

Phenotypic Analysis of Qualitative Traits in Local Ducks of Kediri Regency, East Java

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Abstract. *This study aimed to identify the qualitative characteristics of local ducks in Kediri Regency, East Java, as a foundational basis for breeding and genetic improvement programs. A total of 250 female local ducks were observed across five subdistricts using purposive sampling. Data were collected through direct observation of feather color patterns and beak color and were analyzed descriptively. The results showed that all observed ducks had black beaks (100%) and brown head feathers (100%). Additional dominant characteristics included white feathers above the eyes (96%), brown wing feathers (98%), brown back feathers (100%), brown tail feathers (98%), and brown thigh feathers (100%). These findings indicate that Kediri local ducks are predominantly characterized by brown plumage with distinctive white stripes above the eyes and solid black beaks. The observed variations in feather and beak color are influenced by genetic factors, particularly melanin and lipochrome pigments. This study provides essential baseline data to support selective breeding strategies, genetic conservation, and the sustainable development of local duck resources, thereby contributing to regional livestock improvement programs.*

Keywords: *Beak color, Breeding, Feather color, Genetics, Local ducks, Phenotypic characterization*

INTRODUCTION

The livestock sector is one of Indonesia's leading potential industries, including duck farming. Indonesian local ducks are known as Indian Runner ducks, which are productive as laying ducks. Although they belong to the same family, several local ducks scattered throughout the archipelago have names according to their respective regions or locations. Well-known local duck breeds include the Tegal duck, Bali duck, Mojosari duck, Magelang duck (Solihat et al. 2003), and Alabio duck (Suryana 2007; Dinas Peternakan Kabupaten Hulu Sungai Utara 2000). According to data from the East Java Provincial Statistics Agency (2023), the duck population in Kediri Regency in 2022 reached 367,987, an increase of 1% compared to the previous year. Ducks are known as dual-purpose poultry because they can be used to produce meat and eggs. These animals are aquatic or fond of water, with physical characteristics such as thick oil-containing feathers all over their bodies, short webbed feet, and the ability to lay eggs longer than other poultry (Suharno and Amri, 2010). In addition, ducks have a low mortality rate due to their strong immune system (Fatmona et al., 2023). These advantages make ducks one of the most sought-after and cultivated livestock by farmers in Indonesia.

Ducks are divided into three main types, namely laying ducks, meat ducks, and ornamental ducks, with uses tailored to their respective characteristics. In Kediri Regency, the local duck population still dominates and shows quite diverse characteristics. Duck characteristics are an important factor in the breeding process, as they serve to identify superior traits that have economic value, such as body size and other distinctive features. Qualitative traits in ducks can be observed directly without measurement, for example through feather color and beak color, which can also reflect their origin (Liu and Churchil, 2022). These traits serve as markers and references in grouping duck characteristics. However, to date, characterization and identification activities for local ducks in Kediri Regency have never been carried out, so basic data on qualitative traits is still very limited. Therefore, this study was conducted to examine the characteristics of local ducks in Kediri Regency based on their qualitative traits, as a first step in supporting future breeding programs.

Previous studies in Indonesia have emphasized the importance of phenotypic characterization for local duck development. Research on Magelang ducks demonstrated relatively uniform quantitative traits, including body weight (1.54 ± 0.14 kg), body length

(58.89 ± 2.05 cm), neck length (15.28 ± 1.45 cm), and chest circumference (33.57 ± 1.23 cm), which were associated with similar management practices among farmers (Rahayu et al., 2022). In addition, Magelang ducks exhibit distinctive qualitative characteristics such as a white necklace-like feather pattern, dominant brown plumage, black beak and legs, and active behavior, reflecting long-term adaptation and selection processes (Rahayu et al., 2022).

Similarly, a study conducted in Ternate City reported that qualitative traits in laying ducks were relatively uniform, with most individuals displaying brown plumage, predominantly black or brown beak and shank coloration, and limited color variation (Fatmona et al., 2023). These findings indicate that qualitative phenotypic traits can serve as practical indicators for selection and breed identification in local production systems. However, variations in phenotypic patterns among regions may occur due to differences in environmental conditions, management systems, and historical selection pressures.

At the molecular level, genetic studies using microsatellite markers revealed substantial genetic diversity among Indonesian local duck populations, although positive inbreeding coefficients (FIS) were observed in several populations (Maharani et al., 2017). This highlights the importance of structured breeding programs to prevent inbreeding depression and maintain genetic variability. Furthermore, integrating molecular genetic analysis with phenotypic characterization has been recommended as a comprehensive approach to conservation and sustainable breeding strategies. However, despite phenotypic and genetic studies conducted in regions such as Magelang and Ternate, systematic documentation of qualitative phenotypic characteristics of local ducks in Kediri Regency remains unavailable. Variations in phenotypic expression may occur across regions due to environmental adaptation, management systems, and local selection history. The absence of baseline data in Kediri limits the development of region-specific breeding and conservation programs. Therefore, this study aims to identify and document the qualitative traits of local ducks in Kediri Regency as fundamental information to support selective breeding, genetic conservation, and sustainable development of local duck genetic resources

LITERATURE REVIEW

Research on local duck characteristics in Indonesia has become increasingly important in recent years due to their genetic diversity and contribution to local food

security. Ducks (*Anas platyrhynchos domesticus*) are among Indonesia's major poultry species, providing both meat and eggs for human consumption. According to Maharani *et al.* (2019), the phenotypic diversity in Indonesian local ducks reflects their adaptation to specific ecological zones and traditional breeding systems, making them an important genetic resource for future improvement programs.

Feather and beak color are qualitative traits influenced primarily by genetic and pigment-related factors. The pigmentation process in ducks involves melanin (black/brown color) and lipochrome (yellow/orange color) pigments (Sulaiman and Rahmatullah, 2018). These traits are typically controlled by a few major genes and are inherited from parent stock. Noor (2008) emphasizes that qualitative traits, unlike quantitative ones, are not influenced by environmental variation and can thus serve as reliable markers for breed identification. Beyond the basic role of melanin and lipochrome pigments, recent molecular studies have demonstrated that plumage coloration in poultry is associated with specific genes regulating melanin synthesis pathways, such as the MC1R and ASIP genes (Glyakina *et al.*, 2011; Kerje *et al.*, 2003). Variations in these genes may lead to differences in eumelanin and pheomelanin expression, ultimately influencing brown or black coloration patterns. Compared with these molecular findings, the present study focuses on phenotypic observation; however, the dominance of brown plumage and black beaks in Kediri local ducks suggests a stable expression of melanin-related genes within this population.

Genetic improvement programs often rely on the identification of distinct phenotypic markers. Fatmona *et al.* (2023) highlighted that qualitative characteristics can serve as the foundation for breeding programs aimed at improving productivity and maintaining genetic purity. Qualitative traits in local ducks help preserve biodiversity and support the development of region-specific breeding strategies. In summary, previous research highlights that qualitative characteristics particularly feather and beak color are vital for identifying, preserving, and improving local duck populations. These traits not only reveal genetic diversity but also guide future breeding efforts aimed at enhancing productivity while maintaining the unique genetic heritage of Indonesian ducks.

RESEARCH METHODS

This research was conducted in five subdistricts in Kediri Regency, namely Mojo Subdistrict, Ringinrejo Subdistrict, Wates Subdistrict, Ngasem Subdistrict, and Campurejo Subdistrict, from September 1 to September 30, 2024. The study locations were selected purposively based on official livestock data indicating a high population of local ducks in these areas. Furthermore, these subdistricts have significant potential for the future development of local duck farming systems, making them representative sites for phenotypic characterization studies.

Materials

This study used 250 local ducks, with each subdistrict consisting of 50 female local ducks from five subdistricts in Kediri Regency, namely Mojo Subdistrict, Ringinrejo Subdistrict, Wates Subdistrict, Ngasem Subdistrict, and Gampengrejo Subdistrict. The primary tool used for data collection was a digital camera to document qualitative phenotypic characteristics. Field recording sheets were also used to ensure systematic documentation of observations.

Sampling Technique

Sampling was conducted using a purposive sampling method. Farmers were selected based on the following criteria:

1. Actively raising local ducks.
2. Having a minimum flock size that allowed random observation of individuals.
3. Willingness to participate in the study.

This technique was considered appropriate because the selected subdistricts represent areas with one of the largest populations of local ducks in East Java Province, thereby ensuring the availability of sufficient and relevant samples for phenotypic characterization.

Observation Procedure and Standardization

Observations focused on qualitative phenotypic traits, particularly feather color characteristics.

To ensure consistency and minimize observational bias:

- Observations were conducted under natural daylight conditions at similar times of day.
- All ducks were observed within a comparable age range to reduce age-related phenotypic variation.
- A standardized observation guide was used to classify color traits.
- The same trained observer conducted all observations to maintain consistency.

Prior to data collection, observer calibration was performed through repeated assessments of sample individuals to ensure uniform interpretation of phenotypic categories.

Ethical Considerations

This study involved non-invasive observational procedures only. No experimental treatments or physical interventions were applied to the animals. Observations were conducted following basic animal welfare principles to minimize stress. Farmers provided informed consent prior to participation, and all procedures complied with standard ethical guidelines for animal-based observational research.

Methods

Sampling was conducted using purposive sampling, namely farmers who raise local ducks in Mojo District, Ringinrejo District, Wates District, Ngasem District, and Campurejo District, Kediri Regency, East Java. The qualitative characteristics of local ducks were analyzed using descriptive statistical analysis by calculating the percentage based on Noor's (2008) formula as follows:

$$P = \frac{Xi}{N} \times 100\%$$

Description:

P	=	Percentage of phenotype
Xi	=	Number of animals with a specific color
N	=	Total number of animals observed

RESULTS AND DISCUSSION

Local ducks are breeds of ducks that are raised in their region of origin and are usually named after that region. Some examples of local ducks in Indonesia include Magelang ducks, Mojosari ducks, and Tegal ducks. Ducks are classified as dual-purpose livestock because they can be used to produce both meat and eggs. The types of local ducks that are still bred by farmers in Kediri Regency can be seen in Figure 1.



Figure 1. Local ducks in Kediri Regency

Figure 1. Shows that local ducks in Kediri Regency have qualitative characteristics that can be directly observed, namely feather and beak color. A total of 250 local ducks were observed in 5 subdistricts of Kediri Regency. Figure 1 visually demonstrates the phenotypic uniformity of local ducks across the five subdistricts. The minimal variation in feather and beak coloration observed in the images supports the quantitative findings and indicates a relatively homogeneous population structure. This visual consistency strengthens the assumption that these ducks share a similar genetic background. However, further molecular characterization would be necessary to confirm the degree of genetic similarity among individuals. The beak color was solid black (100%) and the head feather color was brown (100%), white feather color above the eyes (96.00%), brown wing feather color (98.00%), brown back feather color (100%), brown tail feather color (98.00%), and brown thigh feather color (100%). Based on these results, it can be concluded that local ducks in Kediri Regency generally have predominantly brown feathers, accompanied by distinctive features such as white stripes above the eyes and jetblack beaks. The color of the feathers and beaks are distinctive markers that can be used to identify the origin of local ducks from a particular area. Local ducks that are widely distributed in Indonesia, including in Kediri Regency, are the result of

crossbreeding between Mojosari ducks and Alabio ducks. This crossbreeding produces offspring known as MA ducks, which have distinctive characteristics such as predominantly brown feather color, a white ring around the neck, and a white line around the eyes (Suryana, 2013).

The main factor determining the color of the beak and feathers in local ducks is genetics, as these characteristics are inherited from parents to their offspring. According to Sulaiman and Rahmatullah (2018), feather color in livestock is influenced by the presence of pigments, feather structure, or a combination of both. Beak color is associated with skin pigments such as lipochrome, while black beaks are generally caused by melanin pigments. These color patterns are commonly found in ducks raised under smallholder open housing systems. Qualitative traits such as feather and beak color are not influenced by quantitative (morphometric) traits and show distinct phenotypic distribution patterns. Fatmona et al. (2023) state that qualitative traits are typically controlled by one gene or several gene pairs, resulting in clearly distinguishable phenotypes among individuals. Qualitative traits are primarily genetically controlled and generally unaffected by environmental conditions. The high uniformity observed in this study may indicate a limited genetic base within the population. Groeneveld et al. (2010) noted that reduced genetic diversity in livestock populations can increase susceptibility to disease and limit long-term adaptability. Black beaks have attracted attention as a distinctive trait associated with high-quality duck products (Pan et al., 2024). The genetic mechanisms underlying beak pigmentation remain unclear because pigment expression can also be influenced by factors such as nutrition and age.

Qualitative traits are governed by gene interactions distributed across several chromosomes, involving both additive and non-additive gene effects. Their expression is generally stable and not strongly affected by environmental factors. Phenotypic plasticity may evolve when individuals are exposed to varying abiotic and biotic conditions throughout their lifetime (Anderson et al., 2014). The dominance of brown plumage in Kediri local ducks may provide added value in local markets from a socio-economic perspective. Phenotypic characteristics often shape consumer perception and product differentiation in traditional poultry systems (Padhi, 2016). The distinctive appearance of Kediri local ducks can serve as a regional identity marker to support branding strategies and geographical product labeling. Such efforts may enhance farmers' competitiveness,

strengthen market recognition, and contribute to rural income development while maintaining desirable phenotypic traits and genetic variability through controlled breeding and proper recording systems.

CONCLUSION

Local ducks in Kediri Regency are predominantly characterized by brown plumage and black beaks, traits strongly influenced by genetic factors and pigments such as melanin and lipochrome. The high phenotypic uniformity observed suggests a relatively consistent genetic background within the population. However, this study was limited to qualitative phenotypic observations and did not include molecular genetic analysis or productivity evaluation. Future research should incorporate molecular markers and assess production traits to provide a more comprehensive basis for breeding, conservation, and sustainable development programs.

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