Indian Journal of Ecology (2025) 52(1): 222-225
DOI: https://doi.org/10.55362/IJE/2025/4482

Manuscript Number: 4482
NAAS Rating: 5.38

Influence of *Prosopis juliflora* on Breeding Success of Black-headed Ibis *Threskiornis melanocephalus*

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***Abstract*:** The Black-headed Ibis (*Threskiornis melanocephalus*, Latham, 1790) is a large, white-water bird. Nehru Talai of Bhilwara district (Rajasthan, India) is an island-like structure with some exotic *Prosopis juliflora* (Vilayati babul) and native *Vachellia nilotica* (Babul)*, Ziziphus mauritiana,* and *Salvedora percica* vegetations of which stands on the central island and provides an excellent nesting site of Black-headed Ibis. Bird census technique like the focal method was used to monitor Black-headed Ibis**.** Various nest parameters were examined from June 2023 to November 2023 at Nehru Talai. *Prosopis juliflora* is one of the top hundred recognized invasive species worldwide. The percentage of dropped eggs and nestlings per nest was higher in *Prosopis juliflora* than in *Vachellia nilotica* due to the branching angle of *Prosopis juliflora* being higher than *Vachellia nilotica.* In this article, we observed the impact of *Prosopis juliflora* on the breeding success of Black-headed Ibis and to conserve the near threatened Black-headed Ibis, the regular removal of *Prosopis juliflora* from the breeding sites.

***Keywords*:** Black-headed Ibis, Nehru Talai, *Prosopis juliflora, Threskiornis melanocephalus*

The Black-headed Ibis (*Threskiornis melanocephalus*, Latham, 1790) is a large (65-75 cm long), wading, nomadic, and white-water bird. It has a long, downward-curving black bill and a prominently exposed black head and neck. The species is included in the Near Threatened (NT) category by IUCN (Bird Life International 2017) and is widespread resident throughout India (Grimmett et al 2011) and has a wide global range extending from Pakistan to Myanmar and sporadically to China and Japan (Ali and Ripley 1987). The nest of the Black-headed Ibis is a platform made of twigs and sticks that are covered in grass and threads and built on top of *Acacia, Prosopis*, and different types of *Ficus* in wetlands and nearby wetlands (Senma and Acharya 2010). The most preferred nesting tree species were "Vilayati babul *Prosopis juliflora*" and "Babul *Vachellia nilotica*" and Cattle Egrets *Bubulcus ibis* (Choudhary and Koli 2018). The influence of exotic plant invasions on the structure and functional attributes of native ecosystems has been extensively documented and debated **(**Wardle 2011). The complex interactions of invasive species with native ecosystems make invasion ecology an interesting and important area of research. *Prosopis juliflora*, a member of the *Fabaceae* family, is native to South and Central America. It was introduced to India to help recover degraded areas and provide fuel wood for the rural poor. Now it has become an aggressive weed in several parts of the country and poses a serious threat to native biodiversity (Mwangi et al 2005). Bird species and their habitats are declining worldwide (Birdlife International 2017) due to various threats, viz. habitat fragmentation, climate change and higher nest predation (Robinson et al., 1995). Changing ecological conditions across the globe are creating new threats to birds and identifying these emerging threats will help design suitable strategies to conserve them. Negative correlation between *Prosopis juliflora* density and bird diversity has also been reported through a study on the relationship between tree species and avifaunal diversity (Khera et al., 2009). The higher number of fallen eggs and nestlings under *Prosopis juliflora* while the higher number of fledglings per nest on *Vachellia nilotica* relates the difference to the plant architecture (Chandrasekaran et al 2014). *Prosopis* and *Capparis* trees were the least diverse habitat for avian species (Koladiya et al., 2014). In contrast to native vegetation where a variety of food sources are available, *Prosopis* invaded areas were avoided by not only birds but also butterflies (Choudhary and Chishty 2020).

MATERIAL AND METHODS:

Study area: For the study of the influence of *Prosopis juliflora,* Nehru Talai (25°21'26"N 74°38'19"E) of Bhilwara district (Rajasthan, India) was selected. There is an island-like structure with some vegetation of *Vachellia nilotica, Prosopis juliflora, Ziziphus mauritiana,* and *Salvedora percica* which stands on the central island and provides an excellent nesting site for Black-headed Ibis (Fig. 1).

Methods: The bird census technique like the focal method was used to monitor Black-headed Ibis (Colin et al 1993). Photographs were captured (NIKON P900) of the nest locations in *Prosopis juliflora* and *Vachellia nilotica*. The number of nests per tree, eggs per nest, number of fallen

eggs and nestlings, and final population at the fledgling stage were recorded in *Prosopis juliflora* and *Vachellia nilotica* for one breeding season (June 2023 to November 2023). The number of nests per tree was counted with the help of binocular (VANGUARD FR-1650W). We followed the all guidelines for conducting research on the nesting biology of birds (Barve et al., 2020). The percentage of dropped eggs and nestlings per nest was calculated.

$$\text{Per cent of dropped eggs and nestlings per nest} = \frac{\text{Number of fallen eggs/nestlings per tree}}{\text{Number of eggs per tree}} \times 100$$

RESULTS AND DISCUSSION

The Black-headed Ibis built 'platform nests', which consisted of an irregularly placed, loose assemblage of twigs and sticks. The major portion of the nesting materials belonged to the tree on which the nest was located. Vegetations like native trees, Babul *Vachellia nilotica*, Miswak *Salvedora percica,* and exotic tree Vilayati babul *Prosopis juliflora* were dominant in this wetland. On *Vachellia nilotica*, nests were mostly located at nodes with more than two branches (Fig. 2). Nests were distributed at mid-canopy with mostly one nest per node (Fig. 3, Table 1). The nests in *Prosopis juliflora* were distributed at the upper canopy with all nodes and branches (Fig. 4). The number of nests per tree was higher in *Prosopis juliflora* (07) compared to *Vachellia nilotica* (06). There is no difference in the number of eggs per nest between *Prosopis juliflora* (03) and *Vachellia nilotica* (03). The number of fallen eggs (Fig. 5) and nestlings (Fig. 6) was higher under *Prosopis juliflora* (1.2) than *Vachellia nilotica* (0.3). The percentage of dropped eggs and nestlings per nest was 40 and 10 for *Prosopis juliflora* and *Vachellia nilotica,* respectively (Table 2). The number of fledglings per nest was higher in *Vachellia nilotica* (2.7) when compared to *Prosopis juliflora* (1.8). There were four or more individuals (including parents) per nest in *Vachellia nilotica* but only three individuals were recorded in *Prosopis juliflora* at the end of the reproductive season. The number of fledglings were higher in *Prosopis juliflora* when compared to *Vachellia nilotica* (Fig. 7 and 8).

Fig. 1. Nehru Talai, Bhilwara (Rajasthan, India)

CONCLUSIONS

The results of this study unequivocally demonstrate that the *Prosopis juliflora* invasive tree is a serious threat to Black-headed Ibis nesting success. The branching pattern may be involved in the low nesting success in *Prosopis juliflora*. In *Vachellia nilotica*, the branching angle ranges from 20° to 100°, whereas in *Prosopis juliflora*, it primarily ranges from 80° to 180°. This could cause more eggs and nestlings in *Prosopis juliflora* to slide out of their nests. Evidence of the detrimental effects of this alien tree may be seen in the variation in the Black-headed Ibis population structure in *Prosopis juliflora* and *Vachellia nilotica* after the breeding season. *Prosopis juliflora* branching architecture overlaps and reaches in several directions, which may be the cause of the species' highest mortality. *Prosopis juliflora* has overtaken almost all of the wetlands in the state of Rajasthan.

Table 1. Nest site characteristics of Black-headed Ibis at Nehru Talai, Bhilwara (Rajasthan, India)

Nesting trees	NT	TH (M)	UNH (M)	LNH (M)	GBH (M)	Nesting canopy	DTW (M)	Number of nests
Vachellia nilotica	04	8	5	4.5	0.5	Mid canopy	7	27
Prosopis juliflora	12	2	2	0.3	0.15	Upper canopy	1	85
Salvedora percica	02	6	4	3.5	3.0	Upper canopy	2	14

NT- Number of trees, TH- Tree height, UNH- Uppermost nest height, LNH- Lowermost nest height, GBH- Girth at breast height, DTW- Distance to water

Table 2. Comparison of nests of Black-headed Ibis on *Prosopis juliflora* and *Vachellia nilotica* at Nehru Talai, Bhilwara (Rajasthan, India)

Tree	Number of nests per tree	Number of eggs per nest	Number of dropped eggs/nestlings per nest	Number of fledglings per nest	Percentage of dropped eggs per nest
Prosopis juliflora	07	03	1.2	1.8	40
Vachellia nilotica	06	03	0.3	2.7	10

Fig. 2. Black-headed Ibis nests on *Vachellia nilotica*

Fig. 3. Black-headed Ibis nests on *Prosopis juliflora*

Fig. 4. Black-headed Ibis nests on all branches of *Prosopis juliflora*

Fig. 5. Fallen egg of Black-headed Ibis from *Prosopis juliflora*

Fig. 6. Fallen nestling of Black-headed Ibis from *Prosopis juliflora*

Fig. 7. Fledglings on *Vachellia nilotica*

Fig. 8. Fledglings on *Prosopis juliflora*

Therefore, to prevent further loss of this near-threatened bird species, *Prosopis juliflora* must be routinely mechanically removed before Black-headed Ibis arrive at nesting locations.

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Received 30 September, 2024; Accepted 24 January, 2025