



Research Article

Breeding Biology and Egg Parameters of Red-Wattled Lapwing (*Vanellus indicus*) in Agri-Fields of Gomal Landscape, District Tank, Khyber Pakhtunkhwa, Pakistan

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Abstract | The study investigated various features of the breeding-Biology of Red-Wattled Lapwing (*Vanellus indicus*) and characteristics of its eggs in agricultural fields of Gomal, district Tank. The male bird chose a location for the nesting season and the both birds (male, female) assisted in building the nest. The nests were a spherical hole surrounded by rocks or solid clay fragments. The following eggs parameters were recorded: egg width (30.18 mm), egg length (40.00 mm), egg volume (16.64 ml), egg weight (20.29 gm), egg specific gravity (1.21g/cm³), and egg shape index (75.43). Both parents shared the 27-day incubation period, resulting in a hatching success rate of 75.00%. The parents diligently protected their offspring until they were capable flyers, which typically occurred within 22-25 days post-hatching. The entire breeding cycle was completed within 65-78 days.

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Introduction

Vanellus indicus is a member of the Charadriiformes order, specifically the Charadriidae family. It is commonly known as the red-wattled lapwing and is typically found in open fields on the outskirts of

villages and towns, particularly near wetlands, often in pairs or small groups. This species is distributed across the Middle East and South Asia, including countries such as Iraq, Iran, Pakistan, Bangladesh, India, Nepal and Afghanistan (Birdlife International, 2009; Ali and Ripley, 2001). The Red-Wattled

Lapwing is classified as least-concern in terms of conservation status globally (IUCN, 2018), being widespread and abundant throughout the Indian subcontinent. These large waders have a brownish back with a purplish sheen, while their chest, head, neck, and back are black, with an average length of about 35.00 cm. A distinctive white band runs from the tail, under the belly and to the crown sides. They also have red beak, long yellow legs, with the dark grey tip, and a Red-Wattled in front of each eye. They have noticeable white wing bars made of white secondary coverts when they are in flight. Male and female red-wattled lapwings can be distinguished, with males having longer wings and longer spurs on their carpal joints. Their diet primarily consists of ants, beetles, caterpillars, and plant matter (Grimmett *et al.*, 2008).

Nest building is the crucial feature of bird biology and plays the significant role in parent-offspring relationships. Nesting behavior also contributes to maintaining genetic diversity and ecological balance (Saxena and Saxena, 2013). In their natural habitat, red-wattled lapwings typically construct ground scrapes or shallow depressions, sometimes lined with pebbles or animal feces (Sharma, 1992). However, there are reports of them nesting in urban areas as well (Muralidhar and Barve, 2012). Red-wattled lapwings are monogamous birds that exhibit specific mating behaviors within their breeding territories. Males select the mating site, where females lay eggs in a shallow depression and these eggs are 3-4 in number and are laid in open areas, often fenced by small pebbles or chunks of soil (Saxena and Saxena, 2013). The courting behaviors are observed from April to June. Both parents participate in the 27-30 day incubation period, after which precocial chicks emerge from the nest and begin foraging for food, under the watchful eyes of their parents (Saxena and Saxena, 2013; Muralidhar and Barve, 2013). The nesting area is protected by both parents, ensuring the safety of the young until they are fully feathered (around 3 to 5 weeks old) and capable flyers.

Various factors pose threats to red-wattled lapwing nests and offspring, including predators such as house-crow (*Corvus splendens*), Black-kite (*Milvus migrans*), dogs and cats as well as human activities such as habitat destruction and accidental trampling by livestock (Khalil *et al.*, 2018; Fletcher *et al.*, 2005). This study's primary-aim to note the red-wattled lapwing's breeding biology, particularly on rural-agricultural

land, to measure breeding parameters during the study period. To explore nesting site selection, nest construction, and the factors influencing nest-site fidelity. To Track egg development, hatching rates, and chick growth, survival, and fledging success.

Materials and Methods

The breeding-biology of *Vanellus indicus* was considered in the agricultural-fields of Gomal landscape, district Tank, from April to June 2023. During this period, the four pairs of Red-wattled Lapwings were observed, indicating breeding activity. The nesting materials used and the location of the nest were identified through visual observation without disturbing the birds. Throughout the study, careful observations were made, and Records were kept on the quantity of eggs laid, size of the clutch, length of incubation, and number of hatchlings. Nests were checked on a daily basis, in early morning hours. Documentations were also done on the quantity of eggs cracked and the success rate of hatching. An LCD digital vernier caliper was used to measure the width and length of the eggs, a digital weighing instrument was used to weigh them. To determine egg properties such specific gravity, shape index, and volume, two eggs were taken out of nests. Galbraith (1988) provided an empirical formula that was used to compute the egg volume using the parameters of breadth (B) and length (L).

$$\text{Eggs Volume} = (0.458) \times (L) \times (B^2) \times 10^{-3} \text{ml}$$

The eggs shape-index were determined by a micro-meter as described by (Anderson *et al.*, 2004), with eggs categorized built on shape-index into sharp-egg, normal-egg (standard) or round-egg, followed by Sarica and Erensayin (2009).

$$\text{Eggs Shape Index} = \frac{\text{Eggs breadth (mm)}}{\text{Eggs length (mm)}} \times 100$$

The shape index (SI) was used to classify the eggs into the following categories:

Sharp-egg: SI < 72 Normal (standard) egg: SI = 72–76 Round egg: SI > 76. This classification was adapted from Sarica and Erensayin (2009).

Measurements of egg specific gravity were conducted using the protocol described by Khalil *et al.* (2018).

$$\text{Eggs Specific gravity} = \left(\frac{\text{gm}}{\text{Cm}^3} \right) - \frac{\text{Egg weight (gm)}}{\text{Egg volume (cm}^3\text{)}}$$

Traditionally, the proportion of eggs that successfully hatched out of all the eggs deposited was used to compute the hatching success rate. Throughout the incubation stage, their feeding habits and parental care were recorded, as well as how they reacted to humans and possible predators. Images were captured using a Canon DSLR digital camera for documentation purposes.

Results and Discussions

Breeding biology of red wattle lapwing

Bird sightings occurred in pairs between April 6th and 10th, 2023, within agricultural fields. The male initiated courtship behavior by approaching the female with extended neck, upward-pointing beak, fanned tail, and puffy feathers, accompanied by billowing flights and songs. Similar mating behaviors were observed by Singh (2004), who noted male displays of song and flight. The male led the female to the chosen territory with calls, whereupon the male welcomed her with skyward wheeling. Territory defense was maintained by both parents, with intruders being met with alarm calls and physical aggression and assault.

Nests construction began on April 20th, 2023, with both birds participating. Building took place primarily in the morning and evening, consistent with the behavior observed by Collias (1997). The pair collected nesting materials such as pebbles and sticks from the surroundings, as described by Balkhande and Shaikh (2017). The nest was carefully constructed to blend with the ground texture and color, making it difficult to detect. The dimensions of the nest were measured at 3.40 cm depth and 24.50 cm width.

The clutch size consisted of four eggs, laid every other day from May 3rd to May 7th, 2023, as observed by Kumar and Sharma (2011) and Muralidhar and Barve (2013). The arrangement of the eggs facilitated incubation by ensuring they met in the center. The eggs exhibited a characteristic olive-green color with black markings or spots.

Incubation lasted approximately 28 days, differing from previous reports ranging from 24 to 31 days (Saxena and Saxena, 2013; Balkhande and Shaikh,

2017; Muralidhar and Barve, 2013). Three eggs successfully hatched on May 29th, 2023, with intervals of 2.50-3 hours between each hatching, unlike the longer intervals reported by Saxena and Saxena (2013). One egg remained unhatched and was abandoned by the parents. The hatching success rate was calculated at 75%.

After hatching, both parents assumed caregiving responsibilities, remaining vigilant and constantly vocal. They were active around the clock, likely to deter probable predators. The hatchlings had feathers with prominent markings that were a grayish-brown color. They left the nest shortly after drying and were capable of moving easily, aided by their brown coloration blending with the surroundings. The hatchlings exhibited wide white collars, black pectoral bands, and white-tinged chins and underparts, while their bellies and flanks displayed a light brownish coloration... Maternal brooding continued for several days, with nighttime brooding ceasing after approximately 15 days. The hatchlings were capable of flight by 22-25 days post-hatching (Table 1, Figure 1).

Table 1: *Breeding biology of Red-wattled lapwing (Vanellus indicus).*

Breeding-activities	Observations
Selection of site	08-10 days
Nidification	06-08 days
Laying of eggs	5 days
Color of eggs	Olive green with black spots
Size of clutch per pair	04
Eggs hatched	03
Incubation period	23 to 27 days
Hatching	01-day
Fledging	22-25 days
Hatching success of eggs	75%
Overall breeding activities	65-78 days

Eggs parameters of red wattle lapwing

The observed egg measurements were consistent with those reported by Kaur and Khera (2017), with lengths of 40.00 mm, widths of 30.18 mm, and weights of 20.29 gm. The results showed that the egg's specific gravity, shape index, and volume were 1.21 g/cm³, 75.43, and 16.64 ml, respectively. Based on the shape index value of 75.43, the red-wattled lapwing eggs were categorized as normal or standard eggs, falling within the range of 72-76.

Table 2: Red-wattled lapwing (*Vanellus indicus*) nest and egg parameters.

Nest and eggs parameters	Observations
Nest depth	03.40cm
Nest width	24.50cm
Eggs Length	40.00 mm
Eggs Width	30.18 mm
Volume of eggs	016.64 ml
Weight of eggs	20.29 gm
Specific gravity	01.21gm/cm3
Shape index	75.43

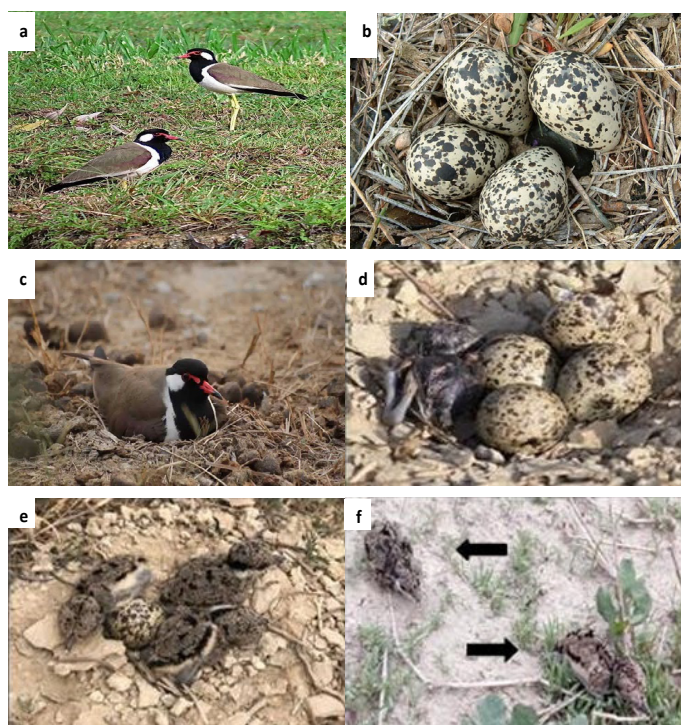


Figure 1: (a) Spyling of Red-wattled lapwing couple, (b) Eggs of lapwing, (c) Incubation period of bird, (d) Initiation of hatching, (e) Hatchlings, (f) Nidifugous behavior of hatchlings.

Both of the partners (male and female) contributed in egg incubation, with female primarily undertaking the task for the majority of the day. The male occasionally assisted the female, particularly during hot afternoons under the scorching sun (Table 2).

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Novelty Statement

This study presents the first comprehensive account of the breeding biology and egg parameters of the Red-Wattled Lapwing (*Vanellus indicus*) in the agricultural landscapes of the Gomal region, District Tank, Khyber Pakhtunkhwa, Pakistan. Unlike previous research largely focused on protected or undisturbed habitats, this work explores the species' reproductive ecology within actively cultivated fields, revealing critical insights into nesting behavior, clutch size, egg morphology, and habitat preferences under anthropogenic pressure. The findings contribute valuable baseline data for avian ecology in southern Khyber Pakhtunkhwa and offer implications for species conservation in agro-ecosystems affected by increasing land-use changes.

Author's Contribution

Shahid Amin: Investigation, supervision, writing review and editing.

Aziz Ur Rehman, Ashfaq, Inayath Ullah: Visualization.

Umer Farooq and Hazrat Ali: Validation.

Muhammad Fawad Fareed: Investigation.

Danial Bakhsh Saigra: Methodology

Conflict of interest

The authors have declared no conflict of interest.

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