of protein and 2 800 kcal ME. From the 9th to the 16th week the birds were given the grower mixture, containing 24.21% of protein and 2 765 kcal ME, while starting from the 17th week to the end of rearing the finisher mixture, containing 18.06% of protein and 2 750 kcal ME should be feeded controlled environmental conditions (Smulikowska and Rutkowski 2005). They have a diploid number of 81 and 82 for females and males, respectively, with the sex chromosomes always unpaired in females. The complete mitochondrial genome is 1662 bp long and is composed of 13 typical protein coding genes, 22 tRNA genes, 2 rRNA genes. The females are not territorial, construct a nest on the ground, and lay 6-14 eggs, laying one egg a day. Hatching can take 23-28 days and fledging takes 7-12 days, with the time to complete independence being 70-80 days. They generally live for 11-18 years in captivity, and approximately 3 years in the wild. Males may have an annual survival rate of 7%, compared with 21-46% for females.

Keywords: morphological variation, *Lophura leucomelanos*, kalij pheasant

Introduction

Pheasants are some of the most hunted bird species in Nepal. Conservation threats to this group of species overlap in most cases and includes illegal hunting, trapping for meat, use of body parts for age old traditional healing practices, and pet keeping. Deforestation and forest fire are also known to be direct cause of reduction in number of kalij Pheasant (Fuller *et al.* 2004). Specific threat includes: killing of Common Peafowl, Himalayan Monal, Satyr Tragopan and kalij pheasant is for their body parts which have high value. The national and global status of kalij and red junglefowl is least concern, and it's population is unknown, but has been estimated about 3000 to 5000. The national status of this bird is that it is a near threatened bird (Esen *et al.* 2010).

Nepal government has granted the rearing license for the Kalij Pheasant. Now a day many hotels and restaurant targeted the flow of costumer at many aspect. They are killed for, food, feather and entertainment; they can be hunted in some of hunting reserves. There are very few studies and findings done regarding Kalij Pheasant which are still insufficient to learn more scientifically about the kalij pheasant, especially in relation to utilizing its potential as a good quality source of meat but by not threatening to its genetic diversity (Garson *et al.* 2000). Due to taste and medicinal purpose people are attracted to the consumption of kalij meat. The people are also attracted with morphological characters and tradition in flow of rearing of kalij

as companion type decorative bird. To protect the native breeds of kalij by enhancing the knowledge of farming and decreasing the hunting pressure is one of the important aspects to be considered.

Pheasants are native to Asia, but have been introduced elsewhere as a game bird. There are 35 species of pheasant belonging to 11 genera (Giuseppe *et al.* 2018) [4]. Pheasants are kept under commercial conditions in range systems while in intensive ones can be kept both in cages and in deep litter floor. A minimum space allowance suitable for pheasants is 4-8 m² per bird in range conditions and only 0.5 m² per breeder when kept intensively. Body weight of adult male 900-1200 g, and adult female 700-900 g. These birds are between 7 and 16 weeks of age and are sold during the summer (Switzer *et al.*, 2011).

Eight species of pheasants are recorded in Nepal: Common Peafowl (*Pavo cristatus*), Red Junglefowl (*Gallus gallus*), Himalayan Monal (*Lophophorus impejanus*), Satyr Tragopan (*Tragopan satyra*), Blood Pheasant (*Ithaginis cruentus*), Cheer Pheasant (*Catreus wallichii*), Koklass Pheasant (*Pucrasia macrolopha*), and Kalij Pheasant (*Lophura leucomelanos*). Pheasants are commonly known birds in Nepal. However, very little information is available on their ecology and population status among the scientific and the conservation fraternity. Despite few sporadic studies, many potential areas are still unexplored. Thus, there is a need to undertake a detail study on population and ecology of pheasant communities suggesting a need for long term studies (Switzer *et al.*, 2011).

There is a high degree of sexual dimorphism with the male bird being typically larger and more colorful than the smaller brown female. Males typically have multicolored plumage with long, pointed and barred tails with heads ranging from glossy dark green to iridescent purple. The males having rich chestnut, golden brown and black markings on the tail and body with a dark green head and red face wattle, there may or may not be a white neck, ring and males are conspicuous and noisy. The female is mottled, with paler brown and black and with a shorter tail and no wattles or pinnae, the latter being the tufts of feathers behind the eyes. Males are rather variable depending on the subspecies involved, but all have an at least partially glossy bluish-black plumage, while females are overall brownish (Moulin *et al.*, 2003).

Rationale of study

Kalij pheasant have been associated with social and religious status of people living in Asia and Europe. Nepal government granted the rearing licence for the Kalij Pheasant. Now a day many hotel and restaurant targeted the flow of customer at many aspect. They are killed for food, feather and entertainment, they can be hunted in some of hunting reserves. There are very few studies and findings are done regarding Kalij Pheasant which are still insufficient about the kalij pheasant. Due to taste and medicinal purpose people are attracted to the consumption of kalij meat. The people are also attracted with morphological character and tradition in flow of rearing of kalij as companion type decorative bird. To protect the native breeds of kalij by enhancing the knowledge of farming and decreasing the hunting pressure.

Statement of problems

Kalij pheasant is most demanded bird by farmers, hotels, restaurants and for decorative use due to its attractiveness, meat quality and taste. Very limited studies have been carried out with respect to overall growth and reproductive

performance of kalij pheasant in Nepal. Besides, performance of kalij pheasant and its different feeding regimes have not been formulated to date which is the utmost need for the commercial farmers. Meat quality and composition is another important trait of kalij with respect to increased profitability of kalij rearing and human health perspectives. Thus, the proposed study will cover all these dynamics including kalij pheasant production, productivity, feeding management and meat quality issues.

Objective

General objective:

Develop nutritional plan and ways to improve productive performance of Kalij pheasant to help promote this species for commercial meat production purpose by also aiming to protect biological diversity and genetic improvement.

Specific objectives:

- 1) To characterize major morphological traits of male and female kalij pheasant in order to establish base population of having diverse group so as to work on nutritional aspects to improve growth performance
- 2) To determine genetic variation of different groups of kalij pheasant and to establish genetic variation with the purpose of maintaining diverse group of kalij pheasants as a potential source of quality meat production through appropriate nutritional management.
- 3) To determine hematological parameters and carcass quality of kalij pheasant with diverse genetic groups raised under different nutritional and feeding management regimes

Literature review

Nutritional habitat

They prefer a diet consisting of wastegrain, weed, seeds, fruits, leaves and insects. In the native range, they feed on plant matter such as fruits, seeds, leaves, buds and a small amount of animal matter such as insects. Where the species is introduced it is an opportunistic omnivore, feeding on a diverse range of food, but preferring energy-rich items such as cultivated grains, mast and fruits. Crops eaten include maize (*Zea mays*), wheat (*Triticum*), barely (*Hordeum vulgare*) and flax (*Linum*). In North America, weed seeds eaten include foxtail (*Setaria*), ragweed (*Ambrosia*) and sunflower (*Helianthus annuus*). Fruits eaten include wild grape (*vitis*), apples (*Malus*), and blackberries (*Rubus*). The birds also eat grasshoppers (*Orthoptera*), caterpillars (*Lepidoptera*), crickets (*Gryllidae*) and snails (*Gastropoda*) (Switzer *et al.*, 2011).

Up to the 8th week the birds kept in the rearing house under controlled environmental conditions, and starting from the 9th week to the end of rearing in partially roofed aviaries. Up to the 8th week of rearing only the pheasants were fed with all-mash pelleted mixture starter, where 1 kg of feed contained 27.32% of protein and 2 800 kcal ME. From the 9th to the 16th week the birds were given the grower mixture, containing 24.21% of protein and 2 765 kcal ME, while starting from the 17th week to the end of rearing the finisher mixture, containing 18.06% of protein and 2 750 kcal ME should be feeded controlled environmental conditions (Smulikowska And Rutkowski 2005).

Genetic information

They have a diploid number of 81 and 82 for females and males, respectively, with the sex chromosomes always unpaired in females. The complete mitochondrial genome is

1662 bp long and is composed of 13 typical protein coding genes, 22 tRNA genes, 2 rRNA genes.

Reproductive biology

They have a polygamous mating system, where males have a harem of females and take no part in rearing the chicks. Males actively defend a territory and crow in an attempt to attract females to mate with. Females choose to mate with males with intermediate similarity of histocompatibility complex and with long tails and ear tufts.

The females are not territorial, construct a nest on the ground, and lay 6-14 eggs, laying one egg a day. Larger clutches occur when more than one female lays her eggs in the same nest. The nest is a shallow depression in the ground, often lined with plant material (BirdLife International, 2015). Hatching can take 23-28 days and fledging takes 7-12 days, with the time to complete independence being 70-80 days. The young are precocial and are able to run around and eat soon after hatching. Sexual maturity occurs at 1 year old (Switzer, 2011).

The breeding season can be highly variable in both native and introduced ranges. Breeding occurs once a year and the

season extends from March to June. In the native range in Azerbaijan, egg-laying occurs in April and May (BirdLife International, 2015).

They generally live for 11-18 years in captivity, and approximately 3 years in the wild. Males may have an annual survival rate of 7%, compared with 21-46% for females.

The highest growth rate of the body weight and measurements in pheasants up to the 8th week of rearing, however the body weight growth expressed as a percentage was highest up to the 3rd week of life and accounted for 147%, from the 3rd to the 8th week of life – 119%, and at successive evaluation dates it was clearly decreasing (Joanna Kuźniacka and Marek Adamski 2010).

Materials and methods

Site selection

District profile

Surkhet district is the province capital of Karnali Province. Surkhet is one of the ten districts of Karnali located about 600 km west of the national capital Kathmandu. The district's area is 2488.64 square km which is longest in Nepal.



Fig 1: Map of Nepal showing Surkhet district

Geographical location

Geographic location of Surkhet is: latitude from 28°20' N to 28°58' N and longitude from 80°59' E to 82°02' E. Altitude ranges from 198 meter to 2347 meter from mean sea level.

Climate

Surkhet also has a diverse climate because of huge altitude variation, from 198meter to 2347meter. Therefore, hot and dry sub tropic to cool temperate climates are found in the district. Average temperature ranges from 37.1°C maximum to 4.5°C minimum. The average rainfall of the district is 1603mm but bulk of the rain (1312mm) falls in the monsoon

leaving other months relatively dry. Surkhet ranks low in overall climate change vulnerability. About 43% of the land belongs to Mahabharata range where soil erosion is prevalent. About 42% falls in plain valley where the soil is fertile. The remaining land fall in Siwalik range which is rich in forest resources.

Population

According to the Central Bureau of Statistics (CBS), 2011 the total population of Surkhet is 350, 804 of which male comprised 169, 421 and female comprised 181, 381. Total households are 72, 863. The major inhabitants in Surkhet are

Chhetri, Janajati, Dalit, Bramhan and Thakuri. Chhetri forms about 32% of the population followed by Dalits about 25% and 20%. The remaining are Tharu, Badi, Newar, Muslim and others.

Land area

Surkhet is 2, 451 square Kilometer in area.

Natural resources

Surkhet is rich in natural resources. Large area is covered by forest (71.4%) and agriculture plus settlement (26.4%). Bheri and Karnali are the major river of the district. Besides, many other rivers are flowing through the Surkhet. The district has 177,854 hectares of forest land which is 71% of the total area. it is very rich in forest resources. (CBS, 2011).

Infrastructure

Surkhet district is the province capital of Karnali Province. It has an airport and is well connected to road network. Of the total cultivated land (37,444 ha) only about one third of the cultivated land (11, 141 ha) has round the year irrigation facility. Being a regional headquarter Surkhet hosts regional offices of ministries/ departments of government of Nepal. It also has a Mid-West University in the Birendranagar (CBS, 2011).

Population and sample

Feeding regimes trial

The base population is not confirmed, after confirmation the base population will be feed the balanced diet according to their age and sex. The diet contain up to the 8th week of rearing only the pheasants were fed with all-mash pelleted mixture starter, where 1 kg of feed contained 27.32% of protein and 2 800 kcal ME. From the 9th to the 16th week the birds were given the grower mixture, containing 24.21% of protein and 2 765 kcal ME, while starting from the 17th week to the end of rearing the finisher mixture, containing 18.06% of protein and 2 750 kcal ME formulated feed will be given. Detail of the plan of nutrition and treatments arrangement for series of experiments will be prepared later based on performance of the base population in terms of maintaining genetic diversity and morphological characteristics.

Carcass quality and composition assessment

The carcass quality of 1.5 years around 1.3-1.5 kg for the content of water, protein nitrogen, fats, ashes, and the most valuable protein is tryptophan in kalij and incomplete proteins (hydroxyprolin) can be examined.

Previous studies reveled that the pectoral muscles had a higher nutritive value against those of the thigh muscles. These all will be done based on series of experiments for nutritional plan studies

Carcass quality and composition analysis

Carcass trait analysis will be done by the measurements of live body weight and carcass weight. Carcasses will be separated into different parts according to standard carcass discerned method.

Dressing percentage

Dressing percentage will be calculated by dividing the warm carcass weight by the shrunk live weight of the goat and expressing the result as a percentage.

Carcass compositions

The content of water, protein nitrogen, fats, ashes, and the most valuable protein in kalij tryptophan and incomplete proteins (hydroxyprolin) can be examined.

Tenderness

Previous studies revealed that the pectoral muscles had a higher nutritive value against those of the thigh muscles.

Expected Outcome

- Scientific information about the rearing potential of Kalij peasants in relation to adaptation, health, feed intake, growth and related parameters will be generated
- Potential of Kalij peasants for commercial farming aiming to quality meat production will be determined
- Scientific information about major hematological parameters and carcass quality of kalij peasants reared under sound nutritional management will be explored.
- Economics of the kalij peasants for different scale of commercial growing will be determined

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