International Journal of
Life Sciences
International Peer Reviewed Open Access Refereed Journal

Int. J. of Life Sciences, 2024; 12 (4): 537-541
ISSN:2320-7817(p) | 2320-964X(o)

Research Article Open Access

Study of vocal signals and behavioral patterns of Red-wattled lapwing *(Venellus indicus)* in response to different stimuli.

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Manuscript details:

Received: 03.12.2024
Accepted: 27.12.2024
Published: 31.12.2024

Cite this article as:
Sachin S. Debaje and Ramesh P. Chondekar (2024) Study of vocal signals and behavioral patterns of Red-wattled lapwing *(Venellus indicus)* in response to different stimuli., *Int. J. of Life Sciences*, 12 (4): 537-541.

Available online on http://www.ijlsci.in
ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

ABSTRACT

Predation is the key factor on prey on natural selection and the outcome of this prey shows the anti-predatory behavior through its vocal signal. Birds show anti-predatory vocal signals like alarm calls, warning calls and mobbing calls, which are produced by the bird in the presence of a predator. Red-wattled lapwing shows strategies against the predators to save their nest and offspring. The observation was made on various vocal responses of red-wattled lapwing (*Venellus indicus*) like alarm call, aggressive behavior, fleeing behavior, and distraction behavior. The red-wattled lapwing used different vocalizations as defense mechanisms in various threatening conditions. Both males and females take part in parental duties in cryptic situations. Predation rates on lapwing nests were found to be high due to human disturbance. The observations were made on lapwing by sound recording analysis. The present study is focused on the vocal behavior and the defense mechanism of Red-wattled lapwing against the predators in the Aurangabad region. (MS)

Keywords: Red -wattled lapwing, Anti-predatory Behavior, Anti predatory Strategies, Defense Mechanism.

INTRODUCTION

Animals defend themselves from predators and any other disturbance or any threat from the surrounding area mainly birds devised the different anti-predatory strategies like camouflage, acoustic communication, distraction displays, vigilance, communal defense, defensive regurgitation, aggression, and escape behaviors (Gupta et al. 2022). Red-wattled lapwing has red marks around their eyes and a red bill the bird sports black, white, and brown colors with yellow legs. Found throughout the Indian subcontinent, they are also present in southeast central Asia as well as China. Red-wattled lapwing is commonly seen near water bodies and in grasslands. The IUCN red list of threatened species classifies red-wattled lapwing as 'Least Concern'. It is listed under Schedule 4th of the Indian Wildlife Act

1972(Journal of threatened taxa). The red-wattled lapwings are known for their cryptic behavior and active defense mechanisms against predators, which contribute to their success as open nesting species. Lapwings demonstrate sophisticated discriminative abilities in responding to various predators and non-predators, tailoring their reactions based on the perceived level of danger each represents (Walters 1990). Alarm calls in red-wattled lapwing play an important role in anti-predatory response within their groups. These calls are produced based on the presence of a predator and these calls are affected by some factors like the predator type, predator location & distance, and the time of day (James et al.2023; Ferrow et al. 2017).

The anti-predatory behavioral response of the red-wattled lapwing

Alarm calls:
Red-wattled lapwings produce loud and high-pitched calls upon detecting a predator, these calls are part of an arranged series showing similarity in vocalization thereby notifying other lapwing species in the vicinity of the potential danger (Mishra & Kumar 2020).

Context-dependent vocalizations:
The anti-predatory vocalizations of red-wattled lapwings exhibit variability in calls based on specific circumstances, such as distinguishing between threats from airborne predators or terrestrial predators (Lucy et al.2017).

Frequency and amplitude:
The frequency of red-wattled lapwing vocalization occurs at a higher range which helps them to flourish in urban environments where lower frequency is masked by ambient noise (Hu & Cardoso 2009).

Aggression Mobbing behavior:
In birds, aggressive behavior is one of the most common defense strategies for the protection of a nest from predators. (Smith and Wilson 2010). Aggression is linked with reproductive success in birds (Fedy and Stutchbury, 2005).

Escape/ Flight initiation behavior:
Escape /Flight initiation behavior is most used by the prey as an anti-predatory response toward the predator. This defense mechanism is considered to as the last line of defense (Cooper and Blumstein 2015). The distance between prey and predator affects the survival of prey hence the flight initiation distance (FID) of birds can be used to determine the risk of predation in birds. FID is nothing but the distance at which a bird flies away after detecting any risk/threat (Weston et al. 2012).

Camouflage:
This is the capability of an animal to show similar appearance to the background. This is one of the defense techniques in birds especially in ground nesting birds. Red-wattled lapwing lay the greenish and gray color eggs with black spot which is camouflage with the ground and protect this ground nesting site from the predators (Kaur and Khera 2017).

MATERIAL AND METHODS

Sound recording and Spectrogram Analysis.
In this study, we used a field survey method in which we visited different sites in the region of Chh. Sambhajinagar for the collection of sounds and photographs to study diverse behavior. This study is conducted during the breeding season of the red-wattled lapwing, from March to August each year from 2023 to 2024. Photographs were collected through the DSLR camera (Nikon Coolpix P1000), and for the collection of bird sounds, we used a unidirectional microphone (Digitek DM 201 microphone).

BirdNET and the Merlin Bird ID app were used for the correct identification of the bird species based on vocalization, which was developed by the Cornell Lab of Ornithology, USA.

The Raven Lite and the Audacity software 3.7 version are used for audio editing and spectrogram analysis.

Study site:
This research work was done in following site from Aurangabad region Maharashtra state.

1. Dr. Babasaheb Ambedkar Marathwada University campus Aurangabad
2. Aurangabad caves area
3. Padegaon
4. Maliwada
5. Naralibag

Fig 1. Study area

RESULTS AND DISCUSSION

This study on Red-wattled lapwings' anti-predatory vocal behavior was conducted from March to August 2023 and March to July 2024 during the breeding season in various places in Aurangabad, Maharashtra. Responses such as warning calls, distraction display, aggression, and generating unpleasant noises were recorded as part of the methods. The unidirectional microphone (Digitek unidirectional microphone) was used to record the sound clips of the Red-wattled lapwing.To identify particular species' sounds, combine with the Merline bird ID and the BirdNet app, which exhibits a perfect resemblance to the recorded voice. We observed that red-wattled lapwings were vocally opposing predators. By emitting loud sounds, they attempted to draw predators' attention to them to save the eggs and the young. Additionally, we found that both the male and female red-wattled lapwings participate in the parental care of the egg and offspring. The male lapwing exhibits more aggressive behavior against the threat than the female.

Table 1. During the study following table shows the anti- predatory response or behavior of Red-wattled lapwing.

No.	Red lapwing behavior	Response against	Period of observation	Associated behavior
1	Territorial Defense	aerial and land predators	August 2023	Lapwing produced high pitch loud and repeated sounds to show ownership of area.
2	Distraction Display	Human and Dog	July 2024	Lapwings shows false incubation pretending to incubate eggs Female lapwing try to move away from the offspring to distract the predator.
3	Aggression and Mobbing	Dog	June 2024	Lapwings are collectively shows the aggressiveness against the threat directly.
4	Flight initiation/escape	Dog and Horse	June 2023	Sudden movements rapid take off and wing flapping.Try to flight away from the threat.

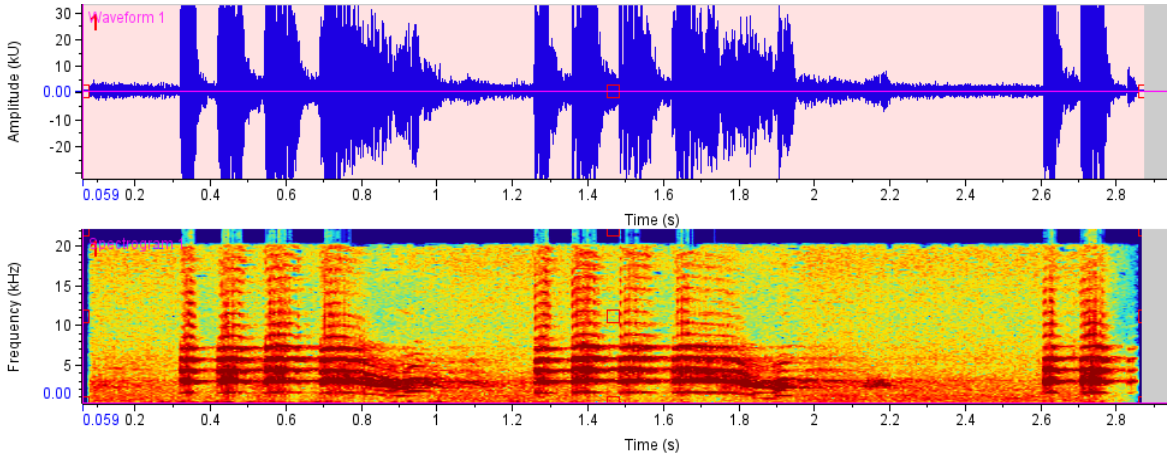

Fig.1: Alarm call

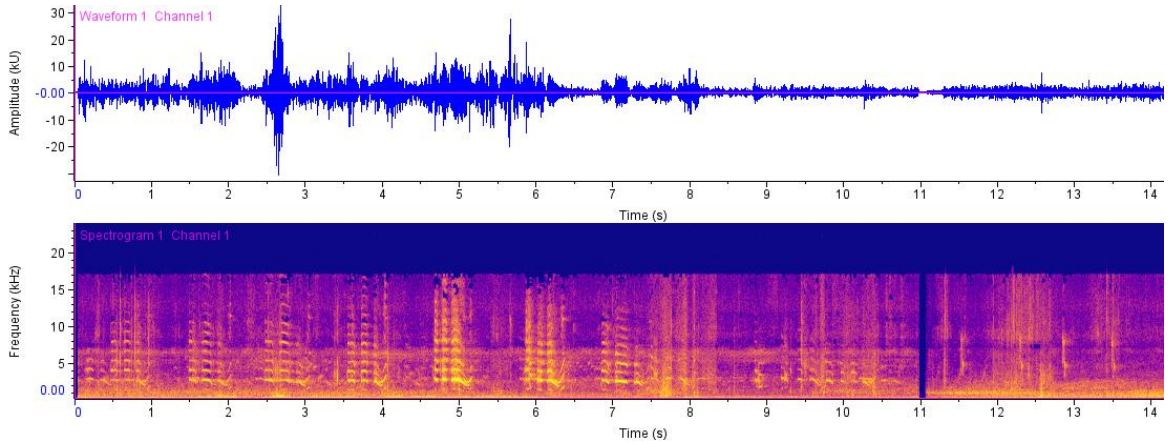

Fig. 2: Terrtorial call

Fig.3: Red lapwing During territorial defense

Fig.4 (A & B) Mother hiding the offspring from predator (C) Red -wattled lapwing showing false incubation

The red-wattled lapwing, exhibits a range of anti-predatory actions. We found that the Lapwing's vocalization was associated with either threat or stimulation. We focused on the response of the *Venellus indicus* to the predators. Territorial calls and other anti-predatory vocalizations and behaviors are examined.When different animal species are present, there may be alarm calls, displays of distraction, attempts at escape or flight, aggression and mobbing behavior. Spectrophotogram analysis shows that vocalizations become more intense and louder when the threat is close.

CONCLUSION

The anti-predatory vocal behavior of red-wattled lapwings was studied during the breeding season in Chh. Sambhajinagar, Maharashtra. The study highlighted the responses such as warning calls, aggressive behavior, distraction displays, escape/flight initiation behavior were noted. The Red-wattled lapwings were found to be vocally hostile predators. To save the eggs and the young, both sexes were actively participated in parental duties. They tried to attract the attention of predators by making loud noises and show the diverse anti predatory strategies.

Conflict of Interest: The authors declare no conflict of interest in relation to this research.

Data Availability Statement: Not applicable.

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Peer review information
IJLSCI thanks the anonymous reviewers for their contribution to the peer review of this work. A peer review file is available.

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