

Full Length Research Paper

Breeding biology of red wattled lapwing (*Vanellus Indicus*) from Southern Punjab, Pakistan

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This study documented some aspects of breeding biology of Red Wattled Lapwing (*Vanellus indicus*) such as breeding season, nest structure, clutch size, incubation period, hatching and fledgling success in Bahawalpur District. We selected 6 sites for the observation; barren, open, cultivated, grassy, area along road sides, and constructed areas with the common vegetation of *Cynodon dactylon*, *Ziziphus mauritiana*, *Albizia procera*, *Cinrus ciliarus*, *Cinrus biflorus*, *Arva jawanica*, *Eucalyptus cameldulensis*, *Acacia nilotica*, *Prosopis juliflora* and *Conocarpus spp.* During the breeding season, the male selects territory. Breeding season starts from April to June. Both male and female participate in nest formation, incubation and other parental duties. Clutch size was mostly 4 and the mean of the clutch size was 4 ± 0.0 (range 0-4). The incubation period of the eggs was 25-28 days and the average of the incubation period was 27.1 ± 0.4 . Total eggs were 24 in 6 nests, out of which 22 were hatched. The percentage of hatched eggs was 91% and the mean hatching rate was 91.6 ± 5.2 per clutch. Fledgling success was 79.1 ± 7.6 and the percentage of the fledgling was 79%. Predation rate in red wattled lapwing was also observed; it was very high due to anthropogenic activities.

Key words: Red wattled lapwing, breeding biology, *Vanellus indicus*, Southern Punjab.

INTRODUCTION

Birds estimate the biodiversity values of a region (Prendergast et al., 1993). Birds are assumed to be an excellent indicator of an ecosystem (Gregory et al., 2004). *Vanellus indicus* (Red Wattled Lapwing-RWL) belongs to the family Charadriidae of the order Charadriiformes. This species occurs geographically and

generally from Iran, Iraq, the Arabian/Persian Gulf to all South Asia including India, Pakistan, Afghanistan, Nepal and Bangladesh (Ali and Ripley, 2001; Birdlife International, 2009). RWL, in Pakistan is mostly present in all irrigated fields and area near wetland in all five provinces (Roberts, 1991; Mirza, 2007; Ghalib et al.,

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2009). Globally, conservation status of RWL is least concern (IUCN, 2018).

Both genders of RWL are indistinguishable; however, in males a more noticeable crest, facial wattles or spot wing spurs are present (Piersma and Wiersma, 1996). The chest, head and front part of neck are black. A red beefy wattle before each eye is also present. The beak is also red with dark black tip and the legs are long and yellow (Mirza, 2007; Grimmett et al., 2008).

The RWL prefers open fields close to wetlands, and mostly forages in freshly irrigated crop lands. It usually feeds on beetles, ants, caterpillars and vegetable residues (Grimmett et al., 2008; Ali and Ripley, 2001). RWL is also found in agricultural lands, for example, maize fields, plowed areas, gardens, and occasionally on grassy highway; it can be found in marshes, as high as 1800 m (Piersma and Wiersma, 1996).

RWL is monogamous bird and especially breeds in selected areas. During breeding season, mating site is carefully chosen by male. The female lapwing lays eggs in a little depression in open areas or ground and encompassed by pebbles or bits of hard earth normally bordered with goat or dairy cattle stools (Saxena and Saxena, 2013). The courtship behavior is displayed from mid-March to June. Firstly, male gives signs of courtship. The female responds through delivering breeding calls. Hatching is finished by both of the two guardians. Four eggs are laid by female. Nidifugous chicks, capable of leaving the nest, develop in 28 to 30 days, almost immediately after hatching, and are able to follow the parents in search of food. Both guardians secure nesting region, and also ensure that the young have developed full plumage (3 to 5 weeks) and have become strong fliers (Piersma and Wiersma, 1996; Saxena and Saxena, 2013; Muralidhar and Barve, 2013).

The male protects the female in the hot noon from predators by taking the task of incubating the eggs; the female can fly away from the nest. Incubation period takes 28-30 days, and both genders perform incubation obligations (Ali and Ripley, 1998; Desai and Malhotra 1976). Eggs of lapwings are lost because of a variety of predators (e.g. kites, mongooses, dogs and crows), because of human exercises (e.g. furrowing) and also as a result of crushing by grazing animals (Naik et al., 1961). After the first week, chick survival is improved.

Now, the RWL is not globally threatened with a strong world population that involves a variety of specialties and is likewise ready to endure regions which are thickly populated with people (Piersma and Wiersma, 1996). Red-wattled lapwing is a noisy bird and can also be heard at night (Hayman et al., 1986).

In Pakistan, few studies are accessible on understanding of the species-habitat relationship (Bilal et al., 2013; Rais et al., 2011; Rais et al., 2010). Data regarding habitat association and territory of RWL are insufficient in Pakistan. Present study was conducted to study the association of RWL with various territories and

to determine breeding success in their preferred habitat.

MATERIALS AND METHODS

Study area

The study was conducted in Southern part of the district of Bahawalpur between 29.3957° N, and 71.6833° E. The period of the study was the breeding season of RWL from March to June, 2016; which is springtime; this is afterwards followed by hot summers until the onset of monsoons in July.

Methodology

Nest building started at the end of March, 2016. The nest was built during early morning up to noon and then in late afternoon on successive days. Nest building is a joint effort of both the parents with almost equal contribution. Observations were taken with full precautions without disturbing birds in different types of six habitats, as: barren land, open land, cultivated land, constructed areas, stony areas along the road side and grassland. Data were collected on daily basis; begin at the outset of breeding season by direct observation with the naked eye, and also by using binoculars (Bushnell, 7x35 mm), starting in early hours of dawn and ending with dusk. Nests were found by spotting lapwing's pairs while incubating the eggs, or foraging near nest. Photographs were taken through a Sony DSC-HX 10V digital camera. A Garmin eTerex 10 GPS navigator was used to take georeference of lapwing nests. Eggs that were laid by the birds were measured for size and weight with the help of electronic scale (SF-820) with range of 0.1 to 300 g; and a digital LCD vernier caliper was used to measure length and width of individual eggs in the nest, and average volume was calculated (Sethi et al., 2011; Khalil et al., 2016).

Statistical analysis

Data were statistically analyzed using one way ANOVA (Analysis of Variance) as described by Clark (2007).

RESULTS

Clutch size in Lapwing was observed to be four eggs. Eggs were laid on alternate days. Eggs were so arranged by the bird that their small ends meet in the center, making for even sitting and easier incubation by the parent. Parent bird was observed to rearrange the disarranged eggs. Eggs were of plover type, broad at one end and much pointed towards the other. Their colors vary from dusty off white to pale olive green with dark black spots.

Lapwings incubated the eggs by sitting on them. Incubation started with the laying of the first egg. Both the sexes shared the duty of sitting on the eggs. Mostly female did the duty but male assisted her some time. Incubation took 25 to 28 days. Young hatched out one after the other starting on 4 May, 2016, at an interval of 24 h, in the order in which they were laid. Hatching was synchronous. Lapwings kept the nest clean and tidy. Egg shells were removed from the nest providing both sanitation and concealment (Figure 1).



Figure 1. Red Wattled Lapwing with its clutch size and hatched chick in Barren land.

All lapwing nests were found on the ground in the vegetation, which mainly comprised *Cynodon dactylon*, *Ziziphus mauritiana*, *Albizia procera*, *Cinncus ciliaris*, *Cinncus biflorus*, *Arva jwanica*, *Eucalyptus cameldulensis*, *Acacia nilotica*, *Prosopis juliflora* and *Conocarpus spp.* (Table 1).

Shape of the nests varied from round to partially round and deep round in all sites, which we selected. Mean outer diameter of nests was 4.3 ± 0.1 inches (range 3.8-4.6 inches); while inner diameter of the nests was 1.1 ± 0.0 (range 1.1-1.3). However when compared no significant difference between the nest sites was observed. The color of eggs was dusty white to pale olive green with dark black spots; the texture was smooth while shape of eggs was oval. Eggs were different in weight and the mean weight of eggs was 18.7 ± 2.9 . Mean length of eggs in all sites was 12.2 ± 2.3 . While mean width of the eggs was 10.6 ± 1.8 and the mean volume of the eggs was 152.7 ± 40.5 (Table 2).

There was somewhat a difference in the egg laying period of the RWL; and the mean of egg laying period was 8 ± 0.26 (range 7-9 days). There was no difference in the clutch size in all six sites; so the mean clutch size of the eggs was 4.0. The incubation period of the eggs was 25 to 28 days, and the average of incubation period was 27.16 ± 0.48 (range 25 to 28 days).

Total eggs were 24 in 6 nests, out of which 22 were hatched. Two eggs were destroyed due to anthropogenic activities and trampling effect of cattle. The percentage of hatched eggs was 91% with the mean hatching rate of 91.66 ± 5.27 per clutch. In the end, fledging success was 79.1 ± 7.6 and percentage of the fledging was 79% (Table 3, Figure 2). The F-ratio of 12.8 is statistically significant ($p = 0.000068$).

Predation in RWL was also observed; predators included; house crow (*Corvus splendens*) and pariah kite (*Milvus migrans*) and anthropogenic activities. Out of 22 chicks only 19 chicks were fledged. 2 chicks died and 1

Table 1. Location and constitute of nesting material of Red Wattled Lapwing in the study area in the district Bahawalpur, Pakistan.

| Nest number | Habitat type | Elevation (ft) | Coordinates | Nest material | Vegetation around nest location |
|-------------|------------------------|----------------|---------------------------|--|---|
| 1 | Grass land | 391 | N29°22.444 E071°45.585 | Grassy straws Pebbles Small mud stones Leaves of <i>Albezzia procera</i> and <i>Conocorpus</i> | <i>Albezzia procera</i> <i>Cynodon dactylon</i> <i>Cenchrus ciliaris</i> <i>Cenchrus biflorus</i> <i>conocorpus</i> <i>Callotropis procera</i> |
| 2 | Barren land | 411 | N29°22.399 E071°45.311 | Leaves of <i>Eucalyptus cameldulensis</i> and <i>Acacia nilotica</i> Small and large pebbles Mud stones | <i>Eucalyptus cameldulensis</i> <i>Acacia nilotica</i> <i>prosopis julifolra</i> <i>Cenchrus biflorus</i> <i>Cenchrus ciliaris</i> |
| 3 | Cultivated land | 381 | N29°22.978 E071°45.610 | Small pebbles Grassy straws <i>Cenchrus biflorus</i> Small mud stones | <i>cenchrus ciliaris</i> <i>Cenchrus biflorus</i> <i>aerva javanica</i> <i>Conocorpus</i> |
| 4 | Open land | 360 | N27°22.971 E071°45.644 | Smooth soil Small and large pebbles Mud stones Grassy straws | <i>cenchrus ciliaris</i> <i>Cenchrus biflorus</i> <i>aerva javanica</i> <i>Conocorpus</i> |
| 5 | Stoney along road side | 346 | N29°23.039 E071°44.629 | Construction material small and large pebbles stones | <i>cenchrus ciliaris</i> <i>Cenchrus biflorus</i> <i>aerva javanica</i> |
| 6 | Constructed area | 415 | N29°22.399 E071°45.311 | Leaves of <i>Eucalyptus cameldulensis</i> ,small and large mud stones,straws. | <i>Zizyphus mauritiana</i> <i>Cenchrus biflorus</i> , <i>Cenchrus ciliaris</i> . |

was predated by a house crow.

DISCUSSION

Present study expresses that survival and hatching success of RWL in nests were higher on ground. While in a study it was observed that grazing animals damage the ground-nests of RWL (Hart et al., 2002). In two cases, we witnessed a herd of grazing sheep crushing the eggs of ground nesting Red-Wattled Lapwing (Fletcher et al., 2005). Additionally, on various occasions, ground-nesting parents were observed violently attacking grazing animals close to their nests. In ground-nests, damage to eggs by grazing animals was also observed (Beintema and Muskens, 1987; Hart et al., 2002).

As described here, it is well recognized that ground-

nesting birds are susceptible to high rates of destruction of their eggs and young (Massey and Fancher, 1989; Armstrong, 1954; Salek and Smilauer, 2002).

Breeding season of RWL begins from April and lasts until June with the peak season of April. However, in a previous study, it was reported that in Northern India this species breeds March to July (Anil and Sharma, 2011); while another study shows that the peak breeding season began from April and lasts up to the end of June (Sujit et al., 2010). Moreover, the peak breeding season of RWL was also observed as April to June (Sethi et al., 2011).

Clutch size of Lapwings was four in the present study, accumulating during a span of seven to nine days; however, some workers have also reported three to five eggs (Conrad and Robertson, 1993). We observed four eggs in each nest in seven to nine days. While Adithi and Barve (2013) observed that cryptic four eggs were laid in

Table 2. Measurements of nests and eggs of Red Wattled Lapwing in observed habitats of district Bahawalpur, Pakistan.

| Nest number (Habitat type) | Shape of nest | Outer diameter of nest (inches) | Inner diameter of nest (inches) | Shape of eggs | Colour of eggs | Surface texture | Weight of eggs (g) | Length of eggs (mm) | Width of eggs (mm) | Volume of eggs (mm ²) |
|-------------------------------|------------------|---------------------------------------|---------------------------------------|------------------|--|--------------------|----------------------------|---------------------------|-----------------------|---|
| 1 (Grassy land) | Round | 4.5 | 1.1 | Oval | Dusty offwhite with black spots | Smooth | 29.63 | 16.67mm 0.656in | 14.83 mm 0.583 in | 247.2 |
| 2 (Barren land) | Deep round | 4.3 | 1.3 | Oval | Offwhite with black spots | Smooth | 18.86 | 2.08 mm 0.0818 in | 2.78 mm 0.109 in | 5.78 |
| 3 (Cultivated land) | Partial round | 4.5 | 1.1 | Oval | Dusty offwhite with dark black spots | Smooth | 17.04 | 13.20 mm 0.52 in | 12.34 mm 0.485in | 162.8 |
| 4 (Open land) | Partial round | 4.6 | 1.2 | Oval | Dusty offwhite and olive green with black spots | Smooth | 7.31 Chick wt: 13.96 | 18.26 mm 0.718 in | 15.12mm 0.595in | 276.09 |
| 5 (Stoney along road side) | Round | 3.8 | 1.2 | Oval | Dusty offwhite with black spots | Smooth | 21.34 | 12.17 mm 0.47 in | 10.00mm 0.393in | 121.7 |
| 6 (Constructed area) | Round | 4.4 | 1.1 | Oval | Dusty offwhite with pale yellow and olive green in colour | Smooth | 18.41 | 11.34 mm 0.446 in | 9.08mm 0.357in | 102.96 |

Table 3. Breeding pattern of Red Wattled Lapwing in different habitats of district Bahawalpur, Pakistan during the period of 2016.

| Nest number (Habitat type) | Egg laying period (days) | Clutch size | Incubation period (days) | Hatching success (%) | Fledging success (%) |
|-------------------------------|--------------------------|-------------|--------------------------|----------------------|----------------------|
| 1 (Grassy land) | 8 | 4 | 28 | 100 | 75 |
| 2 (Barren land) | 7 | 4 | 27 | 75 | 75 |
| 3 (Cultivated land) | 8 | 4 | 27 | 100 | 100 |
| 4 (Open land) | 9 | 4 | 28 | 100 | 100 |
| 5 (Stoney along road side) | 8 | 4 | 28 | 100 | 75 |
| 6 (Constructed area) | 8 | 4 | 25 | 75 | 50 |

a period of four days.

The incubation period of 25-28 days was observed, while in another study it was reported to last for 28 to 30 days (Ali and Ripley, 1998; Desai

and Malhotra, 1976). The incubation period we observed was as similar to another study in which incubation was 25 days in natural conditions without using hormone treatment (Smith, 1993).

Current observations show that RWL is adapting to urban settings and choosing a nest location to minimize human and livestock interference. Breeding success can be enhanced for this

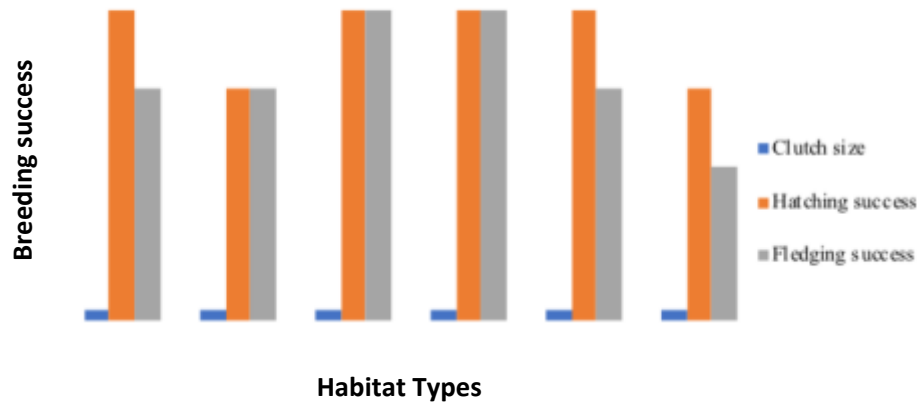


Figure 2. Breeding success (clutch size, hatching and fledging success) of Red Wattled Lapwing in the district Bahawalpur, Pakistan.

precious bird by improving its habitat and by raising awareness at the local level, so that it would ultimately be helpful for conservation of RWL throughout its area of distribution.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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